Compendium of Comprehensive Examinations in Microeconomic Theory in the Applied Economics Ph.D. Program at Clemson University
Comprehensive Examination in Microeconomic Theory  
Preliminary to candidacy for the Ph.D. in Applied Economics  

August 24, 2007

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After Ambrose Bierce
PART I: (60 points; 10 points each)

Determine--and clearly state--whether each of the following statements is **true, false, or uncertain**, and justify your answer. Your score will depend almost exclusively on the clarity and correctness of your justification.

1. When no one country has any market power on world markets, eliminating barriers to international trade increases the welfare of consumers by more than it reduces the incomes of producers.
2. It is well known that the value of an artist's paintings rises after he or she dies. **TFU:** The increase in the value of an artist's paintings will tend to be larger if he or she dies in an airplane crash than in a nursing home.
3. A wage subsidy is always preferable to a binding minimum wage as a way to increase the incomes of the working poor.
4. Economies of scale occur if and only if fixed costs are a nontrivial share of total costs.
5. If a competitive industry’s supply curve is upward-sloping, then that industry’s production technology must exhibit decreasing returns to scale.
6. Assume that labor and capital each account for 50 percent of costs in a perfectly competitive, constant-returns-to-scale industry. Assume further that capital is in perfectly elastic supply to this industry, while the supply curve of labor to the industry is upward-sloping. **TFU:** A ten percent increase in the supply price of capital will increase the price of the final product of this industry by less than five percent.
PART II: (35 points, as shown below)

A. Many people lately have claimed that the standard of living of poor people in America has been declining, and that the rising cost of health care is an important reason for this. Consider the data below which show expenditures and prices for poor families in 2000 and 2006. (Note that poor families consume only these two goods.)

<table>
<thead>
<tr>
<th>Year</th>
<th>Expenditure per family per week (in dollars)</th>
<th>Price Indices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Care</td>
<td>125</td>
<td>150</td>
</tr>
<tr>
<td>All Other Goods</td>
<td>250</td>
<td>400</td>
</tr>
</tbody>
</table>

1. (10 points) Are poor families better off or worse off in 2006 than in 2000, according to these data? Explain, showing all relevant calculations.

2. (10 points) Are rising health-care costs the cause of this change in welfare, if in fact there has been one? Explain, showing any relevant calculations.

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B. Marvin’s preferences over peanuts and beer in any particular evening can be represented as $U = X^2Y^3$, where $X$ represents ounces of peanuts and $Y$ represents fluid ounces of beer. Marvin has decided to spend some time in a tavern where peanuts cost 20 cents per ounce and beer costs 30 cents per fluid ounce. Marvin has allowed himself a budget of $10 for the evening, and both beer and peanuts can be purchased in continuously variable quantities. Explain whether each of the following statements about Marvin are true, false or uncertain, using as much mathematical precision as you can:

1. (5 points) Marvin’s marginal utility of consumption of both peanuts and beer is nondecreasing.

2. (5 points) Marvin will either consume all beer and no peanuts, or all peanuts and no beer, depending on their relative prices.

3. (5 points) Assume that Marvin has in fact consumed some beer at his favorite tavern and is now about to leave. If the bartender offers Marvin the chance to flip a coin to determine whether he owes nothing (if the coin lands showing “heads”) or twice the actual cost of what he drank (if the coin lands showing “tails”), Marvin will accept the bartender’s offer.
PART III: (15 points)

Currently screenwriters are paid both an up-front fee for a television or movie script and a “residual” payment every time one of their TV programs or movies is aired (after its initial release) or whenever a copy of one of their TV programs or movies is sold (as a videotape or digital video disc, for example). Several major studios are proposing a new standard contract that would eliminate all “residual” payments to screenwriters. Analyze the likely effect that such a contractual change would have on (a) the incomes of screenwriters, (b) the average quality of scripts, and (c) the welfare of screenwriters.

PART IV: (25 points, as shown below)

Assume that chocolate is produced by combining cocoa with other productive inputs according to the production function \( Q = \min \{2C, N\} \), where \( Q \) represents pounds of chocolate, \( C \) represents pounds of cocoa, and \( N \) represents a unit of other productive inputs. Assume further that each unit of other productive inputs is in perfectly elastic supply to the chocolate industry at a price of $2, and that the chocolate industry is perfectly competitive.

1. (10 points) If the annual demand for chocolate can be approximated by the function \( Q^d = 12 - P \), where \( P \) represents the price of chocolate per pound (in dollars) and quantity demanded (\( Q^d \)) is in millions of pounds per year, what is the industry’s annual demand for cocoa?

2. (10 points) Suppose that all the world’s cocoa were produced in Ghana, and that the supply price of Ghanaian cocoa is given by the function \( P^s_g = 2 + 2C_g \), where \( C_g \) represents annual Ghanaian cocoa production in millions of half-pounds and \( P^s_g \) is in dollars per half-pound. What would be Ghana’s optimal export tax on cocoa per half-pound?

3. (5 points) If there were only a single firm producing all the world’s chocolate, would it still be optimal for Ghana to impose a per-unit export tax on cocoa? Explain.
PART V: (25 points, as shown below)

There is much talk around the world today of using carbon credits to reduce global climate change, and fishing quotas to enhance or protect global fish populations. In light of such talk, consider a competitive industry comprising $N$ heterogeneous firms, i.e., firms that do not have identical cost functions. Suppose the initial equilibrium output of this industry is $X_0$. Now suppose that a quota system is introduced. Each of the existing firms in the industry is given a total of $X_0/N$ quota coupons, with each coupon granting the right to produce one unit of output.

1. (10 points) If the quota coupons are not transferable, what impact will the quota system have on the price and output of this good? Explain carefully.

Now assume that the quota coupons are fully transferable (tradeable) in any quantity.

2. (5 points) What will be the impact of this quota scheme on the price and output of the good in question? Explain fully.

3. (10 points) What will be the equilibrium price of a quota coupon? Explain fully.

PART VI: (20 points, as shown below)

Consider the widget industry, in which there are only two firms and neither firm is able to operate more than one production facility. Quantity demanded per day is equal to $(100 - P)$ units, where $P$ is the price per widget. The production capacity of each firm is "lumpy," with capacity being expandable in increments of 5 widgets. The cost of each unit of capacity is 50.

1. (10 points) Find the Cournot-Nash equilibrium to this duopoly game.
2. (10 points) Is the Cournot equilibrium also a Bertrand equilibrium to this game? Why or why not?
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After Ambrose Bierce
True, False, Uncertain

(10) TFU: “What we obtain too cheap, we esteem too lightly; it is dearness only that gives everything its value.” Thomas Paine

(10) TFU: “A penny saved is a penny earned.” Benjamin Franklin

(10) TFU: If competitive firms have decreasing returns to scale in their production processes, industry supply must be positively sloped.

(10) Open borders for the U.S. are good because even if wages fall, the returns to capital and land outweigh the losses to labor. Assuming capital and land are owned domestically, the income of the average U.S. worker increases.

Recent changes in U.S. airport security restrictions on carry-on baggage have caused a substantial increase in the amount of checked baggage and a substantial increase in the amount of checked baggage lost by the airlines.

(10) TFU: In the short run, the percentage of all baggage that is lost will be no different than it was before the security restrictions were imposed.

(10) TFU: How would you expect the presence of long run economies (or diseconomies) of scale in the handling of checked baggage to affect the number and proportion of bags lost in the new long run equilibrium in the aftermath of the security restrictions? Explain.
II. Maximize This

Consider the class of utility functions

\[ U(.) = (x_1 - x_i^0)^a_i (x_2 - x_i^0)^a_2 \]

where the \( x_i^0 \) can be thought of as subsistence levels of the goods. That is, if \( x_i < x_i^0 \), then \( U(.) = 0 \). Assume \( a_i > 0 \) for \( i = 1, 2 \).

A. Show that this utility function generates demand systems with the characteristic that the expenditure \( p_i x_i \) on any good \( j \) is a linear function of all prices and money income.

B. What can you say about the own price and income elasticities of demand for \( x_i \), \( i = 1, 2 \), if \( x_i^0 > 0 \), \( i = 1, 2 \)? Show your work explicitly and neatly. Do your conclusions change if \( x_i^0 = 0 \), \( i = 1, 2 \)?
III. Airplanes

Police believe that a drug shipment is being smuggled into the country in the baggage of an unknown passenger on one of two flights, one from Bogota and one from Cartagena. Both flights arrive at the same time. There are 15 customs officers available, and each officer can perform a close inspection of 10 passengers in a “reasonable” time. The flight from Bogota is carrying 200 passengers and the flight from Cartagena is carrying 100 passengers. Nothing is known about the characteristics of the suspected smuggler, but police believe that if the smuggler is coming from Bogota he (or she) is carrying twice as valuable a shipment than if he (or she) is coming from Cartagena.

Police also believe that the drug kingpins know what information the police have. The drug kingpins want to maximize the expected value of this smuggling attempt. The customs authorities want to maximize the expected value of the drugs they find.

The customs officials and police lose nothing if they fail to find the drug smuggler, while the drug shippers lose the value of the shipment if police find the smuggler (and seize the drugs).

A. How many customs officers should be assigned to inspect passengers arriving on the flight from Bogota?

B. If customs officers are allocated according to your answer above, what is the probability that the drug shipment is found?
IV. Cars and Trains

The City of Clemson is trying to decide whether to build a overpass over the railroad tracks that would enable more cars to travel between Clemson and various key local destinations, such as Six Mile. The cost per day of the overpass is $800, regardless of the volume of traffic. The overpass will have a capacity of 2500 cars per day. There is no congestion up to 2500 cars per day, but no more than 2500 cars can cross the overpass in a day. The compensated demand for crossings per day is

\[ X = 2000 - 2000 \cdot P \]

where \( X \) is crossings per day and \( P \) is measured in dollars per crossing.

Based on this information, answer the following:

A. If the overpass is built, what is the optimal (or efficient) price? Explain briefly, showing any necessary calculations clearly.

B. Should the overpass be built? Why or why not? Explain briefly, showing any necessary calculations clearly.

C. Would a private entrepreneur be willing to build the overpass? Why or why not? Explain, showing any relevant calculations clearly.
V. Boats

Companies in China transport large amounts of toys and clothes to the U.S. Companies in the U.S. send scrap metal to China. All of this shipping (in both directions) is done on container ships. Under Chinese law, all of these container ships are owned by China, and the Chinese government decides how many ships per year will be allowed to sail. Each ship has aboard a representative of the Communist Party, who ensures each ship returns to China from the U.S.

The demand for space on ships going (eastbound) from China to the U.S. is given by

\[ P_e = 100 - Q_e \]

where \( P_e \) is the price per eastbound trip and \( Q_e \) is the number of eastbound trips each year. The demand for ships going (westbound) from the U.S. to China is given by

\[ P_w = 60 - Q_w \]

where \( P_w \) is the price per westbound trip and \( Q_w \) is the number of westbound trips each year.

The cost per round trip of operating a container ship is 60.

As would be expected of any good Communist government, the Chinese government wishes to maximize the total gains from trade with the U.S.

A. How many container ships should sail each year to achieve this objective? Explain briefly, showing any relevant calculations.

B. What price should the Chinese government charge eastbound shippers and westbound shippers? Explain briefly, showing any relevant calculations.

Assume that a decline in the price of diesel oil reduces the cost per round trip of operating a container ship to 30.

C. How will the appropriate prices for shipments in each direction change? Show all relevant calculations clearly.
VI. More Boats

America’s Cup sailboats are highly specialized vessels used only to compete for an international trophy known as the America’s Cup. (The cup got its name because the winner of the first of these races, back in 1851, was a sailboat named *America*.)

The (compensated) demand for America’s Cup sailboats is given by

$$Q = 200 - 2P$$

where $Q$ is number of boats per year and $P$ is the price per boat.

Currently, all of the boats are built by just two firms, Gigantor and Octopus, which behave as Cournot duopolists. Each firm’s total cost of production of equal to $0.5Q_i^2$, where $Q_i$ represents the $i^{th}$ firm’s annual output and $i = 1, 2$.

A. Find the equilibrium price and output of America’s Cup boats. Show your analysis explicitly and neatly. (Is there anything about the word neatly that you don’t understand?)

Gigantor and Octopus have proposed a merger between themselves. The new firm would be called Megayacht and would have total costs of production equal to $0.5Q_i^2$ where $Q_i$ represents the $i^{th}$ firm’s annual output and $i = 1$.

B. Find the equilibrium price and output of America’s Cup boats if the merger happens. Show your analysis explicitly and neatly. Calculate your best estimate of the welfare effects of the merger, showing your analysis explicitly and neatly.
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After Ambrose Bierce
I. True, False, Uncertain (60 points—10 each)

1. A government advertising campaign that is effective in getting American consumers to “Buy America” will raise real income in the United States.

2. If widgets are the only variable input used in the production of blivets, then if the price of widgets increases by some amount, say $\Delta w$, then the perfectly competitive blivet industry’s inverse supply curve will shift up vertically by the same amount, $\Delta w$.

3. Let $c(q, w_1, w_2) = a + (q + 0.5q^2)(w_1 + (w_1^{0.4}w_2^{0.6}) + w_2)$ be total costs of a cost-minimizing firm in which $a$ is a positive parameter, $w_1$ and $w_2$ are the prices per unit of each of the two variable inputs, and $q$ is the output. **TFU:** This cost function is homogeneous of degree one in $w_1$ and $w_2$.

4. Competitive firms earn no profits in the long run.

5. New car rebates (i.e., price discounts offered by auto makers) are self-defeating, because they reduce the resale value of auto makers’ products.

6. If all consumers are identical, two-part pricing by a monopolist is the same as first degree price discrimination.
II. Work Hard, Get Rich—Or Not (35 points)  

There are two ranks in the Bathtub Navy: sailor and officer. The wage per hour paid a sailor is \( W_s \), while the wage per hour paid an officer is \( W_o \), and officers are paid more than sailors, i.e., \( W_o > W_s \). If an individual works less than \( H_{\text{min}} \) hours there is no chance of promotion to officer rank; that person is simply paid the sailor’s wage for each hour of work. If an individual works more than \( H_{\text{min}} \) hours there is a probability of promotion (\( p \)) to officer rank that is linearly increasing in \( H \) (hours worked) until \( H_{\text{max}} \) work is reached, at which point, \( p = 1 \). People who work \( H_{\text{max}} \) or more are paid an officer’s wage for each hour of work. Note that \( H_{\text{max}} > H_{\text{min}} \). A convenient linear form for the probability of promotion is  
\[
p = \frac{(H - H_{\text{min}})}{(H_{\text{max}} - H_{\text{min}})}
\]
for \( H_{\text{min}} \leq H \leq H_{\text{max}} \) and \( H \) is the number of hours actually worked.

Both expected income (\( Y \)) and leisure (\( L \)) enter everyone’s utility function and everyone is endowed with \( T \) units of time that can be allocated between leisure and work. (Thus, \( T = L + H \).)  

A. (9 points) Draw a picture of the budget constraint facing individuals in the navy. Be sure to label all relevant points and define any notation not defined above. (Hint 1: There should be three distinct segments. Hint 2: You will do better later in the question if you explicitly write out the algebra that represents each portion of the budget constraint.)  

B. (8 points) Show how each of the following events affects an individual’s entire budget constraint. Draw a separate picture for each event.  
   i. The wage paid to officers (\( W_o \)) falls  
   ii. The wage paid to sailors (\( W_s \)) rises  
   iii. \( H_{\text{min}} \) is reduced  
   iv. \( H_{\text{max}} \) is increased  

Be sure to label all relevant points.

C. (6 points) Could a rise in \( W_s \) ever induce a Master to become an Able? Could a rise in \( W_s \) ever cause a Master to become a Landman? Explain why or why not. (Assume \( W_s < W_o \) throughout.)  

D. (6 points) Could a fall in \( W_o \) ever induce an Able to work more hours? Could a fall in \( W_o \) ever induce a Landman to work fewer hours? Explain why or why not. (Assume \( W_s < W_o \) throughout.)  

E. (6 points) How will an increase in \( H_{\text{min}} \) affect the (i) amount of work and (ii) promotion probabilities of individuals of each of the three types? Explain.
III. Rich Man, Poor Man (20 points)

The great American economist Irving Fisher argued in 1891 that a poor community will hardly distinguish among quality grades of a commodity like beef, while a rich community would make such distinctions. “In the country districts of ‘the West’ all cuts of beef sell for the same price (about 10 cents per lb.). In the cities of the West two or three qualities are commonly distinguished, while in New York a grocer will enumerate over a dozen prices in the same beef varying from 10 to 25 cents per lb.” [I. Fisher, *Mathematical Investigations in the Theory of Value and Prices*]

A. (8 points) Construct the implied indifferences curves, at low and high levels of income, between low-quality beef and high-quality beef, making all relevant distinctions and explaining them.

B. (8 points) Why would you expect preferences to look the way you drew them in part A? That is, why would different beef qualities be better substitutes at low incomes than at high incomes? Explain.

C. (4 points) What would you anticipate about the price elasticity of demand for low-quality beef compared to the price elasticity for high quality beef? Would this be true in both poor and rich communities? Explain.
IV. Cookie Competition (30 points)

Ma Barker produces and sells coolies in a perfectly competitive market under constant returns to scale. At initial factor prices, ingredients (such as flour) account for half of her costs, capital (such as ovens) accounts for one-fourth of her costs, and labor (all of it supplied by her) accounts for the remaining one-fourth of costs. She and her competitors are price takers in factor markets. The market demand for cookies is \( Q = A(P_c/P_o)Y \), where

\[
\begin{align*}
Q &= \text{pounds of cookies demanded per time period} \\
P_c &= \text{price of cookies per pound} \\
P_o &= \text{price of other goods} \\
Y &= \text{real income per time period} \\
A &= \text{a constant parameter}
\end{align*}
\]

A. (10 points) If Ma Barker decided to expand production by using twice as many ingredients but holding constant the amounts of other inputs used, by what percentage would her output change? Convince us. (Note: Do not trivialize this part of the question by assuming fixed proportions production.)

B. (10 points) If the price of ingredients doubles for all cookie makers, what is the upper limit on the resulting increase in the price of cookies? What determines whether this upper bound will be reached? Explain.

C. (10 points) If the opportunity cost of Ma Barker’s time doubles, due to the arrival of her third grandchild, what will be the effect on the price of her cookies? Explain.
V. Monopoly Madness? (35 points)

Suppose that a car dealer has an exclusive territorial franchise in selling Hondas. It pays a wholesale price of $w$ to Honda for each car that it sells, and charges each customer a retail price of $p$. The demand curve that the dealer faces is best described by the linear function:

$$Q = 30 - p$$

where $Q$ is quantity and the price is in units of thousands of dollars.

A. (10 points) What is the profit-maximizing price for the dealer to set? (Recognize that it will be stated as a function of $w$.) For simplicity, assume the retailer has no costs other than $w$.

B. (10 points) Now consider the situation from the car manufacturer’s viewpoint. Suppose that it cost Honda $5,000 to produce a car. What is the profit-maximizing choice of $w$? What will Honda’s profits be? What price $p$ will the dealer set and what profit will the dealer earn at Honda’s profit-maximizing choice of wholesale price $w$?

C. (10 points) Now suppose Honda operates the dealership and sells directly to its customers. What will be Honda’s profit maximizing price $p$? What will Honda’s profit be? Compare your answer in (3) to the answer you worked out in (2). Give an economic explanation for why the answers differ. Be specific and be complete in your analysis.

D. (5 points) In light of your results above, (why) would Honda ever grant exclusive territorial franchises to its distributors? Explain."
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After Ambrose Bierce
Part I: True, False, Uncertain (60 points—10 each)

Tell us whether these statements are true, false, or uncertain, and explain your reasoning. Almost all of your score will depend on the quality of your reasoning.

1. “High [lump sum] lease fees paid for the right to extract oil from public lands tend to motivate the lessee to get back his fees through early production. This is, of course, less true when fees are low.”
   
   *No Time to Lose*, Ford Foundation Report on Energy Policy

2. “Price controls reduce costs for consumers.”
   
   *Economic Report of the President*, Council of Economic Advisors

3. Firms seeking protection from foreign competition should be indifferent between a tariff and a quota, as long as they each yield the same market price for the good they produce.

4. The choice problem faced by the firm is identical to that faced by the consumer; one need only re-label the variables appropriately.

5. If the gasoline refining industry were competitive, then when the price of crude oil increased by 20 percent, the price of gasoline should increase by 20 percent.

6. Although the output supply elasticity of a perfectly competitive industry is affected by the supply elasticities of the inputs used by that industry, the demand elasticity of one input is unaffected by the supply elasticity of another.
Part II (40 points)

Effective January 1, senior citizens are eligible for special discounts on their prescription drugs. Assume for the purposes of this question that the discount is \(1-\alpha\), \(0<\alpha<1\), so that the price paid by seniors is now \(P_d = \alpha P_s\), where \(P_s\) is the price received by suppliers of drugs. In addition to being at least 65 years old to participate in the program, seniors may have to pay a lump sum fee (called an “insurance premium”) to participate in the program.

A. What is the largest fee, \(F\), that can be charged to the typical senior citizen and still have her just willing to enroll in the program? Explain.

B. Suppose this maximum fee is in fact charged. Will the typical senior citizen buy more, less, or the same amount of drugs, compared to before the program? Convince us.

C. Is the maximum fee more or less than \(\Delta P \cdot Q_{\text{old}}\), where \(\Delta P\) is the price change experienced by the typical senior citizen and \(Q_{\text{old}}\) is the quantity consumed before the program? Is the maximum fee more or less than \(\Delta P \cdot Q_{\text{new}}\), where \(\Delta P\) is the price change experienced by the typical senior citizen and \(Q_{\text{new}}\) is the quantity consumed before the program? Convince us in each case.

Assume that all senior citizens are just like the typical senior citizen.

D. Political forces may cause the fee to be zero. Suppose for this part (D) of the question that the fee is zero. In the \((P_s, Q)\) space, where \(Q\) is the quantity of drugs, show exactly what will happen to the demand for drugs among senior citizens, relative to the demand prior to the program. Be precise.

E. Alternatively, suppose for this part (E) of the question that the maximum fee is charged for the program. In fact, assume the fee is always adjusted to be the maximum possible, regardless of the market price of drugs, so that the typical senior citizen is just willing to be in the program rather than not. In the \((P_s, Q)\) space, where \(Q\) is the quantity of drugs, show what will happen to the demand for drugs among senior citizens, relative to the demand prior to the program. Be precise.
Part III (20 points)

Here are two stylized facts about income and demand:

1. It is commonly argued that, the more broadly a good is defined, the less likely that the good will be found to be an inferior good. Frankfurters may be inferior, but meat certainly has positive income elasticity. Demand for municipal bus service may be negatively related to income but transportation is a normal good.

2. For a good to be a Giffen good, it must be inferior; this is well known. Moreover, for a good to be a Giffen good, the income effect of the price increase for the good must pack some punch as it must overcome its rising opportunity cost relative to all other goods.

These observations taken together suggest that Giffen goods will be rarely identified empirically. Explain why.

Part IV (20 points)

Assume you know that the consumption of a gallon of gasoline to propel a motor vehicle involves a cost not directly borne by the consumer of the gallon of gasoline. (For example, internal combustion might cause harmful air pollution.) You, as energy czar, have a choice between two policy instruments to reduce the implied efficiency losses:

(i) a fuel economy standard, which specifies the minimum fuel efficiency (miles per gallon) that automobiles must achieve; or
(ii) a tax on gasoline.

A. As the Chairman of the Council of Economic Advisors, which would you recommend to the President? Why? Explain concisely but carefully, using algebra or graphs if appropriate.

B. It is possible the President will ignore your recommendation, so you must be prepared to respond with a recommendation about how best to implement the President’s choice.

   (i) If the President picks the fuel the economy standard, would you recommend it apply only to cars newly produced each or, or would you recommend requiring the entire stock of existing cars to meet the standard? Explain.
   (ii) If the President picked the tax, would you recommend a fixed, per-gallon tax, or a proportional, ad valorem tax? Explain.

Part V (20 points)

There are numerous examples in everyday life where consumers of the same product pay different prices. For instance, a Google search for "first time buyer discounts" returns two companies in the first ten hits that give discounts to first-time buyers. One is a pet food supplier. The other is a vendor of dietary supplements. Please address the following:

A. How can discounts to first-time customers of these firms increase profits?
B. How can these firms enforce this discriminatory pricing?

C. Neither of the two firms returned in the Google search appear to have market power. How can price discrimination be sustained in the face of competition?

D. Do your answers in regard to first-time buyer discounts apply with the same force to discounts given to senior citizens at, say, hotels?

**Part VI (20 points)**

Many Clemson students live in Central, SC and commute into Clemson each day along Highway 93. Suppose that the demand for trips into Clemson each day is given by

\[ P = 20 - 0.01X \]

where

- \( P \) is the cost per trip, and
- \( X \) is the number of people making the trip.

Also suppose that the cost per trip for any individual depends on the total number of people who make the trip, because heavier traffic means slower speeds, which in turn makes gas mileage worse and makes the trip take longer. Specifically, assume that the cost per trip for any person making the trip is given by

\[ P = 2 + 0.01X. \]

A. How many people will commute from Central to Clemson each day? Show your work clearly and explicitly. Be neat.

B. What is the efficient number of people who should be commuting each day? Show your work clearly and explicitly. Be neat.

C. How would you propose to get from the current actual number to the efficient number? Explain. Be explicit.

D. What gain would result from the implementation of your policy? Be explicit. Give an exact number. Show your work. Be neat.
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

May 24, 2005

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Heed the following: The Roman historian, Suetonius, says that Caesar’s famous phrase, “Veni, vidi, vici,” referred not so much to the force of his victory as to the speed with which it was accomplished.
Part I: True, False, Uncertain (60 points—10 each)

Tell us whether these statements are true, false, or uncertain, and explain your reasoning. Almost all of your score will depend on the quality of your reasoning.

1. A profit-maximizing firm will never operate in a region of decreasing returns to scale.

2. Suppose that the Island of Orange is populated entirely by households with identical preferences and incomes for whom rice is a Giffen good. Assume further that Orange is a small, open economy that produces no rice domestically.
   **TFU:** If Orange imposed an import duty on rice, and if the revenue from that tariff were distributed randomly among all households in the nation, then the quantity of rice consumed in Orange will increase.

3. If all firms in the horseshoe industry have the same production function and there is free entry into the industry, then the long-run supply curve of horseshoes is perfectly elastic.

4. If we observe that the price of roses triples on Valentine's Day compared to the rest of the year while the price of candy stays about the same, we can conclude that many more people give roses than candy as Valentine's Day presents.

5. Assume that the long-run elasticity of demand for sporks is -1, the long-run elasticity of supply of sporks is +10, and the spork industry is perfectly competitive. **TFU:** If an innovation in spork production enables any firm to produce 20 percent more output with the same inputs, then the quantity of sporks consumed will increase by more than 20 percent in the long run.

6. Only two firms in the world produce widgets. Both firms have identical (constant) marginal costs of production, the demand for widgets is linear, and consumers consider the widgets produced by each firm to be identical. **TFU:** If the demand curve for widgets shifted to the right by 10 percent at any price, the quantity of widgets produced would increase by 10 percent whether the two firms had Cournot or Bertrand conjectures.
Part II: Demand (50 points total, 10 points for each part of each question)

A. A consumer spends 25 percent of his income on Good 1, 50 percent of his income on Good 2, and the rest on Good 3. His money income is independent of the prices of these three goods. It is observed that when the price of Good 1 rises by 10 percent he consumes 22.5 percent less of that good if no other prices change. It is also observed that, given the prices of Goods 1 and 3, a 10 percent increase in the price of Good 2 induces a 15 percent increase in this consumer's purchases of Good 1. Finally, it is the case that the proportions of his income that this consumer allocates to each good are unaffected by changes in his income.

1. What is this consumer's elasticity of demand for Good 1 with respect to the price of Good 3?
2. What is this person's elasticity of demand for Good 2 with respect to the price of Good 1?
3. What is this person's elasticity of demand for Good 2 with respect to the price of Good 3?

B. Mary Pratt's preference ordering over all possible combinations of $X$ and $Y$ can be described by the utility function $U = X^{.4} Y^{.5}$. Heather Arrow's preferences can be described by the utility function $U = X^{.6} Y^{.75}$. Explain why:

1. for given levels of income, Mary's and Heather's choices will be identical, but
2. their choices among actuarially-fair uncertain outcomes will be different.
Part III: Market Equilibrium (40 points total; 2 questions, 20 points each)

A. There are several daily newspapers available in print in the upstate. The Greenville News and the Anderson Independent are two important ones. It is noted that the prices of these newspapers vary by the location of sale. For instance, The News costs $.50 in Greenville, its hometown of publication, but only $.25 in Abbeville, some 65 miles away. Similarly, the Independent costs $.50 in Anderson, but only $.25 in Six Mile, which is about half-way between the two cities.

1. Why are these newspaper prices lower the farther the way they are from the point of production?
2. What impact do these pricing structures have on newspaper competition and the market for newspapers?

B. Some commentators argue against patent aggregating (the purchase of many competing patents by one firm) because it extends the monopoly power of the patent right beyond the degree to which exclusive production rights are efficient. Assess this claim in the context of a simple model. Let the demand for different products 1 and 2 be:

\[ q_1 = 10 - 2p_1 + p_2 \]
\[ q_2 = 10 + p_1 - 2p_2 \]

where \( q_i \) and \( p_i \) represent the respective quantity demanded and price of the \( i \)th good. Assume production costs for both goods are zero.

1. Calculate the prices that two separate monopolies would charge when each regards the other’s price as beyond its control. (To do this, find the profit maximizing behavioral equation for each firm operating separately. Because \( p_i \) will be a function of \( p_j \), the behavioral equations of independent monopolists must be solved simultaneously.)

2. Calculate the prices that a single monopolist of both goods would charge for each and show that the prices are different and profits are higher than is the case in (1) above. (Again, find the behavioral equations or first order conditions for the single, joint profit maximizing monopolist. Here the first order conditions will involve two equations that must be solved simultaneously. However, the equations are different when one firm operates both businesses.)
Part IV: Applied Economics (15 points total as indicated)

Consider a cost function:

\[ \ln(C) = 12 + 0.84 \ln(SV) - 0.08 \ln(TV) + 0.34 \ln(LPRI) + 0.47 \ln(LWAGE) \]

in which \( \ln(.) \) is the natural logarithm, \( C \) is the total cost of a stormwater pond, \( SV \) is the water storage volume (ft\(^3\)) of the pond, \( TV \) is the water treatment volume (ft\(^3\)) of the pond, \( LPRI \) is the price of land ($/acre), \( LWAGE \) is the landscaper wage ($/hour), and \( SV = TV + OV \). \( OV \) is the storage volume of the pond other than the water treatment volume. The sample means of \( C, SV, TV, LPRI, \) and \( LWAGE \) are $900,000; 300,000 ft\(^3\); 200,000 ft\(^3\); $280,000/acre, and $15/hr.

1. (6 pts.) What is the elasticity of total cost with respect to water treatment volume at the mean value of the relevant variable(s)? (Account for all effects.)
2. (2 pts.) Interpret your calculation of this elasticity in non-technical language.
3. (2 pts.) Total costs of a stormwater pond are homogeneous of what degree in land prices and landscaper wages?

B. Let \( TVC(y) \) represent total variable cost as a function of a firm’s output and \( AVC(y) \) represent average variable cost as a function of a firm’s output.

1. (3 pts.) What is \( AVC(y) \) for \( y \) arbitrarily close to zero? Be as precise and show all work for maximum credit.
2. (2 pts.) Interpret your answer to (1) above.

Part V: Price Discrimination (15 points total)

Currently the Walker Course at Clemson University offers students two pricing options. By one plan, students pay a unit price for each round of golf that they play. Let’s assume that this price is $21 per round. Alternatively, students can pay a larger, lump-sum fee once each semester and play unlimited rounds. This lump-sum fee is $250.

a) Explain the circumstances of demand that make this pricing strategy beneficial to the Walker Course.

The university is considering instituting multiple blocks or buckets of rounds similar to cell phone pricing. That is, the golf course could have different fees for 1 to 5 rounds, 6 to 10 rounds, and 10 rounds and above.

b) Is it likely that the multiple bucket idea can further increase revenues?
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

February 4, 2005

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Heed the following: The Roman historian, Suetonius, says that Caesar’s famous phrase, “Veni, vidi, vici,” referred not so much to the force of his victory as to the speed with which it was accomplished.

**Part I: True, False, Uncertain (60 points—10 each)**

Tell us whether these statements are true, false, or uncertain, and explain your reasoning. Almost all of your score will depend on the quality of your reasoning.
1. Whales are a renewable natural resource while crude oil is an exhaustible natural resource. Therefore it is likely that the world will run out of oil long before it runs out of whales.

2. Supermarkets in France force consumers to “rent” shopping carts by inserting a coin to unlock them. Consumers are refunded their “rent” when they return the cart to a common location. Of course, consumers can leave their carts anywhere, also leaving the deposited coin as payment. This French system is superior to the common American practice of free carts because it directly charges consumers for cart service.¹

3. Futures contracts are an agreement in which the seller promises to deliver a good at a distant point in time at a price specified by the contract. If the observed average rate of return on these futures contracts is negative, then the market participants are not fully rational.²

4. Children impose an externality on people outside of their family. This results from the fact that when children are born, their existence makes resources more scarce.³

5. Mandatory liability insurance requires government regulation of insurance companies.

6. Assume that there are only two types of people in the world, Gas Guzzlers and Enviro-Nuts. Gas Guzzlers are rich and Enviro-Nuts are poor. Further assume that there are only two goods, gasoline and everything else. Rationing gasoline use so that Gas Guzzlers are not allowed to consume as much gasoline as they would like will not improve the welfare of Enviro-Nuts as much as a direct income transfer from Gas Guzzlers to Enviro-Nuts.⁴

Part II: Demand (45 points total, as indicated)

A. Consider a three good world. Estimated demand curves for goods one and two are:

\[ x_1 = a + bP_1 + cP_2 \]
\[ x_2 = d + eP_1 + gP_2 \]

Notice that these demand curves have income effects equal to zero.

a) What restrictions on the coefficients within each equation are implied by the theory of consumer behavior? [10 points]

b) What restrictions on the coefficients across equations are implied by the theory of consumer behavior? [10 points]

c) Assume that government wants to impose a per-unit tax on one or the other of these goods. Taxation of which good will create less dead-weight loss? [10 points]⁵

B. In prior years, the State of South Carolina had no charge to enter most state parks. They did require registration, from which researchers could measure the distance that visitors traveled
to reach the park. Now the state is proposing to charge a fee to enter state parks.

1. Explain how researchers could estimate the demand curve for state parks from the data available prior to the initiation of a fee structure.
2. Explain how researchers should approach the demand estimation problem if the state begins to charge for admission.
3. Are estimates of price elasticity equivalent under the two regimes? Explain.

Part III: Market Equilibrium (30 points total, 10 points each part)

Currently, 80-90% of the shrimp available in the U.S. is farm-raised shrimp from outside the U.S. The importation of farm-raised shrimp has significantly reduced the prices paid to domestic shrimp trawlers (who sell shrimp caught in the ocean), and the low prices encouraged many domestic trawlers to exit the industry. To assist the domestic shrimp trawling industry, the federal government placed tariffs on imported shrimp. Given the above, answer the following:

1. What is the impact of the tariffs on U.S., shrimp trawlers, U.S. consumers of shrimp, and foreign producers of farm-raised shrimp? Be specific.
2. An alternative to the tariff on imports is to tax U.S. residents to provide cash subsidies to U.S. shrimp trawlers. What will be the impact of a subsidy to trawlers on the U.S. shrimp trawlers, U.S. consumers of shrimp, and foreign producers of farm-raised shrimp? Be specific.
3. Finally, U.S. importers of foreign farm-raised shrimp have offered to pay U.S. shrimp trawlers $100 million a year to do away with the tariff on imported shrimp. The U.S. shrimp trawlers have refused the offer. What insights does this offer and refusal give about the U.S. shrimp market? Explain.

Part IV: Applied Economics (15 points)

Do a brief cost-benefit analysis of the gun control issue. Where the benefits of gun control outweigh the costs, we expect to see more gun control. Where the costs outweigh the benefits, we expect to see less. Hence, it seems clear that in the U.S. the costs of gun control outweigh the benefits, whereas in other countries such as Great Britain the opposite is true. Great Britain has stricter gun control regulations than the U.S.

1. What are the benefits of gun control? [5 points]
2. What are the costs of gun control? [5 points]
3. What sort of empirical tests would you propose to test the hypothesis that in the U.S. the costs of gun control outweigh the benefits? [5 points]

Part V: Imperfect Competition (5 points each; 30 points total)

Suppose CML Toys sells its products in two separable markets. The demand equations are

\[ Q_1 = 100 - P_1 \]
\[ Q_2 = 50 - 0.25P_2 \]
The firm’s total cost equation is $TC = 150 + 5Q + 0.5Q^2$

a. If CML Toys engages in third-degree price discrimination, how much should it sell, and what price should it charge, in each market? Show all your work to get full credit.
b. What is CML Toys’ total profit? Show all your work to get full credit.

Suppose CML Toys charges a uniform price in the two markets in which it sells its product.

c. Find the uniform price charged, and the quantity sold, in the two markets. Show all your work to get full credit.
d. What is CML Toy’s total profit? Show all your work to get full credit.

Compare the results derived from uniform pricing to those obtained in third-degree price discrimination.

e. How does output vary between uniform pricing and market segmentation? Show all your work to get full credit.
f. Which pricing scheme leads to greater consumer welfare?
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

September 24, 2004

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After Ambrose Bierce
Part I: True, False, Uncertain (60 points—10 each)

Tell us whether these statements are true, false, or uncertain, and explain your reasoning. Almost all of your score will depend on the quality of your reasoning.

A. The deterrent effect of capital punishment should have the least impact in armed robbery situations.

B. Monopoly in one sector of the economy is inefficient for two reasons: First because it raises prices and lowers output in the monopolized sector, and second because it induces too much production in the competitive sectors of the economy.

C. If a firm produces the same product at two different locations, it should equalize the rate of capacity utilization between the two locations in order to minimize costs.

D. We can conclude that transaction costs are too high for Coasian bargaining to take place when we observe pollutants being dumped into rivers and streams.

E. The U.S. imports about 8 percent of its crude oil from Iraq. Attacks on pipelines have recently reduced Iraq’s crude oil exports by about 50 percent. TFU: If the short-run elasticity of demand for oil in the U.S. is -0.2, then the recent reduction in Iraq’s oil exports alone could be responsible for a 20 percent increase in the price of oil within the U.S.

F. If a newly developed strain of wheat yields 30% more output than before from the same amount of all other inputs, if the new strain of wheat costs the same to sow as the old strain, and if the long-run elasticity of demand for wheat is -0.6, then the price of wheat would fall by 50% in the long run.
Part II: Demand (40 points)

Horizon is a cellular communications company that has a monopoly on cellular service in the isolated country of Tadzhit. It has two pricing plans. In one, customers pay $50 per month, get 500 minutes of free calling time, and pay 10¢/minute for additional air time. In the second plan consumers pay $100 per month, get 1500 free minutes, and pay 5¢ for additional time. The customers are split evenly between the plans, and everyone uses all their free minutes and no extra minutes.

Horizon begins offering a third plan. This plan costs $80 per month for which customers get 1000 free minutes and pay 7¢ per additional minutes. As soon as Horizon offers this plan, all customers switch to it. Again, everyone uses all the free minutes and buys no additional minutes.

a. Describe the alternative pricing plans in terms of the budget constraints facing the consumers between cell phone usage and all other goods.

b. How is it possible that Horizon’s customers were evenly split between the first and second plans and then all switched to the third plan?

c. Is Horizon’s revenue higher with plan three than it was with plans one and two?

d. Is it possible for Horizon to improve its revenue without raising prices or reducing free minutes in any of its plans?

Part III: Market Equilibrium (25 points total)

Auctions on eBay last for a fixed amount of time. The end point is well known and well publicized. Casual as well as careful examination of the data shows that many bidders on eBay engage in a practice called “sniping.” That is, they only submit their bids late in the auction, many times only in the last few seconds.

a. Explain how this practice can be rationalized by the existence of private information about the common value of the object. (Common value comes from aspects of the product that will be appealing to all consumers.)

b. In what sense is sniping costly to individuals with idiosyncratic valuation of the auction item? (Idiosyncratic value comes from product characteristics that appeal only to a single buyer.)

Sellers on eBay on average set minimum bids at levels considerably less than the item’s book value. Furthermore, sellers avoid the use of secret reserve prices to high-value objects to a greater degree than can be explained by price that eBay charges for this feature.

c. Explain why these practices are optimal from the seller’s perspective and consistent with the buyers’ behavior discussed in your answers to (a) and (b) above.

d. Auctions that close on weekdays have higher winning bids. Can you explain this?
Part IV: Applied Economics (20 points)

Hurricanes, while they occur every year, cause damage that varies dramatically across time and place. If you live in Pensacola, Florida, the probability of substantial hurricane damage including loss of electrical power is low, but not trivial.

Florida has a law that makes it illegal for vendors to sell items immediately before and just following a hurricane at prices that are significantly higher than the price for which the item normally sells. So, for instance, ice that sells for $1.50 per bag before a hurricane must be sold for this same price after a hurricane. Electric generators that sell for $600 in May cannot be sold for more when a hurricane looms on the coast. The same is true for things like gasoline and chain saws. In the absence of price variation, these goods are allocated on the basis of first-come-first-served.

(a) Compare the efficiency of first-come-first-served allocation to rationing by means of price. Specify clearly what you mean by efficiency.

(b) Are there any theoretical arguments for the efficiency of laws against price gouging?

(c) Critics of a laissez-faire pricing policy (i.e., charging whatever the market will bear) commonly claim that such a policy is unfair. Can you devise a policy that leads to an efficient allocation of while meeting the concerns of the critics of equilibrium pricing?
Part V: Imperfect Competition (Two parts; 35 points total)

A. (25 points)

Consider a manufacturing company, Iorta, that sells a product, Ravicept, both in the United States and worldwide. Ravicept is a chemical compound made from corn that increases the strength of titanium alloys. Ravicept is under patent in the United States, which allows Iorta to set a monopoly price. However, Iorta’s patent rights to Ravicept are not recognized internationally, so while Iorta sells Ravicept in the world market, it faces competition and is forced to sell the product at a price determined by perfectly elastic supply from world-wide manufacturers.

a. Assume that Iorta charges a single monopoly price in the United States. What is the relation between the worldwide price and the monopoly price in the United States?

b. Assume that U.S. regulators increase Iorta’s cost of producing Ravicept by imposing new and meaningless work rules at Iorta’s manufacturing facilities. If Ravicept continues to sell in the world market what will happen to the price in the United States.

c. Is it possible that Iorta will stop selling the compound internationally? If so, what will happen to the price in the United States?

d. What would happen to the price of the compound both domestically and internationally if the price of corn increases?

B. (10 points)

Let the inverse demand function for a firm’s output be $P(Q)$, where $P$ is the price of the good, $Q$ is quantity consumed, and the derivative, $dP/dQ < 0$ for all $Q > 0$. Let the firm’s total cost to produce this good be $C(Q)$, for which $C' = dC/dQ > 0$. Assume that marginal profit strictly decreases as output of the good increases. The Lerner index is $\frac{P - C'}{P}$ and represents the markup of price over marginal cost as a share of price. Prove that, at the profit-maximizing level of output ($Q^*$), the Lerner index is $\{1/\varepsilon\}$, where $\varepsilon$ is the price elasticity of demand for the firm’s output. (Show your work.)
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

February 6, 2004

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After Ambrose Bierce
Part I: True, False, Uncertain (60 points—10 each)

Tell us whether these statements are true, false, or uncertain, and explain your reasoning. Almost all of your score will depend on the quality of your reasoning.

1. If kumquats are an inferior good, the demand curve for kumquats has a positive slope.
2. Suppose SuperMart builds a new store next to the town of Central. Also suppose that the result is to make all land in Central more valuable in commercial (business) uses than before, but to make all land in Central less valuable in residential uses. TFU: As a result of the new SuperMart store, residents of Central will devote fewer resources to maintaining their homes (e.g., they will paint them less often, are less likely to repair broken gutters or windows, etc.).
3. The greater the number of “middlemen” within a supply chain, the higher will be the final cost of a consumer product.
4. If a competitive firm has the production function is \( X = AL^\alpha \), then the elasticity of the firm's demand for labor is equal to \( 1/\alpha \).
5. Suppose Octopus Manufacturing has two plants, A and B. For any given level of output, costs are lower if the output is produced at plant A. TFU: Octopus will operate only plant A.
6. Because all costs can be avoided in the long run but not the short run, long run marginal costs can never be higher than short run marginal costs.
Part II: Demand (30 points, as shown)

1. (10 points) It is an election year and environmental issues are important. The president’s environmental advisors have advocated that he ask Congress to impose a new tax of 10 cents per gallon on gasoline, because, it is claimed, a higher price of gas will cause people to drive and thus pollute less. Currently, consumption of gas is 500 gallon per person per year.

The president’s political advisors tell him that, because it is an election year, if he imposes the tax, he must do so in way that drivers are not made worse off by the tax. Hence, the advisors tell him that the proceeds of the tax must be used to give drivers each a lump-sum payment to “ease the pain” of the new tax.

The president turns to you for advice.

A. Given the information available to you, what is the smallest lump sum payment that is sufficient to ensure that, despite the tax, drivers are no worse off? Be specific and show your work.

B. If the rebate is set at this level, will the federal deficit (tax receipts minus spending) rise or fall? Why?

2. (20 points) Last year, the Isle of Frigidaire built a dam that lowered the price of electricity on the island to 5 cents per kilowatt hour ($0.05) from its previous level of 10 cents per kilowatt hour ($0.10/kwh). At a result of the price reduction, electricity consumption by the typical family rose to 6,000 kwh per month from its previous level of 3,000 kwh per month. All other goods on the island have a price of $1.00 per unit. Average family income on the island is $600 per month.

A. Based on this information, construct upper and lower bounds on the value to the typical family of the new dam. Show your calculations explicitly and neatly, and briefly explain how you know you have obtained upper and lower limits of the dam’s value to the islanders.

B. Now suppose that you find an article in the Journal of Amazing Econometrics that reveals the indirect utility function of a family on the island may be written as

\[ V = \frac{M^2}{4P_eP_a} \]

where M is monthly income, \( P_e \) is the price of electricity and \( P_a \) is the price of all other goods. Use this new information to construct improved upper and lower bounds on the value to islanders of the dam (in dollars). Show calculations explicitly and neatly.
Part III: Supply (35 points total, allocated as shown)

The Department of Petroleum Exploitation (DOPE) in the country of Luxor recently instituted a program to limit the production of oil by producers in their country. This program involves the imposition of quotas on the amount of oil produced by each producer.

There are two groups of producers in Luxor. The marginal cost curve of each member of the first group of producers (the "low-cost producers") is given by

\[ MC = 6 + 0.05Q. \]

The marginal cost curve of each member of the second group of producers (the "high cost producers") is given by

\[ MC = 12 + 0.05Q. \]

There are 100 members of each group of producers. The world price of oil is \( P = $24 \) per barrel. (In answering the questions that follow, assume that this is a one period problem.)

A. (5 pts.) What is the "demand curve for quota" for a typical producer in each group? Be explicit. (NOTE: To avoid confusion, let \( R \) represent the price of quota.)

Under its program to limit oil production, the DOPE has decided on a quota of 180 barrels of oil for each producer.

B. (10 pts.) Assume the DOPE does not allow the sale of production quotas among producers. What will be the (i) marginal and (ii) total cost of production of each producer? What will be the net income (producer surplus) of each producer? Show your calculations clearly and carefully.

C. (8 pts.) Now assume the DOPE decides to allow the sale of production quotas among producers. What will be the market clearing sale price of quota (\( R^* \))? How much oil will be produced by producers in each group after the market for quota has cleared? What will be the net income (producer surplus) of producers in each group?

D. (12 pts.) Compared to the situation with quota, but without transferability of quota, what is the impact on the following of having transferable quota (i.e., transferable production)?

1. total production and production by firms in each group
2. the total costs of producing oil in Luxor
3. the net incomes (producer surplus) of producers in each group.

Show your reasoning in each case.
Part IV: Applied Economics (20 points—allocated as shown)

It is nearly Spring, and Professor Blitz is thinking about buying a vacation home in Montana. He has heard from his colleagues that, because of its terrible weather the rest of the year, vacations in Montana are suitable only during June, July, and August. Being a professor at a certain southern university, Blitz happens to be able to reside in his prospective vacation home during all of June, July, and August.

There is a well-established rental market for houses like the one Blitz might buy, so he can forecast with certainty that he could rent his property to other people for $5,000 per month during each of those three months (and zero in any of the other months). Assume that each month’s rent payment is received on the first day of the month in which it is rented. Also assume that Blitz can choose from among a number of identical houses, some of which are rented and some of which are occupied by their owners during June, July, and August. Finally, assume that this market is in long-run equilibrium.

A. (10 pts.) If no change in demand or supply conditions is anticipated, what will be the time path of the price of a vacation home in Montana over the course of a year? When will the purchase price of one of these vacation homes reach its maximum? When will it reach its minimum? Be explicit and precise, not vague. Explain.

B. (10 pts.) Now suppose that new information is made public that makes it certain that the monthly rental rates of these houses will be $6,000 per month (i.e., 20% higher) next year, and will stay at that new level in subsequent years. If this news is announced late on May 31 of this year, how will the purchase prices of these houses change over the course of the ensuing year? Explain.
Part V: Imperfect Competition (35 points total)

Assume that the demand curve for the prescription drug Kuretal in the United States is given by the function \( P = 40 - (10^6)Q \), where \( Q \) is the number of units of Kuretal consumed and \( P \) is the price per unit. Assume further that Pharma, the producer of Kuretal, holds the patent on this drug, and thus is the only seller of it. Finally, assume that each unit of a Kuretal can be produced at a marginal cost of 2.

A. (5 pts.) At what price per unit will Pharma sell Kuretal in the U.S.? Show all calculations neatly and explicitly.

B. (10 pts.) The Canadian government is the sole purchaser of prescription drugs for purposes of distribution through its national health-care system. Suppose the Canadian government offers Pharma a “take-it-or-leave-it” offer of 5 per unit of Kuretal. Further suppose it is illegal to re-import U.S.-made prescription drugs into the United States from outside the country. Assuming that the ban on re-importation is fully enforced, will Pharma choose to sell any Kuretal to the Canadian government? Explain. Show calculations neatly and explicitly.

C. (10 pts.) Assume that the quantity of Kuretal demanded by Canadians at any particular price is always exactly half the quantity demanded in the U.S. at the same price. If re-importation of U.S.-made drugs from Canada back into the United States were made legal, and if transportation costs are negligible (small enough to be ignored), would the manufacturer of Kuretal be willing to sell to the Canadian health-care system at a price of 5? Show calculations neatly and explicitly.

D. (10 pts.) Suppose that Pharma and the Canadian government bargained explicitly over the price to be charged for Kuretal in Canada, and that the outcome of that bargaining process corresponded to the prediction of Nash’s two-person bargaining model. If the objective of Pharma were to maximize its profits from Kuretal and the objective of the Canadian government were to maximize its citizens’ consumer surplus from Pharma, what factors would jointly determine the Canadian price of Kuretal (1) when it is impossible to re-import the drug from Canada into the U.S. and (2) when it is costless to do so? You must explain clearly what the relevant factors are and precisely how they would affect the outcome of the bargain, preferably by means of an explicit formula, but you do not have to calculate the numerical outcome of the bargain.
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

September 26, 2003

You have three (3) hours to complete this examination. There are five parts, I-V. Point values are shown for each question. There are a total of 180 points and 180 minutes available. Before you begin answering any questions, you should examine the allocation of points across topics.

In preparing your examination paper, please follow these instructions:

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   **Unreadable answers will receive zero credit.**

2. Write your assigned identification number on the top left-hand corner of each page. Do not write any other personal identifier on any page.

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4. **Write on only one side of each sheet of paper.**

5. At the end of the exam, assemble your answers in the order in which the questions were **asked** on the exam.

6. After assembling your exam in the manner specified in (5), number each page in the upper right-hand corner. If the material on a page is a continuation of an answer, be sure to clearly denote that fact.

As you answer the questions, always remember you are hoping to become an

_Economist: A blackguard who sees things as they are, rather than as they should be._

After Ambrose Bierce
Part I: True, False, Uncertain (60 points—10 each)

Tell us whether these statements are true, false, or uncertain, and explain your reasoning. Almost all of your score will depend on the quality of your reasoning.

1. Surveys of individuals tend to find low or no correlation between income and self-reported happiness. TFU: These findings suggest that it is incorrect to model consumers as utility maximizers upon whom budget constraints are binding.

2. Because traffic lights at intersections reduce drivers’ choice sets, they must reduce drivers’ utility.

3. If consumers have Cobb-Douglas preferences, all compensated demand curves are inelastic.

4. If negotiation is costless and rights are well-specified and enforced, then the allocation of resources will be identical, whatever the initial allocation of legal rights.

5. Constant returns to scale industries have perfectly elastic long run supply curves.

6. A price discriminating monopolist produces more output than a single price monopolist.
Part II: Demand (40 points)

The typical student at Doggone U. spends $1000 per month on housing. Each unmarried football player at Doggone U. receives a scholarship in the form of a voucher of $750 per month that can be applied (only) to his housing expenditures.

A) Draw (and write out) the budget constraint for football players, with and without the housing voucher.
B) Does the housing voucher always increase utility for recipients? Explain.
C) Does the housing voucher always increase housing consumption by recipients? Explain.

Married football players receive a different type of housing scholarship. They are given a housing allowance of up to $1000 per month. It comes in the form of a cash rebate of half of whatever they spend on rent. (Thus, a married player who rented a $1200 per month apartment would get a rebate of $600, while one who rented a $2500 per month apartment would get a rebate of $1000 (not $1250)).

D) Draw (and write out the equation for) the budget constraint for married athletes, comparing it to the budget constraint the student would have if (i) he were an unmarried football player or (ii) not a football player.
E) How does marriage affect the utility derived from an athlete’s housing scholarship? In particular, you should address at least these issues:
   (i) Does the rebate ever create an incentive for a scholarship athlete to get married?
   (ii) Does the rebate always create an incentive for a scholarship athlete to get married?
   (iii) Could a scholarship athlete ever be indifferent between the voucher and the rebate?
Explain in each case.

Some married athletes sub-lease their apartments to other students. They are usually only able to sub-lease them for less than 100 percent of the market rental. Call the proportion of the market rental value that they are able to get $\beta$, where $0<\beta<1$.

F) What is the minimum value of $\beta$ at which any married athlete would be willing to sub-lease his apartment? Explain. (Hint: Your answer should be independent of preferences.)

Suppose a student finds that the $\beta$ he is able to achieve with sub-leasing exceeds the minimum value you just found.

G) Draw the budget constraint facing students who sub-let.
H) Describe the consumption characteristics of these scholarship athletes.

Suppose the university decides that it wants to discourage sub-leasing by married athletes, because administrative costs are higher for the university when there is sub-leasing. Thus, the university imposes a $100 per month administrative fee on all sub-leases.

I) Show how this administrative fee affects the budget constraint of an athlete who subleases.
Part III: Supply (20 points total)

Morgan’s Flower Shop specializes in cut flower arrangements. It takes Sally about 15 minutes per arrangement. Sally is paid $20 per hour. The flowers themselves cost around $15 per arrangement. The arrangements sell for $45. The flower business is highly competitive, and previous studies of this industry reveal that

1. the demand for cut flower arrangements is unit elastic, and
2. the industry is characterized by constant returns to scale; indeed, the Cobb-Douglas production function is a useful approximation of production at the firm level.

Assume that the wholesale cost of flowers that Sally has been using in each arrangement rises to $20, from its previous level of $15.

A) What is your best estimate of the resulting increase in the retail price of flower arrangements?

B) How and by how much will the time that Sally spends on each arrangement change?

C) How and by how much will the amount of flowers in each arrangement change?

D) How and by how much will the total number of flower arrangers like Sally change?

E) How and by how much will the amount of wholesale flowers used in the industry change?

Show all calculation, being sure to explain your reasoning where appropriate.
Part IV: Applied Economics (40 points—allocated as shown)

Answer all parts of all questions on this page

Toll Road Taxes (15 points)

All 4,350 miles of expressway in Japan’s national highway system are toll roads, i.e., drivers must pay a fee (called a “toll”) to drive on them. The fees were originally imposed to pay for building the highways. Japan began building its national highways in 1956, with money borrowed from the World Bank, and it used the funds from tolls to pay off the loans. The loans were paid off, but the tolls continue to be charged.

A) Once an expressway is built, what is the argument that people should be allowed to travel on it at no charge? Explain.

B) Why, then, do we see toll roads? Explain.

The newspaper article that reports the facts in the introduction to this question goes on to note that: “Though expressways in and around Tokyo see a lot of traffic, the rest of the system is sparsely traveled.” Moreover, the article notes, the tolls are now “used to pay down the nation’s massive debt from [other] public works projects.”

C) Should tolls on expressways ever be used to pay down debt or indeed to finance other projects by the government? Explain.

Health Care Subsidies (25 points)

Suppose there are two groups of health care consumers: old (O) and young (Y). The government decides that the old should have their health care subsidized, in this manner: the government will pay a proportion, \( 0 < \alpha < 1 \), of all the health care expenditures incurred by each old person. (Although the subsidy will presumably have to be paid for out of higher taxes or lower government spending, you may assume that these other, secondary effects of the program are small enough to ignore for the purposes of this problem.)

A) Analyze the effects of this subsidy program (call it “Medicare” if you like) on the market for health care. You should assess the effects (if any) on demand and supply, as well as the impacts on all relevant prices and quantities. Be as specific as you can. Vague reasoning and imprecise diagrams will be downgraded.

B) Who gains and who loses as a result of this program? Be specific. Pictures are worth a thousand words each (or thereabouts). Again, precision and completeness will score points.

C) Suppose (for the purposes of this part only) that \( \alpha = 1 \). Show specifically what will happen to the demand for health care by the old, as well as the total demand for health care. Is there an equilibrium?
D) Now return to $0 < \alpha < 1$. How much is the government spending on Medicare? A picture will help a lot. Suppose the government decides that this is too much and thus imposes a “cap” on Medicare reimbursements. Specifically, the government announces it will pay no more than $C$ dollars per unit for health care consumed by old people.

(i) What is the largest that $C$ can be and still be effective in reducing health care purchases by the old? Be specific.

(ii) Suppose $C$ is in fact smaller than the amount you just calculated. Analyze the effects of this Medicare cap on the market for health care. Be specific in showing the impact and its consequences.

Part V: Imperfect Competition (20 points total)

Today, drug companies spend large sums to determine additional uses for their existing drugs. For example, Glaxo, a pharmaceutical giant, learned that its drug bupropion hydrochloride (abbreviated BH) is more effective than the nicotine patch for people trying to quit smoking. When sold to people who wish to stop smoking, BH is sold as Zyban, but BH originally was introduced in 1997 as an antidepressant called Wellbutrin. Projected 2003 sales were $240 million for Zyban and $600 million for Wellbutrin. Glaxo currently sells both drugs for $1.20 per pill.

Suppose initially that the “choke price” (i.e., the price at which consumers refuse to buy anything) is the same for both Zyban and Wellbutrin.

A) Assuming for simplicity that the relevant demand curves can be approximated as being linear, what are the demand curves for Wellbutrin and Zyban and the total demand for this drug, BH? Show us the algebra and the graphical representations, being sure to explain your notation and label all relevant points in the graph(s).

B) Why does Glaxo, the monopoly producer, set the same price for both drugs?

Now suppose that the choke prices for Zyban and Wellbutrin are different (say, $P_Z$ and $P_W$) but that the estimated slopes of the (linear) demand curves are the same.

C) What are the demand curves for Wellbutrin and Zyban and the total demand for this drug, BH? Show us the algebra and the graphical representations, being sure to explain your notation and label all relevant points in the graph(s).

D) Under these demand conditions, what pricing proposal would you suggest for Glaxo if you were hired as a consultant?
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

February 7, 2003

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After Ambrose Bierce
Part I: True, False, Uncertain (60 points—10 each)

Tell us whether these statements are true, false, or uncertain, and explain your reasoning. Almost all of your score will depend on the quality of your reasoning.

1. Given two students with identical intellectual abilities but different preferences, a student specializing in the humanities (a relatively low-paying field) is likely to take longer to complete his education than a student specializing in economics (a relatively high-paying field).

2. If firms in more highly concentrated industries tend to be more profitable on average than firms in less concentrated industries, we can conclude that, the more concentrated an industry is, the less competitive it is.

3. If nonsmokers are bothered by “second-hand smoke” by an amount that is greater than the value smokers place on smoking, and if it is prohibitively costly for nonsmokers to bargain with smokers in restaurants or bars, then a ban on smoking in such establishments would be Hicks-Kaldor efficient relative to the unregulated equilibrium.

4. If widgets are an input to the production of gadgets, and if both Amalgamated Gadget and International Widget are monopolists, Amalgamated would reduce its cost of producing gadgets by acquiring International.

5. At the typical university, professors’ salaries are the single largest component of total cost. It follows that in the higher-education industry the demand for professors is more elastic than the demand for clerical and custodial staff.

6. In an infinitely repeated Prisoners' Dilemma game, “tit-for-tat” is a dominant strategy.
Part II: Demand (30 points, as shown)

Assume that the demand for food in the Jack and Jill household is separable from other consumption decisions. Jack and Jill live in a primitive community in which the only food products are beer, kumquats, and chocolate cake. The demands for beer, kumquats, and cake are represented by the following equations:

\[
\ln q_B = \alpha_{BB} \ln p_B + \alpha_{BK} \ln p_K + \alpha_{BC} \ln p_C + \alpha_{BX} \ln X
\]

\[
\ln q_K = \alpha_{KB} \ln p_B + \alpha_{KK} \ln p_K + \alpha_{KC} \ln p_C + \alpha_{KX} \ln X
\]

\[
\ln q_C = \alpha_{CB} \ln p_B + \alpha_{CK} \ln p_K + \alpha_{CC} \ln p_C + \alpha_{CX} \ln X
\]

where \( q \) is quantity consumed, \( p \) is price, and \( X \) is total expenditures on beer, kumquats, and chocolate cake. The subscript \( B \) refers to beer, \( K \) to kumquats, and \( C \) to chocolate cake.

The first table below gives the expenditure shares among food items. The second table gives the values for many of the coefficients. Answer the following questions and show your work—do not simply write down numbers, for example.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Share of Food Expenditures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beer</td>
<td>0.4</td>
</tr>
<tr>
<td>Kumquats</td>
<td>0.3</td>
</tr>
<tr>
<td>Chocolate Cake</td>
<td>0.3</td>
</tr>
</tbody>
</table>

(5 points) (a) Separability means that demand curves like those shown above can be consistently estimated. What are the conditions required for separability?

(5 points) (b) If the conditions for separability are not satisfied, how should the demand for these three goods be estimated?

(4 points) (c) What is the value of \( \alpha_{BC} \)?

(4 points) (d) Is \( \alpha_{CX} \) greater than or less than one?

(4 points) (e) Is \( \alpha_{KC} \) greater than or less than zero?

(4 points) (f) Is \( \alpha_{CX} \) greater than or less than one?

(4 points) (g) Is \( \alpha_{CB} \) greater than or less than \( \alpha_{BC} \)?

\[
\alpha_{BB} = -0.8 \quad \alpha_{KB} = -0.1 \quad \alpha_{CB} = ??
\]
\[
\alpha_{BK} = +0.1 \quad \alpha_{KK} = -0.9 \quad \alpha_{CK} = -0.23\quad \alpha_{CC} = -0.12
\]
\[
\alpha_{BC} = ?? \quad \alpha_{KC} = ?? \quad \alpha_{CX} = ??
\]

\[
\alpha_{BX} = +1.0 \quad \alpha_{KX} = ?? \quad \alpha_{CX} = ??
\]
Part III: Supply (30 points total, allocated as shown)

Last year the City of Clemson refused to grant an exception to its zoning laws that would have allowed Wal-Mart to open a store on the outskirts of town.

(6 pts) A. At a public hearing on the issue a Clemson University professor stated that the presence of a Wal-Mart store would confer no net benefits to the community because it would merely divert business from existing stores. Evaluate this assertion.

(12pts) B. Now suppose that Wal-Mart does indeed divert business from existing small retail shops. (For example, independent clothing, hardware, and drug stores might be displaced by a Wal-Mart selling items in all those categories.) Is this welfare-improving or not? Who wins and who loses in this process and why? Be specific about the economic forces at play and about what welfare criteria you are using to assess the impact, and how you would measure those welfare changes. Be specific and comprehensive—but remember that you have many other questions to answer.

(6 pts) C. Another occasional objection to the entry of a Wal-Mart store is that such stores are ugly. Is this likely to make zoning regulation that governs the appearance of stores a good idea? Why or why not? If so, what is the appropriate form of that regulation?

(6pts) D. Another objection to “superstores” in general is that their parking lots are so large that the water runoff during rainstorms might cause flooding nearby. Is this likely to make zoning regulation that governs the design of parking lots a good idea? Why or why not? If so, what is the appropriate form of that regulation? How, if at all, does either your reasoning or your policy conclusion differ from the answer you gave in part (C)?
Part IV: Applied Economics (40 points—allocated as shown)

Answer BOTH questions 1 and 2.

1. (20 points) For over two decades the U.S. government has imposed fuel efficiency requirements on cars and trucks sold in the U.S. The regulations do not apply to each car or truck in particular, but rather to the average of all cars or all trucks sold by a manufacturer. The regulations differ between cars and trucks, with the fuel efficiency requirements not as severe for trucks. Sport utility vehicles (SUVs) are in the truck class

   (6 pts) A. Until recently the public-interest explanation for mileage requirements has been that they are necessary to induce manufacturers to make more fuel-efficient vehicles. Does this make sense; i.e., is the argument economically sound?

   (6 pts) B. A corollary to this public-interest argument is that drivers of SUVs (and other vehicles that get poor mileage) increase the price of gasoline and oil for all of the rest of us. Assume that this is true. Is social welfare improved by having government mandated fuel efficiency regulations?

   (8 pts) C. The most recent argument of public-interest commentators is that drivers of high mileage vehicles increase the price of gasoline and oil (assumed above to be true), and that this increases the threat of terrorism by making the U.S. more dependent on oil from the middle east. The commentators go on to say that SUVs and similar vehicles should be taxed differentially to account for this externality. Does this argument make any sense, i.e., is the argument economically sound?

2. (20 points) Venezuela usually produces between 4 and 5 percent of the world’s supply of crude oil. In opposition to the government of Hugo Chavez, Venezuela’s workers have called a general strike, shutting down oil production there. Answer the questions that follow both specifically and comprehensively

   (12 pts) A. How would you provide a back-of-the-envelope upper bound estimate of the effect of this strike on gasoline prices in the United States? (Assume that 50% of U.S. gasoline is refined from imported crude oil, and that 20% of U.S. imports of crude oil come from Venezuela.)

   (4 pts) B. In what sense is your estimate an upper bound estimate of the effects of the strike on U.S. gasoline prices?

   (4 pts) C. What is your lower bound estimate of the effects of the strike on U.S. gasoline prices?
Part V: Imperfect Competition (20 points total—allocated as shown)

In response to budgetary cutbacks from the state government, Clemson has sought to ease the pain by turning many of the support activities on campus into profit centers which themselves raise money for the university. Campus parking is an example. Fees have been raised for faculty and staff to park on campus and this money goes into the school budget. Moreover, price discrimination has been introduced. Parking hang-tags for the same privileges are priced on the basis of income. The fees for a parking permit were raised for higher paid employees and faculty while those who earn lower pay continue to pay the old rate.

(4 pts) A. Under what circumstances will this discriminatory pricing scheme yield an increase in parking revenues? Explain.

(4 pts) B. Is it possible that revenues will actually decrease? Explain.

(6 pts) C. Why does the university charge faculty and staff to park at all (instead of letting each employee have a parking sticker at a price of zero)? They must pay these people to get them to come to work at all. Why then turn around and raise the cost to the same people of doing so?

(6 pts) D. An earlier chairman of the economics department wrote the Tiger a letter arguing that this pricing practice might actually have perverse consequences. His reasoning suggested that total revenues including tuition revenues might actually go down even if parking revenues went up. His argument had to do with the transfer-pricing theorem. What do you think he said?
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

September 27, 2002

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After Ambrose Bierce
Part I: (60 points — ten each)

Tell us whether these statements are true, false, or uncertain, and explain your reasoning. Almost all of your score will depend on the quality of your reasoning.

1. The Smith Corporation holds patents on both gadgets and widgets and is the sole producer of both. Each product is produced with constant-returns-to-scale technology. The own-price elasticity of demand for gadgets is -2 and the own-price elasticity of demand for widgets is -3. **TFU**: To maximize its profits, the firm should charge a price for gadgets that is 50 percent higher than the price of widgets.

2. The supply curve of a perfectly competitive industry can never be negatively sloped.

3. Given a competitive industry using a constant-returns-to-scale production function \( f(L,K) \), the greater is the elasticity of supply of \( L \) to the industry the more elastic is the industry’s demand for \( K \).

4. When a perfectly competitive equilibrium exists, it is always Pareto optimal.

5. Risk-neutral consumers prefer goods prices that fluctuate around a stable mean to prices that are stable at that mean.

6. If the hourly wages paid by Chili’s restaurant to waiters at its Atlanta airport restaurant are observed to be significantly higher than the wages it pays to waiters at its other restaurants in Atlanta area, we can conclude that the waiters at the airport are more productive workers.
II. War and Peace (40 points–8 each)

The nation of Israel can spend its income on either of two goods: settlements (S) in areas that are in dispute with the Palestinians, and all other goods (O). Suppose the United States would like to give Israel some extra income, called foreign aid, but the U.S. finds Israeli spending on settlements to be objectionable. Thus, the foreign aid package offered by the U.S. specifies that, if the Israelis spend nothing on settlements, they will receive an amount (A). But for each dollar Israel spends on settlements, the U.S. will reduce A by exactly one dollar.

1. Write out the algebraic expression of the Israeli budget constraint
   (i) in the absence of the U.S. aid, and then
   (ii) in the presence of the aid.

   Draw pictures of both budget constraints. To reduce grading costs, please put other goods (O) on the vertical axis and settlements (S) on the horizontal axis.

2. Is it possible that the Israelis would decline the U.S. offer of aid under these circumstances? Explain why or why not. A picture (or algebra) will surely be helpful.

3. Suppose the Israelis in fact decide to accept the offer of aid under the conditions specified. Can you be certain what will happen to the number of settlements built relative to the number built before the offer of aid? What can you say if the comparison is made relative to an offer of the same amount A, but without the provision for settlement-spending deductions? Explain your conclusions.

4. Now let’s examine more closely the offer that specifies deductions for money spent on settlements. Suppose the U.S. chooses a value for A such that A = P*Sb, where Sb is the number of settlements consumed before the offer and Ps is the price per settlement.
   i. Can you be certain whether the Israelis will accept this offer?
   ii. If the Israelis accept, can you be certain what will happen to the number of settlements that will be built, relative to, the number built before the aid?

   Explain your answers.

5. Again, assuming the U.S. insists on deducting for Israeli spending on settlements, what is the smallest A that can be offered by the U.S. that will induce the Israelis to accept the offer? (You need not, indeed cannot without more information, give an exact number; but you can characterize the minimum conceptually.) If the U.S. makes such an offer, what will happen to the number of settlements, again relative to the number consumed before the aid? Explain your answers.
III. Applied Economics (30 points total, distributed as shown)

1. (20 points) There are two main producers of aluminum in the United States: Kaiser and Alcoa. Aluminum smelting requires huge amounts of electricity. For many years, Kaiser has had a long term contract with the Bonneville Power Authority, stipulating that Kaiser can purchase as much electricity from Bonneville as it wants, at a price per unit that is fixed in the contract. In contrast, Alcoa purchases its electricity in spot markets, paying whatever is the current market price.

During the summer of 2000, electricity prices in spot markets soared across the U.S. Kaiser, of course, was protected by its long term contract, while Alcoa had to continue relying on spot markets. What is your prediction about how each firm adjusted its production of aluminum during the summer of 2000? Explain. (Note: This is a true story and you will be graded on the basis of how well your predictions conform to the observed behavior of the firms involved.)

2. (10 points) Police in Mayberry have received reliable information that there will be a bank robbery tomorrow, but they don’t know which of the town’s two banks will be the target. Bank A has $1 million in currency on hand, while Bank B has $2 million. If the police try to guard both banks, they will not have enough manpower to stop the thieves, but if they concentrate their resources on one bank they can successfully prevent that bank from being robbed. If the police know that the thieves know this, how should the police determine which bank to guard if their goal is to minimize the expected amount stolen? (Assume that the police correctly believe that the thieves’ goal is to maximize the expected value of the amount stolen.)
IV. Competition, Imperfectly Contemplated (30 points) Answer **ONE** of the two questions on this page.

DO **NOT** ANSWER BOTH QUESTIONS ON THIS PAGE.

Answer **either** this question . . . .

1. Cable TV and satellite TV are close substitutes. For sake of discussion, let the demand curves look like the following:

\[
q_1 = 10 - 2p_1 + p_2 \\
q_2 = 10 + p_1 - 2p_2
\]

where \( q_i \) and \( p_i \) represent the respective quantity demanded and price of the \( i^{th} \) good. Let cable TV be market 1 and satellite TV be market 2.

i) Assume that the markets are competitive. Let the supply function be \( m_1 = a + q_1 \) and \( m_2 = b + q_2 \), where \( m_i \) is marginal cost.

a) What are the equilibrium prices and quantities in the two markets?

b) What will be the effect on equilibrium price and quantity of cable TV of an increase in the marginal costs of producing satellite TV?

ii) Assume now that the satellite market becomes monopolized. *(To reduce your computational burden, you may wish to assume that \( a=b=2 \), but you are not required to make this assumption.)*

a) Solve for the new equilibrium prices and quantities.

b) How do the new equilibria compare to the competitive market? Do the equilibrium prices change in the same direction? Do they change by the same amount? How does the change in the price and quantity of cable TV compare to the results you found in part (b)?

**Or answer this question** . . . .

2. Assume the following:

(1) There are \( n \) firms in an industry.

(2) Each of the \( n \) firms produces a homogeneous product.

(3) These firms face a linear demand curve for their output.

(4) Each firm in the industry treats the output of all other firms in the industry as fixed.

(5) The marginal cost curve for firm \( m \) is linear and upward sloping.

Use the following notation:

\[
X = \text{the total output of the } n \text{ firms in an industry.}
\]

\[
x_m = \text{the output of firm } m.
\]

\[
i=1^{n-1} x_i = X_0 \text{, the output of all firms in the industry except firm } m.
\]

Therefore, \( x_m + X_0 = X \).

(a) Derive the mathematical expression for the profit-maximizing output level for firm \( m \). Define all notation.

(b) Does firm \( m \) increase or decrease its output as the output of all other firms increases? Derive the mathematical expression that shows whether firm \( m \) increases or decreases its output. Give an economic explanation of the mathematical result.

(c) Derive the mathematical expression that shows whether firm \( m \) increases or decreases its output as the number of firms in the industry increases, assuming that all of the \( n \) firms in the industry are identical. Explain.
V. It Takes a Village (20 points–4 for each part of the question)

The people who live on the shores of Lake Invidious are a strange group. There are 100 of them, and they live in a circle around the lake. Each person has two neighbors, one on his right and one on his left. There is only one commodity and they all consume it on their front lawns in full view of their two neighbors. Each person likes to consume the commodity but is very envious of consumption by the neighbor on his left. Curiously, nobody cares what the neighbor on his right is doing. In fact every person has a utility function $U(c,l) = c - l^2$, where $c$ is his own consumption and $l$ is consumption by his neighbor on the left. Suppose that each person owns 1 unit of the consumption good.

1. Suppose each person consumes the 1 unit of the good he owns. Calculate the utility level of a representative person.

2. Suppose that each consumer consumes only $\frac{3}{4}$ of a unit of the good. Will all individuals be better or worse off than when each consumes 1 unit?

3. What is the best possible consumption level if all individuals are to consume the same amount?

4. Suppose that everybody around the lake is consuming 1 unit each. Can any two people make themselves both better off either by redistributing consumption between them or by throwing something away? How about a group of three people? Explain.

5. How large is the smallest group that could cooperate to benefit all its members?
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

February 8, 2002

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In preparing your examination paper, follow these instructions:

1. Use only paper given to you by the supervising faculty member.

2. Ink is preferred, because it makes clearer copies. If you use pencil, it is your responsibility to ensure that there is sufficient contrast between your writing and the paper you are using. Do not use yellow paper if you use pencil. Unreadable answers will receive zero credit.

3. Write your assigned identification number on the top left-hand corner of each page. Do not write any other personal identifier on any page.

4. Start your answer to each question on a fresh piece of paper. You may, however, answer more than one TFU on a single page and you may answer more than one sub-question on a single page.

5. Write on only one side of each sheet of paper.

6. At the end of the exam, assemble your answers in the order in which the questions were asked on the exam.

7. After assembling your exam in the manner specified in (5), number each page in the upper right-hand corner. If the material on a page is a continuation of an answer, be sure to clearly denote that fact.

8. Do not leave the examination room without prior permission from the supervising faculty member.

As you answer the questions, always remember you are hoping to become an

Economist: A blackguard who sees things as they are, rather than as they should be.

After Ambrose Bierce
Part I: (60 points—10 each)

Tell us whether these statements are true, false, or uncertain, and explain your reasoning. Almost all of your score will depend on the quality of your reasoning.

1. A firm that discriminates against minorities in its hiring practices will have higher costs of production than it would if it did not discriminate.

2. "Nobody who works for somebody else ever got overpaid." --Babe Ruth

3. Until this past semester, each custodian in Sirrine Hall was assigned to a particular department. Now the custodial staff is randomly assigned to different locations each week. TFU: It is likely that both the level of effort by the custodians and the amount of cash given to them by faculty members as Christmas gifts have gone down this year compared to previous years.

4. Long run costs must be higher than short run costs, because short run costs do not include the cost of capital.

5. Consider a hypothetical country with two regions, North and South. The climate in the North is ill-suited to outdoor activities most of the year, while the climate in the South is well-suited to such activities for most of the year. TFU: If workers (and firms) can move between the two regions at relatively low cost, then in long-run equilibrium people in the North will work longer hours and earn higher wages (as well as higher incomes) than their counterparts in the South.

6. If tractors and labor are used to produce potatoes, and if the price of tractors is greater than the price of labor, it is possible for the government to lower the equilibrium price of potatoes by requiring firms to decrease the tractor-labor ratio they use.
Part II: (30 points—5 each)

Suppose you are scheduled to take an exam with two parts; the maximum available number of points on each part are designated by $X_m$ and $Y_m$ respectively. Although $X_m=Y_m$, you know that the committee grading the exam does not weight the points from the exams equally when it assigns a score to each paper. In particular, scores are assigned as follows:

$$S = \beta \ln X + Y$$

where $X$ and $Y$ are the actual points you receive on each part.

Your abilities in taking the exam are given by the following

$$X = \alpha_x t_x$$

and

$$Y = \alpha_y t_y$$

where $t_x$ and $t_y$ are the number of minutes you spend on each question, and you are limited to spending no more than $T$ minutes on the exam as a whole.

A. Draw a picture in the $(X,Y)$ space of the opportunity set you face, being sure to label all relevant points (slopes, intercepts, etc.). Be careful; getting this correct is important in everything that follows. Please put $X$ on the horizontal axis.

B. What is the “price” of a point on each part of the exam?

C. Assuming that your objective is to maximize your score, as calculated above, what is your optimal allocation of time between the two questions? Show all of your work explicitly.

D. Suppose that you are given an extra $K$ minutes to use on the exam. How will you allocate it? Be precise and be sure to explain how the specifics of your decision depend on the optimum for which you solved in part C.

E. Will you ever choose to get a perfect score on either part of the exam? Explain.

F. Suppose you are at an optimum at which you are not intending to obtain a perfect score on either part. If $\alpha_x$ changes, how will you change your allocation of time between the two parts of the exam? Be precise and show your work explicitly.
Part III: (30 points total, allocated as shown)

Answer both questions 1 and 2 below.

1. (15 points—5 points each) GM puts day-light running lights on most of its cars. These are headlights that stay on all the time. They are supposed increase safety by making the car more noticeable. GM is lobbying the government to force all car manufacturers to install similar devices.

   A. If day-light running lights are truly safer, why should the government need to force companies to install them?

   B. If day-light running lights are truly safer, why should GM want the government to force other car manufacturers to install them?

   C. Regardless of their effectiveness, is there any reason why GM would benefit from a government mandate forcing other manufacturers to install these devices.

2. (15 points) The “Southern Connector” is a semi-private toll road that loops around the south side of Greenville. The number of riders is substantially below the investors’ expectations and there is an alarming shortfall in actual revenues from projected revenues.

   The toll road is equipped with automated toll taking devices as well as the normal cash windows. The automated devices are radio devices that send a signal to the toll machine when the user’s car passes through the toll booth. This allows tolls to be deducted automatically from a user’s account.

   Given these institutional possibilities, suggest alternative pricing practices that the Southern Connector management might consider as a way of boosting revenues. Be precise in the details of your recommendations both in terms of the practicability of your plan and the likelihood of its increasing revenues.
Part IV (30 points—6 each)

(Note: Although the numbers have been changed, this question captures the essence of events that transpired in Seattle, Washington during the Fall and Winter of 1978-79.)

Suppose that the operators of taxicabs must have a government-issued license to operate. If they have a license, they may supply as many taxicab services as they care to; adding a second license to a cab does not affect its ability to offer services. Anyone who attempted to operate without a license would be punished so severely that no one attempts to do so. Licenses are "freely transferable" (i.e., may be purchased and sold) once they have been issued by the government.

The market demand for taxicab services ("rides") is as follows:

\[ P = 100 - Q \]

where \( P \) is the price per ride and \( Q \) is the quantity of rides consumed. The marginal cost curve of each and every current and prospective (or potential) taxicab operator is as follows:

\[ MC_i = 10 + q_i \]

where \( q_i \) is the number of rides produced by the \( i^{th} \) taxicab operator, and \( MC_i \) is the marginal cost of operating at that rate of output. All costs (except that of a license—see below) are variable; that is, they depend on output in exactly the manner shown above.

Initially there are fifty (50) taxicab licenses.

A. What will be the rental price of a license?

B. Suppose there are complaints among prospective taxicab operators that taxicab licenses are "too expensive" for them to afford. Evaluate these complaints—are they sensible or not?

C. Despite your eloquent answer to the previous question, the government decides to issue more licenses. Specifically, it decides that $10 per license is a "fair and just rental price" for licenses. How many licenses must the government issue to achieve this rental price?

D. Will increasing the number of licenses make prospective taxicab operators better off? What about existing taxicab operators? What about taxicab riders? Explain.

E. How, if at all, do your answers to part E depend on whether the government sells new licenses or simply gives them away? Explain.
Part V: (30 points total, allocated as shown)

Answer both questions 1 and 2 below.

1. (15 points) Suppose there is a price setting firm that sells in a market into two segments, i.e., there are two “types” of customers.

   A. (5 points) Under what conditions will that firm find it profitable to price its good differently in the two segments?

   B. (10 points) Suppose the conditions you outlined in (a) are met and the two segments are priced differently. What happens to the two prices if the firm experiences an increase in marginal cost? Be specific. Which price increases more? The low or the high price? (For simplicity, you may assume that the demand curves are linear, but you don’t have to if you don’t want to.)

2. (15 points) Imagine that there is a vertical chain in the production and distribution of some product. For ease of discussion suppose there are three elements—manufacture, wholesale, and retail. Compare and contrast the impacts of a monopoly or an effective cartel at the manufacturing stage with a monopoly or effective cartel at the retail stage. Be sure to convince us how (if at all) retail price, retail output, and welfare will differ under the two scenarios.
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

September 28, 2001

You have three (3) hours to complete this examination. There are four parts, I-IV. Point values are shown for each question. There are a total of 180 points and 180 minutes available. Before you begin answering any questions, you should examine the allocation of points across topics.

In preparing your examination paper, please follow these instructions:

1. **Ink** is preferred, because it makes clearer copies. If you use pencil, it is your responsibility to ensure that there is sufficient contrast between your writing and the paper you are using. At the very least, do not use yellow paper if you use pencil. Unreadable answers will receive zero credit.

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As you answer the questions, always remember you are hoping to become an

**Economist**: A blackguard who sees things as they are, rather than as they should be.

After Ambrose Bierce
Part I: True, False, or Uncertain (50 points: 10 points each)—Tell us whether these statements are true, false, or uncertain, and explain your reasoning. Answer ALL five.

1. Historically, many people work in the underground turquoise mining industry have died prematurely of “blue lung disease,” caused by turquoise dust in the air that circulates in the mines. New technology that filters out 100% of the dust has been developed and introduced into the mines.
   **TFU:** Because most workers already suffer from the disease, the new safer technology will not immediately lead to any reduction in the compensating wage differential associated with the hazards of blue lung disease.

2. **TFU:** If all firms in a competitive industry use a production technology that is linearly homogeneous, then the long-run supply curve of that industry is horizontal.

3. Mike’s Meat Shoppe engages in third-degree price discrimination in selling pork chops to its two customers, the Old and the Young. The two groups have different demands for pork shops, but each group’s demand curve is linear.
   **TFU:** If the wholesale price of pork chops (paid by Mike) falls, the difference between the retail prices Mike charges to the two groups will increase.

4. **TFU:** An income tax distorts the choice between labor and leisure, while a general sales tax distorts the choice between consumption and saving.

5. Suppose there are two restaurant chains that are identical except that A buys its potatoes in the spot market, paying whatever price prevails at the moment of purchase while B has entered into a long-term contract with a potato supplier at a fixed price. **TFU:** An increase in the spot price of potatoes will cause A, but not B, to increase the prices at which it sells its french-fried potatoes.
Part II: Utility Maximization and Demand (45 points). Answer **BOTH** questions.

1. (24 points) The estimated household demand parameters for fish are as follows:

   Own price elasticity:  
   Income elasticity:  
   Cross price elasticity with all other goods:  
   
   Assume that the price of fish is $5 per pound, income is $55,000 per year, and budget share 
   (spent on fish) is 3 percent. Address following:

   a) (8 points) Evaluate in detail whether these facts are consistent with the law of demand. If 
      they are not, please tell us precisely what the problem is.

   b) (16 points) The domestic fishing industry has obtained import restrictions on fish that raise 
      the price of fish to domestic consumers by $1 per pound. How much would domestic 
      consumers be willing to pay per household in order to have these restrictions abandoned?

2. (21 points) The following data were obtained from experiments performed by Battalio, Kagel, 
   & Kogut and reported in the *American Economic Review*, September 1991:

<table>
<thead>
<tr>
<th>Trials</th>
<th>Income (total presses allowed each session)</th>
<th>Price (amount dispensed for each press)</th>
<th>Quantity Consumed (in cc's; presses in parentheses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quinine</td>
<td>Root Beer</td>
<td>Quinine</td>
<td>Root Beer</td>
</tr>
<tr>
<td>a</td>
<td>110</td>
<td>.1cc</td>
<td>.05cc</td>
</tr>
<tr>
<td>b</td>
<td>75</td>
<td>.1cc</td>
<td>.05cc</td>
</tr>
<tr>
<td>c</td>
<td>75</td>
<td>.15cc</td>
<td>.05cc</td>
</tr>
</tbody>
</table>

   a) (3 points) Plot the budget constraints and the subject responses in consumption space.

   b) (5 points) Calculate the price effect.

   c) (5 points) Calculate the income effect.

   d) (5 points) Calculate the substitution effect.

   e) (3 points) Is the rat behaving rationally?
Part III. Applied Economics (45 points) Answer **ALL** three questions.

1. Suppose that the current price of electricity in California is $0.12 per kwh. At that price the average person buys 1,500 kwh per month. The short run price elasticity of demand for electricity is $-0.4$, and the long run elasticity is $-1$. It is expected that, next summer, there will be a 25 percent shortage in electricity: Demand is higher in the summer because customers run their air conditioners to keep cool. If the short run price elasticity of supply is 0.6 and the long run elasticity of supply is 1.0, what price would clear the market in the short and long run?

2. Lease contracts in large shopping malls generally have a number of interesting characteristics. For example, the owner of the mall usually receives a specified percentage of the total sales of each of the stores in the mall as a portion of the rent. Given that it is costly to monitor this arrangement—that is, it is cheaper to specify a fixed fee per month as the rental price, there must be some economic advantage to this contractual provision.
   a. What forces might be at work to make this technique advantageous to the mall owner and renters?
   b. Does your answer help explain why the malls have large commons inside and out?
   c. Expand your answer to explain why most mall operators contract for mall and parking cleaning, but they charge back the stores for this service. Why does the operator not leave cleaning and snow removal to the individual stores in the mall? Or, why, given that the operator performs these chores, does the contract have a charge back system? Why not just include the average cost of cleaning in the rental rate charged up front?

3. Last week, Novartis, the Swiss chemical and pharmaceutical giant, was granted permission by the U.S. FDA to market its revolutionary, cancer treatment drug, STI571 under the name Gleevec. For some time, experiments have suggested that this drug is very effective at treating certain kinds of leukemias and other cancers with virtually no side effects. It is a so-called, stealth drug that only attacks cancer cells, and not healthy ones like traditional chemotherapies. Over this recent time period, Novartis has been trying to boost capacity because of the expected permission and the anticipated demand for this drug. If Novartis decides to license this formula to other pharmaceutical manufacturers, the fee will be substantial. The expected price for this drug will be about $2,400 per month per person.

   Because Novartis does not have to pay itself the license fee, explain how and why it will price its product compared to its licensees.
Part IV: Theory and Policy (40 points). Answer TWO of the following three questions.

1. In determining benefits and costs of a specific optimization policy some (such as Lipsey and Lancaster) have argued that only general equilibrium solutions are valid. Others (such as Davis and Winston) have argued that evaluations based on “piecemeal analysis” are acceptable.

   a. Explain their two divergent views assuming the following Lagrange function:

   \[ L = U(q_1, \ldots, q_n) - \lambda F(q_1, \ldots, q_n, X^0) \]

   b. What guidance regarding this debate would you give to an economist doing policy analysis on railroads, given there is imperfect competition in the market for chewing gum? Explain.

   c. Would your answer to part (b) change if there was imperfect competition in the market for steel? Explain.

2. Networking externalities have played an important part in the federal government’s antitrust case against Microsoft, Inc. The notion of path dependency has also been used in these contexts.

   a. Define networking externalities and give an example of how such externalities might exist in the market for computer operating systems.

   b. In what sense do these externalities result in divergences between private and social marginal efficiency conditions, and what relevance might they have to Microsoft’s alleged violations of antitrust law?

   c. Define path dependency and give an example of how such a concept might have antitrust implications in such a case.

THERE IS ANOTHER QUESTION ON THE NEXT PAGE!
3. On Monday, July 16, a Russian computer programmer (Dmitry Sklyarov) in Las Vegas for a convention was arrested on charges that he wrote a program that allows users to bypass encryption put into digital material by publishers trying to protect their copyrights. The 1998 Digital Millennium Copyright Act (DMCA) makes it illegal to copy digital material for personal use even if you legitimately purchase the original. Many commentators claim that the DMCA is bad law and bad economics. They say that digital material should be subject to the same “fair use” standard that has long been applied to photocopying printed material. (For printed material “fair use” means that the legitimate owner of a document can make photocopies for personal use.)

The DMCA is a restriction on the use of copyrighted material. It presumably raises the cost to consumers while increasing the income to producers. Like other cases of intellectual property there is a balancing of consumer and producer interests. Amending the DMCA to allow for fair use copying would increase consumption of the current stock of digital material, but it would reduce income to producers and thereby reduce the amount of digital material produced in the future.

a) Sketch out a model that accounts for the short-run and long-run effects on consumer surplus that would result from changing the DMCA to allow for fair-use copying.

b) Under what circumstances do more restrictive copyright practices lower consumer surplus? Is it ever possible that copyright laws should be abolished altogether?
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

February 23, 2001

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**Economist: A blackguard who sees things as they are, rather than as they should be.**

After Ambrose Bierce
Part I: True, False, or Uncertain (50 points--10 points each)—Tell us whether any five of these statements are true, false, or uncertain, and explain your reasoning. Answer five—and only five.

Do not answer all six. Answer only five TFU questions.

1. Kurt has an obsessive personality. Ceteris paribus, the more beer he drinks, the higher is the marginal utility of beer to him. In addition, the more potato chips he eats, ceteris paribus, the higher is the marginal utility of potato chips to him. TFU: If Kurt were in a bar that served only beer and potato chips, he would either drink beer or eat potato chips (depending on their relative prices) but he would not consume both.

2. Suppose that the nation of Santa Pellagra is populated entirely by households with identical preferences and incomes for whom rice is a Giffen good. Assume further that Santa Pellagra is a small, open economy that produces no rice domestically. TFU: If Santa Pellagra imposed an import duty on rice, and if the revenue from that tariff were distributed randomly among all households in the nation, then the quantity of rice consumed in Santa Pellagra will decline.

3. On Monday, when prices are \((p_1, p_2) = (10, 20)\), Ralph purchases a bundle \((x_1, x_2) = (9, 3)\), exhausting his income. On Tuesday, when prices are \((p_1, p_2) = (5, 25)\), Ralph purchases \((x_1, x_2) = (1, 6)\). TFU: Between Monday’s purchases and Tuesday’s purchases, Ralph’s preferences must have changed.

4. In the United States, the demand for frozen turkeys can safely be presumed to be much higher close to Thanksgiving than it is during the rest of the year. It can also be presumed that the demand for fresh roses is much higher close to Valentine’s Day than it is during the rest of the year. Casual empiricism suggests that the price of frozen turkeys does not exhibit a “spike” (i.e., sharp rise) at Thanksgiving while the price of fresh roses does exhibit a spike at Valentine’s Day. TFU: This evidence suggests that the consumers and producers of roses are short-sighted, compared to the consumers and producers of turkeys.

5. TFU: A two-factor, constant-returns-to-scale production function generates homothetic isoquants.

6. TFU: In the absence of governmental restrictions, no firm can exercise monopoly power in the long run.
**Part II: Utility Maximization** (30 points)

A consumer’s utility function is

\[ U(X_1, X_2) = X_1X_2 \]

where \( U = \) utility
\( X_i = \) quantity of good \( i \) consumed.

The prices of the two goods are as follows:

\[ P_1 = $5 \]
\[ P_2 = $2.50 \]

The consumer has a total income of $50 each week.

A. How much of each good will be consumed to maximize utility?

Now assume that the consumer must have ration points in addition to dollars to obtain the goods. The consumer is given 60 ration points each week and he must give up 6 ration points to obtain each unit of good 1 and 10 ration points to obtain each unit of good 2. (Notational hint: Let \( R_1 = 6 \) and \( R_2 = 10 \) represent the coupon prices of the goods.)

B. How much of each good will be consumed to maximize utility now that the consumer must use both dollars and points to buy goods? Is the consumer better off or worse off as the result of rationing? Can you be sure?

C. Explain how the introduction of rationing affects consumption. Use a graph in your explanation. Under what condition(s) does rationing affect consumption in general? Explain.

D. Given the optimum you found in part (b), what is the marginal utility of a ration point? What is the marginal utility of a dollar?

E. Explain how the introduction of a market for ration points (so that this consumer could buy or sell points for dollars) would benefit or hurt the consumer.
Part III: Supply and Demand (40 points)

Medicare is a U.S. government program that subsidizes the health care of persons aged 65 or older (“senior citizens”) in this country. For simplicity, assume that there are two classes of senior citizens, “rich” and “poor,” and that they differ only in their income levels. Specifically, (i) each rich person is identical to all other rich people, just as each poor person is identical to all other poor people; (ii) there are equal numbers of rich people and poor people; and (iii) each rich person has a high income and each poor person has a low income.

Also assume for simplicity that senior citizens are the only people who consume prescription drugs.

A. Suppose the demand for drugs by each group (rich and poor, respectively) can be linearly approximated by the following:

\[ Q_R = a - (b - c Y_R)P \]  for rich people, with income \( Y_R \)

\[ Q_P = a - (b - c Y_P)P \]  for poor people, with income \( Y_P \)

where \( a, b, \) and \( c \) are constants, \( P \) is the market price of drugs, and \( Y < (b/c) \) for both groups.

(i) Construct the market demand curve for drugs.

(ii) If the short run supply of drugs is fixed at an amount equal to \( a + \epsilon \), where \( \epsilon \) is an arbitrarily small positive amount, what will be the equilibrium price of drugs?

(iii) How many drugs will be consumed by rich and poor, respectively?

President Bush has proposed that a “drug benefit” be added to Medicare. Specifically, he has proposed that the government should pay for 100% of an older person’s expenditures on prescription drugs, if that person is poor. The government will pay nothing for prescription drug purchases made by rich people.

B. Show how Bush’s proposed program would affect the budget constraints of rich and poor people, respectively. (If you wish, you may assume the program is paid for by donations from a foreign country whose ruler is concerned for the welfare of poor people in America.) What must be true about the marginal rate of substitution between drugs and other goods for poor people in the presence of this program? Give us an exact number.

C. Suppose Bush’s program is put into place, with the same supply assumptions as above.

(i) What will be the new demand curve for drugs on the part of poor people? Be precise.

(ii) What will be the new market demand for drugs? Be explicit algebraically and draw the picture.

(iii) What will be the equilibrium price and the consumption of drugs by poor and by rich? Be explicit algebraically and draw the picture.

(iv) Presumably, your answers to (i)-(iii) in this part implicitly assumed that rich and poor people both “played by the rules.” Given the assumption about the supply of drugs, what will happen to the
price of drugs if rich and poor begin behaving like every Clemson Ph.D. knows they will? Explain.
Part IV: Applied Economics (30 points; 15 points each). Answer any two—and only two—of the following three questions. Remember: these are worth only 15 points each; allocate your time accordingly.

Do not answer all three questions. Answer only two questions in this Part.

1. Milton Friedman in The Price Theory: A Provisional Text (p.23) argues that “the purpose of ceteris paribus is methodological and not substantive.” He discusses this, saying ceteris paribus often includes:

   (1) Prices of all other products
   (2) Quantities of all other products
   (3) Money income or money expenditures of consumers

Explain what he meant by “methodological and not substantive.”

2. DuPont has just received a patent on a new type of glue, the principle use of which is in the manufacture of laminated wood products. The important feature of the new glue is that it makes the wood product waterproof without further treatment. This makes all laminated products more durable.

The invention is simple: It only requires adding a small amount of a common chemical to the standard glue used by manufacturers. This mixing procedure can be carried out on-site at virtually no cost. Moreover, it is very easy from a technical standpoint to determine if a manufacturer of a laminated wood product has utilized the chemical innovation. All that is required is a litmus-like analysis of the wood on the rack in any store or warehouse.

DuPont managers are debating how to market the invention. Several suggestions are on the table.

   i. DuPont can sell a site license to each wood processor for use of the new glue.
   ii. DuPont can sell pre-mixed glue.
   iii. DuPont can sell the chemical additive.
   iv. DuPont can charge a royalty based the quantity of laminated wood produced using the new gluing compound.

What factors will determine which pricing method DuPont will choose? Explain carefully.

3. Suppose the state government decides to regulate agricultural production in an effort to decrease the amount of land planted, thereby increasing the amount of idle land that might be useful wildlife habitat. Assume for simplicity that no land is sold. There are two possible regulations being considered:

   (i) require each producer to set aside x percent of his land, and
   (ii) charge a tax per acre of land planted for production.

If both regulations were designed to achieve the same amount of idle land, which scheme would the producer prefer and why?
Part V: Discrimination and Taxes (30 points)

Assume the following demand functions characterize two markets served by a monopolist. Further assume that these demand curves reflect the ability of the monopolist to separate the markets and thereby price differently in each market.

\[ q_1 = 2 - 2P_1 + P_2 \]
\[ q_2 = 1 + P_1 - P_2 \]

Let the cost of production be: \[ C = q^2 = (q_1 + q_2)^2. \]

Answer the following questions. (Note: Most of the credit will be given for correctly specifying and analyzing the economic problem in each question; trivial errors in arithmetic will be (almost) free.)

A. What is the profit maximization price and quantity in each market?

B. How will the profit-maximizing values change if a per-unit tax of $0.10 is levied in market one? Most importantly, what is the change in price and quantity in market two?

C. What tax rate imposed on market one will maximize tax revenue?

Hint, applicable to all three questions: Remember that you can model the problem in price or quantity space, and this is true even for cost.
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

September 22, 2000

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Economist: A blackguard who sees things as they are, rather than as they should be.  
After Ambrose Bierce
Part I: True, False, or Uncertain (50 points--10 points each)—Tell us whether these statements are true, false, or uncertain, and explain your reasoning.

1. It is impossible for a demand curve to have a constant elasticity throughout its entire price range.

2. The corporate income tax code in the United States, which forces firms to depreciate capital expenditures over their useful life, biases against capital investment, compared to a system in which firms could write off all their capital expenditures immediately.

3. When the variance of the outcome in a two-person tournament increases, effort falls and so do wages.

4. If the State of South Carolina replaces the property tax on cars with a higher gasoline tax, the result will be less fuel-efficient cars on the roads of South Carolina.

5. Even though it seems odd that, in China, fish is a complement to meat (the cross price elasticity of the consumption of fish with respect to the price of meat is -.11) while meat is a substitute for fish (the cross price elasticity of meat with respect to the price of fish is .01), these facts are consistent with the income elasticities which are 1.34 for fish and 2.53 for meat.
Part II: Utility Maximization (30 points)

1. (5 points) What is a monotonic transformation? Explain why we care.

2. (5 points) Perform a monotonic transformation on the following utility function to make it analytically tractable. Be sure to show us that your transformation is in fact a monotonic transformation.
   \[ U = [(x - x_0)^\alpha (y - y_0)^\beta]^\theta \]
   where \(x_0\) and \(y_0\) are the subsistence (minimum permissible) levels of consumption for \(x\) and \(y\), respectively.

3. (20 points) Do the demand curves generated by this utility function satisfy the standard restrictions that we insist demand functions satisfy? Be specific. Convince us.
   (Hint: You may want to start by defining \(X = (x - x_0)\) and \(Y = (y - y_0)\) as discretionary purchases of \(x\) and \(y\), and \(E = I - p_x x_0 - p_y y_0\) as discretionary spending, and doing your initial manipulations in terms of these variables. Then, account for the necessary subsistence (non-discretionary) spending.)

\[1\] This problem is interesting in the following way: The FOC and SSOC are satisfied for all values of \(x\) and \(y\). However, the demand curves only obey the law of demand for values of \(x\) and \(y\) in excess of the subsistence levels. The easiest way to show this is following the hints, but it can be done the long way. The implication is that to show that a particular function is consistent with the Law of Demand it is necessary to derive the demand curves and demonstrate that the Slutsky condition holds. This seems odd.
Part III: Supply and Demand (30 points)

Medicare is a U.S. government program that subsidizes the health care of persons aged 65 or older (“senior citizens”) in this country. At least one presidential candidate has argued that a “drug benefit” be added to Medicare. One specific proposal is that the government should pay for half of an older person’s expenditures on prescription drugs.

A. (5 points) Show how such a program would affect the representative senior citizen’s budget constraint. (Be explicit regarding your assumption as to who is paying the taxes needed to finance the program.)

B. (5 points) One version of the drug plan would “cap” (limit) the government’s annual spending per beneficiary. Suppose a cap of $2000 per year were included in the program. Compared to the program without the cap, how would the cap affect the behavior of various people? Is a program with a cap different from a cash grant to seniors to spend on anything they want to purchase? Explain, briefly.

C. (10 points) Suppose the program is implemented without the cap; thus, senior citizens would get fifty cents from the government every time they spent a dollar on prescription drugs, no matter how much they bought. Also suppose that, because of existing patent protections, in the short run all existing drugs are each produced by monopolists. (For your convenience, you may also (but do not have to) assume that marginal manufacturing costs for existing drugs are effectively zero.) What will be the impact of the program on the price and rate of production of drugs in this short run, i.e., given the drugs already in existence? Be precise . . . very precise. By how much do senior citizens benefit? Be precise.

D. (10 points) Again, assess the program without the cap, but now look at the long run effects. Specifically, assume that in the long run, there is competition for innovation in new drugs. What will be the impact of the program on the price and rate of innovation of new drugs in the long run? Be precise. By how much do senior citizens benefit? Be precise.
Part IV: Applied Economics (40 points total; 20 points each)

1. Efficient Rate-Regulation (20 points)

From about 1900 until the mid-1970's, the nature of the market for electricity was natural monopoly. Average cost was downward sloping in the relevant range of production. Firms were regulated and the prices that they charged were set so that they enjoyed revenue that was just sufficient to cover their cost of production.

Electricity is consumed by different groups of consumers that can be easily distinguished. For simplicity assume that there are only two groups: residential and industrial customers. It costs more to serve residential customers because they take electricity at a lower voltage, requiring an additional transformer. The result is an additional per unit cost of serving residential customers, equal to \( t \) c/kWh.

In the mid-1970's, the cost structure in the industry changed from downward sloping average cost to constant average cost. Now all firms have production characterized by constant returns to scale. The average cost of production also fell.

Assume that regulators set the optimal prices for both residential and industrial customers in both periods subject to the constraint that total revenue must cover total cost.

A. How do you expect the price elasticities for residential and industrial customers will differ?

B. What should have been the price ratio between residential and industrial customers in the first period (1900 to the mid-1970s)?

C. What should be the price ratio between residential and industrial customers now?

2. Intellectual Property (20 points)

In the early days of personal computers, many software vendors attempted to copy protect their products. Most of these attempts failed for a number of technical reasons. Now that approach as resurfaced with digital music. Answer the following questions:

A. Suppose copy protection for digital music turns out to be a failure. What will happen to the quantity and price of digitally recorded music as a result of this failure? Be careful—very careful—to specify precisely (i) what “quantity” you are referring to and (ii) the exact item whose price you are talking about.

B. Will copy protection for digital music turn out to be a failure? That is, what are the relevant economic issues that will determine success or failure of copy protection for music?
Part V: Life in the Fast Lane (30 points)

The U.S. Department of Transportation has forced cities to institute HOV (high occupancy vehicle) incentives for automobile commuters. In Atlanta this takes the form of a special lane of traffic on the main expressways that is reserved for cars carrying two or more people. For simplicity assume that the expressway is 4 lanes wide, plus the HOV lane. Let all people have the same value of time. Also assume that all traffic in the HOV lane carries exactly two people and all traffic in the other lanes carries exactly one person per vehicle.

A. How many cars must travel in the HOV lane relative to a regular lane to make total passenger miles increase due to the HOV restrictions? (Explain. Note the emphasis on total passenger miles.)

B. Assume that traffic congestion can be modeled in the following way. Commuting time per car is a function of the total number of cars on some space of road at a given moment. Specifically, let $C$ be the total number of cars and $T$ be the commuting time per car, then

$$T = C^\alpha$$

Assume $\alpha = .9$. It is commonly reported that the commuting time over a 5-mile stretch is 15 minutes in the HOV lane and 20 minutes in the other lanes. Is this reported time saving for commuters in the HOV lane evidence that the HOV restriction is efficient in increasing total passenger miles? (Show your work.)

C. Assuming the same congestion equation specified above, would a time saving of 15 minutes be evidence of efficiency in increasing total passenger miles? (That is, assume that the commute takes 20 minutes in the non-HOV lanes and 5 minutes in the HOV lane.)

D. If all people have the same value of time, why is it that some people choose to travel two to a car in the HOV lane and reduce commuting time costs while others travel one per car at higher time costs? (Equivalently, tell us who will be in the HOV lanes and who will be elsewhere.)

E. What do you think would be the effect on total passenger miles of restricting an additional lane to HOV?
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

February 11, 2000

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After Ambrose Bierce
I. TFU (50 points—10 points each)

   Explain whether each of the following statements is either true, false, or uncertain. Be sure you state clearly whether you believe them to be T, F, or U, but remember that almost all of the credit will depend on your explanation.

1. Food and clothing are the only two goods that Jack consumes. Jack always spends 25 percent of his income on food. The income elasticity of demand for food is 1.0 and the own-price elasticity is -1.0. Therefore the cross-elasticity of demand for food is zero.

2. In societies where the cost of bearing children is lower (e.g., the medical risk to mothers is lower), women have fewer children. Also, in economies with higher per capita incomes, people have fewer children. Hence, children are a Giffen good.

3. Constrained average cost (average cost derived from a model with a subset of inputs held constant) is less elastic with respect to output than unconstrained average cost because constrained marginal cost is steeper than unconstrained marginal cost.

4. If a competitive industry became monopolized, the quality of output would decrease.

5. A perfectly competitive firm is less likely to discriminate against women or minorities in its hiring and promotion practices than is a monopolist.
II. Demand (40 points—5 for each part)

In-state students at Clemson University pay $P = $125 per credit hour for the classes they take, up to 12 credit hours per semester, a level that makes them “full-time students.” Additional credit hours beyond 12 per semester can be taken by full-time students at no additional charge, but no more than 21 credit hours per semester can be taken by anyone. (For simplicity, assume throughout that credit-hours are continuously divisible, just as we normally assume for goods.)

A. For a world in which there are just two goods (education and “all other goods”), write out and draw a picture of the budget constraint facing in-state Clemson students. Please put education, measured in credit hours, along the horizontal axis.

B. If a student were observed to take 15 credit hours in a semester, what can you infer about that student’s marginal rate of substitution between other goods and education?

C. If students consider education to be a good over all ranges of feasible consumption, what can you predict about the number(s) of credit hours that students will be observed to take each semester?

Recently, the state of South Carolina introduced the LIFE Scholarship, which pays in-state students $1000 per semester, provided that they enroll for at least 12 credit hours for that semester. Assume for simplicity that the taxes used to pay for these scholarships are not levied on students.

D. Show both algebraically and graphically how the introduction of the LIFE scholarships affects the in-state student’s budget constraint.

E. Once the scholarship is in place, will any students go to school part-time (i.e., less than “full-time” as defined above)? Explain.

F. Consider a person originally (before the scholarship program) enrolled for 8 credit hours. What will be this person’s response to the program? Be precise.

G. Are there any students whose educational consumption will be unaffected by the introduction of the LIFE scholarships?

Suppose the LIFE scholarships were worth $1500 per semester, but were otherwise the same as noted above.

H. Would any students go to school part-time? Explain.
III. Supply (30 points—10 for each part)

In the town of Slobbovia there is a well that is the sole source of water. The marginal cost of producing water from the well is $10 per acre-foot of water. The demand for water in the town is $P = 100 - Q$, where $Q$ is measured in acre-feet and $P$ is measured in dollars per acre-foot.

A. Suppose each resident of the town owns one share of non-transferable stock in the Water Company, which is the firm that operates the well. What will be the price and quantity of water in Slobbovia? Be explicit.

B. Suppose instead that the Water Company stock can be bought or sold freely. A controlling interest in the Water Company consists of a simple majority of shares. What is the equilibrium ownership structure of the Water Company? What will be the price and quantity of water in Slobbovia? Be explicit.

C. According to the Coase Theorem, what will be the price and quantity of water in Slobbovia? Does the ownership structure of the Water Company matter for your answer? If so, how? If not, why not?
IV. Equilibrium (20 points)

In Walhalla, SC there are two kinds of workers. The first kind has a (constant) marginal product of $15 per hour and the second has a (constant) marginal product of $10 per hour. There are equal numbers of workers of each kind. Employers cannot tell which kind of worker an applicant is when he applies for work. Finished output is simply dumped into the communal output bin as it is completed so that the output of each worker cannot be determined, even after it has been performed. Workers get no disutility from work, once they are at the job site. At the end of the day total output is evaluated, and each worker is paid an equal share of the total output.

Answer the following questions:

A. Assume the employers are perfect competitors for labor. What is the equilibrium wage? Explain, briefly.

B. Assume that Tri-County Tech offers a (no tuition) course in price theory. The course does not affect productivity on the job, and high productivity workers regard taking this course to be just as bad as accepting a $3 per hour pay reduction. Low productivity workers regard it as bad as accepting a $6 pay cut. Upon successful completion of the course, a worker is given a certificate which he may show potential employers attesting to his success. Will workers take the course in equilibrium? Why or why not?

C. Suppose the instructor in the price theory course tells sophisticated jokes. The jokes are not understood by the low productivity workers, and so do not affect how they feel about the course. But the more productive workers both understand and enjoy the jokes, so they now regard the class to be only as bad as accepting a $2 per hour pay reduction. How would your answer to the previous question change? Explain carefully.
V. Applied Economics (20 points)

Agricultural policy-makers have devised schemes for reducing output with the goal of improving the welfare of farmers. One way to reduce output is by imposing a restriction on a single input as in the case of acreage restrictions which establish maximum acreages that farmers are permitted to plant to certain crops like corn or wheat; another is to impose a maximum quota on output as in the case of tobacco or peanuts.

A. Show the farmer’s optimization strategy under each case.

B. What are the welfare implications of the two schemes? Which do you prefer? Why?
VI. General Equilibrium (20 points)

In 1348, the bubonic plague swept into central Europe carried by fleas on the backs of dogs. In two years, one-third of the population was dead. The black death subsided, but recurred with a lower death toll approximately every ten years into the 15th century. Is it possible that the per capita income of Europe rose during this period? On the flip side, some people argue that welfare is diminishing today due to population growth. Some go so far as to say, cynically, that we need another plague. Is it possible that current population growth is responsible for declining welfare? Make sure that your answers across these centuries mirror each other.
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

September 24, 1999

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After Ambrose Bierce

And one more thing:

“If you want to be good, you have to be willing to be wrong.”

Karl Brunner
I. True, False, Uncertain and Explain (40 points; 8 points each)

1. Every good must have at least one substitute.

2. The market supply curve in a competitive industry must be perfectly elastic if all firms are identical.

3. Fixed costs are irrelevant to output decisions.

4. Whales are a renewable natural resource, whereas coal is not (i.e., for all practical purposes, the total amount of coal on the planet is fixed). Therefore environmental activists should spend less time trying to “save the whales” and more time trying to “save the coal.”

5. When the atomic bomb exploded over Hiroshima in August, 1945, interest rates in Japan rose.
II. Demand (55 points)

(NOTE: The section on Demand covers two pages; the contents of this page are worth only 20 points)

1. (20 points) Shown below are some estimates of equations that are claimed to be demand curves. Which of these alleged demand curves satisfy the basic laws of demand? Which do not? Explain. (In answering, assume that the estimated standard errors are very low relative to the estimated values of the coefficients.)

NOTATION:  
\( \ln Q \) is natural log of the quantity demanded  
\( \ln P \) is the natural log of the price (own- or cross-price, as appropriate)  
\( \ln M \) is the natural log of money income

a. The demand curve for good 1 is estimated:
\[
\ln Q_1 = 1.1 - 1.1 \ln P_1 - 1.1 \ln P_2 + 1.1 \ln M
\]

b. In a world where consumers spend 20% of their income on good 1:
\[
\ln Q_1 = 1.1 - 0.4 \ln P_1 - 2.6 \ln P_2 + 3.0 \ln M
\]

c. In a two good world, this system of demand curves is estimated:
\[
\begin{align*}
\ln Q_1 &= 3.2 - 1.7 \ln P_1 + 1.3 \ln P_2 + 0.4 \ln M \\
\ln Q_2 &= 1.4 + 1.2 \ln P_1 - 0.9 \ln P_2 + 0.3 \ln M
\end{align*}
\]

d. Based on Chinese expenditure data aggregated to the categories non-food (good 1) and food (good 2) this system of demand curves is estimated, with expenditures divided equally between the two categories:
\[
\begin{align*}
\ln Q_1 &= -.77 - 1.015 \ln P_1 - .015 \ln P_2 + 1.03 \ln M \\
\ln Q_2 &= -.62 + .015 \ln P_1 - .985 \ln P_2 + .97 \ln M
\end{align*}
\]

e. The demand curve for good 1 is estimated:
\[
\ln Q_1 = 2.2 - 0.7 \ln P_1 + 0.3 \ln P_2 + 0.4 \ln M
\]
II. Demand (continued)

2. (35 points) Consider the same person in two different years. In the first year he makes $90,000 in wage income and $10,000 in investment income. In the second year earns $50,000 in wage income and $50,000 in investment income. In both years, his wage rate (per time period worked) is known to be the same.
   a. Construct the budget constraint facing this person in each year, both algebraically and graphically.
   b. Graphically demonstrate his optimum combination of leisure and the non-leisure good in each of the two years. Be precise: much of what follows depends on your answer here.
   c. What is this individual’s income elasticity of demand for the non-leisure good over the observed range?
   d. Suppose for computational simplicity that each year contains a total of exactly 8000 hours. Also suppose that this person’s hourly wage rate is $50 per hour.
      (i) What share of his income is this person devoting to each of the two goods (leisure and non-leisure) in each of the two years?
      (ii) What is this person’s income elasticity of demand for leisure over the observed range? (Hint: Your answer to part (c) contains a key piece of information.)
   e. Consider now this person’s price elasticity of demand for the non-leisure good. What can you say about the relative magnitudes of his compensated and uncompensated own-price demand elasticities for the non-leisure good in each of the two years? Explain, using whatever algebraic or diagrammatic aids you find appropriate.
   f. Consider now this person’s price elasticity of demand for the leisure good. What can you say about the relative magnitudes of his compensated and uncompensated own-price demand elasticities for the leisure good in each of the two years? Explain, using whatever algebraic or diagrammatic aids you find appropriate.
   g. What, if anything, can you conclude about his elasticity of supply of labor in one year compared to the other? Explain.
III. Supply (15 points)

Assume that the labor market is composed of firms employing workers of various skill levels. There are male and female workers at each skill level. Males and females are equally productive at each skill level. Assume that males are prejudiced against female workers.

a. Assume initially that it is costless for firms to recruit workers at each skill level. Explain:
   i. Whether or not male and female workers will earn the same wages.
   ii. How males and females will be distributed across firms.

b. Now assume that it is costly for firms to recruit workers at each skill level. That is, firms must engage in costly advertising and interviewing to find the right person for each task. Explain:
   i. Whether or not male and female workers will earn the same wages.
   ii. How males and females will be distributed across firms.

c. Propose specific empirical tests for the hypotheses you propose in part (b). In doing so, identify the factors that will affect recruiting costs. Explain how you would measure such factors and how changes in these factors should be systematically related to the male-female wage gap and the gender composition of workers within each firm, under the maintained hypothesis that men are prejudiced against women.
IV. Externalities (40 points)

The north shore of the Choptank River consists of swampland on which nothing can be built. Thus, all development occurs along the south shore, along which are both industrial firms (indicated in the map below by capital letters “A”, “B”, and so forth) and households (indicated by the numerals “1”, “2” and so forth). The river flows from west to east, emptying into the sea.

Swamp

---------------------------------------------------
<p>| |
|                                                  |
|                                                  |
|                                                  |
| River  ----------&gt;  Sea                          |</p>
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Here are the other key facts:
1. Each month each of the firms emits 12 units of an unpleasant smelling chemical into the river, which flows downstream.
2. Each household likes to swim in clean water; the distaste it suffers from chemicals in the water amounts to $1 for each gallon of the chemical that is in the water that flows in front of its house.
3. Each firm could completely eliminate its chemical emissions by using a filter that costs $40 per month to operate.
4. Each household could lease its own swimming pool (and thus avoid having to swim in the river) at a cost of $40 per month.

Here are the questions:

a. Construct a simple table, or matrix, showing the potential damages done by each firm to each household.

b. Even though these facts are known to us, assume that initially no one is able to determine which firms are dumping chemicals into the water, nor how much they are dumping. How many (and which) firms will install filters? How many (and which) households will install swimming pools? Explain your answers.

c. Now suppose that the invention of a new measuring device makes it possible to costlessly determine which firms are dumping chemicals into the river. Political agitation by households leads to passage of a law that requires all firms to halt chemical dumping. Does the law result in a net benefit or loss to society? Explain.

d. Assume now that economists study the law’s consequences and report their findings to the legislature, which amends the law to permit firms to either (i) install filters, or (ii) compensate households for any damages done to them by the firms’ chemicals, or (iii) pay for the rental of swimming pools. How many filters will be installed? How many swimming pools will be rented? Explain, being sure to indicate where the filters and swimming pools will be located.

e. Does the amended law mentioned in part (d) yield a net gain or loss relative to the outcome in (b) and relative to the outcome in (c)? Explain, briefly.
V. Imperfect Competition (30 points)

An inventor asks your advice. She has just developed a new kind of patio furniture. The furniture has unique characteristics that are patented. As a consequence, the market demand curve for the furniture is downward sloping and can be characterized as \( q = 20 - p \) based on analysis done by a competent advertising agency. The unit cost of manufacturing the furniture is constant at $1 per unit. The marginal cost of selling the furniture is given by \( MC = q \).

The inventor wants to know whether it would be better to start her own retail store or simply sell the furniture through the existing retail establishment. If she starts her own store, there is an overhead cost of $20 in addition to the selling cost. If she sells through the existing outlet, there is no overhead but the same marginal selling costs are incurred by the existing retailer.

Please respond to the following specific questions in sufficient detail to be convincing:

a. If she starts her own store, at what price should she sell the furniture? How much will she sell? What will be the costs of production and of selling? What are her profits?

b. If she sells the furniture at wholesale to the existing retail establishment at a flat price per unit, is it possible to make as much profit as will be made by owning the retail establishment? (Hint: Recognize that you must account for the independent profit maximizing behavior of the retailer.)

c. She could sell the furniture on a franchise basis. One way to do this is to make the retailer pay for the furniture at manufacturing cost and then charge a royalty that is a percentage share of net revenues, where net revenues are revenues less the cost of the furniture and less marketing costs incurred by the retailers. Is there a royalty rate that will generate more profits for our inventor compared to opening her own stores?

d. What are the possible contracting problems that might develop in the franchise case? What are the contracting problems of opening a company store? Explain.
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

February 12, 1999

You have three (3) hours to complete this examination. There are five parts, I-V. Point values are shown for each question. There are a total of 180 points and 180 minutes available. Before you begin answering any questions, you should examine the allocation of points across topics.

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1. Write your assigned identification number on the top left-hand corner of each page. Do not write any other personal identifier on any page.

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4. At the end of the exam, assemble your answers in the order in which the questions were asked on the exam.

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**Economist:** A blackguard who sees things as they are, rather than as they should be.

After Ambrose Bierce

I. TFU (40 points; 8 for each)

1. The value of a tree farm can be calculated by multiplying the board feet of the lumber in the standing trees by the current price of lumber.

2. A single plant monopolist may operate in the declining portion of its long run average cost curve, but will always operate at the minimum of its short run average cost curve.

3. Recently New York City Transit Authority began offering free bus-to-subway transfers. The result was an increase in revenue of 4 percent and an increase of 17 percent in riders. This proves that demand is elastic.
4. A two-part pricing monopolist sets the unit price equal to marginal cost and makes all of its profit on the fixed fee.

5. Long run costs are always greater than short run costs, because in the short run some costs can be avoided.

II. Demand (40 points)

1. (30 points) The theory of consumer behavior gives us several theorems. They are:

   a. Slutsky equations.
   b. Homogeneity conditions.
   c. Symmetry of compensated cross-price elasticities.
   d. Aggregation conditions for income elasticities.
   e. Aggregation conditions for price elasticities.
   f. Budget shares condition.

   For each of these, do these things:
   (i) Specify algebraically what each theorem states.
   (ii) Explain in words what you think the algebra says.
   (iii) Discuss explicitly how each theorem can be utilized by the applied economist in actually estimating demand curves.

2. (5 points) If telecommunications is a gross complement to automobile transportation, but automobile transportation is a gross substitute for telecommunications, what do we know about the relative income elasticities of automobile transportation and telecommunications? Explain.

3. (5 points) The demand for fresh fish products in China has been estimated to be very price inelastic and also highly income elastic. Are such estimates consistent with the theory of consumer behavior?
III. Supply (40 points)

1. (20 points) Harrah’s is considering two, mutually exclusive projects in Mississippi. One is to start a gambling casino that will only last for 10 years because the land upon which it will be built is deeded to a wildlife conservancy and reverts to their control in 10 years. The other project would place a casino on land that can be acquired by Harrah’s. Hence, the project has an indefinite (i.e., infinite) life. The two projects have identical present values given the current tax structure. However, the state is debating whether it should impose a new “gambler’s levy” on such projects.

Answer the following questions:
(i) Which project has the higher cash flows?
(ii) If the state imposes the “gambler’s levy” in the form of a property tax, what will be the effect on the relative attractiveness of the two projects?
(iii) What happens to the relative present values of the two projects if the “gambler’s levy” takes the form of a tax on casino profits.

Ans: a. Shorter project has higher cash flows; b. the property tax makes the shorter project look better because the effective tax declines as the project nears its end; c. income tax has no effect.

2. (20 points) A firm knows that it will sell N units of a product during a period at a uniform rate. (For example, if the firm knows that it will sell 100 units in 100 days, then it will sell 1 unit each day.) Assume that the firm places orders of equal quantities. That is, the firm orders n units of the product each time it orders. Also assume that the entire order arrives and is available for sale instantaneously. Thus, inventory is at its maximum when the order arrives. The inventory decreases uniformly until it becomes zero. Then the next order arrives. Thus, the firm always has enough units to satisfy its customers.

The firm incurs a fixed cost of D dollars whenever the firm places an order of any quantity. The firm also incurs storage costs of S dollars for each unit of the product that it holds in inventory. (These storage costs include interest costs as well as the physical costs of storage.) Given that the maximum inventory is n units and the inventory decreases uniformly, the firm holds n/2 units of inventory on average during the period.

(i) Give an economic explanation (in words) of how a profit-maximizing firm decides how many units it will order and how many times it will order each period.
(ii) Use mathematics to show how a profit-maximizing firm will determine the optimal number of units it will order and how many times it will order each period.
(iii) Use mathematics to determine how the optimal number of units ordered changes as the per unit storage cost changes. Give an economic explanation of the mathematical result. Specifically, does the optimal number ordered increase, decrease, or remain constant as storage cost increases? Explain.
(iv) Now assume that the order arrives continuously instead of instantaneously. Ignore all costs other than the ones described above. Would the optimal number of units ordered increase, decrease, or stay the same? Explain.
IV. Applied Economics (30 points)

1. (18 points) The American Economic Association (AEA) charges membership dues on the basis of academic salary. A member (except those with family memberships) receive three journals published by the association. A member may elect to not receive any one of these journals and deduct $6 from the annual dues. University libraries also subscribe to the journals, but they pay a much higher fee, $130.
   (i) Why does the AEA charge libraries and faculty different subscription rates for its journals?
   (ii) Why does the association charge different rates for its faculty members based on annual income?
   (iii) Why doesn't the AEA charge different rates to libraries based on income or circulation?

2. (12 points) Your company has developed a secret process for making some cleaning solvents cheaper than any of the competition. There are many sellers of this product, it is a large global market, and your product is the same quality as the competition, but you can simply produce it cheaper, owing to your secret process.
   (i) What price do you charge compared to your competitors?
   (ii) Does your company make more profit than its comparable rivals?

V. More Applied Economics (30 points)

In Liberty, SC there are two kinds of workers. The first kind has a (constant) marginal product of $15 per hour and the second has a (constant) marginal product of $10 per hour. There are equal numbers of workers of each kind. Employers cannot tell which kind of worker an applicant is when he applies for work. Finished output is simply dumped into the communal output bin as it is completed so that the output of each worker cannot be determined, even after it has been performed. Workers get no disutility from work, once they are at the job site. At the end of the day total output is evaluated, and each worker is paid an equal share of the total output.
Answer the following questions:

(i) Assume the employers are perfect competitors for labor. What is the equilibrium wage that employers will pay? Describe the nature of the equilibrium.

(ii) Assume that Tri-County Tech offers a (no tuition) course in price theory. The course does not affect productivity on the job, and high productivity workers regard taking this course to be just as bad as accepting a $3 pay reduction. Low productivity workers regard it as bad as accepting a $6 pay cut. Upon successful completion of the course, a worker is given a certificate which he may show potential employers attesting to his success. Nevertheless, some workers will take the course in equilibrium. Explain why, being sure to indicate which workers will take the course and which will not.

(iii) Devoting resources to the study of price theory by these workers is a dead weight loss to society. It does not improve their productivity (hence no additional output is produced), and the experience has negative value to the students. Would society be better off if economics courses are banned? Explain.

(iv) How would your answers be changed if it were assumed that effort on the job produces disutility and is actually costly?
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

September 11, 1998

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3. Write on only one side of each sheet of paper.

4. At the end of the exam, assemble your answers in the order in which the questions were asked on the exam.

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6. As you answer the questions, always remember you are hoping to become an

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   After Ambrose Bierce
I. True, False, or Uncertain (40 points, 8 points each)

The statements below are either true, false, or uncertain. Tell us which and explain your reasoning.

1. The preferences described by the utility function $U = X^{1/4} + Y^{3/4}$ are homothetic.

2. If a good is income elastic, it is price elastic.

3. In an industry whose firms produce under conditions of increasing returns to scale, it is not possible to pay each factor of production the value of its marginal product.

4. A vertically integrated, multi divisional firm produces both widgets and gadgets. Widgets are inputs to the production of gadgets. The firm is a price searcher in the market for widgets, which it sells to other gadget manufacturers in addition to using in its own production of gadgets. It is a price taker in the market for gadgets. TFU: The firm’s widget division should charge its gadget division the same price it charges to other gadget producers if the firm is to maximize the sum of its profits from both divisions.

5. Studies suggest that the productivity of workers in unionized firms exceeds the productivity of workers in nonunion firms. TFU: This indicates that workers’ gains from unionization do not necessarily come at the expense of firms or their shareholders.

Ans:
1. No, ratio of 1st partials is not homogeneous of degree 0.
2. No, but more likely to be. If price inelastic and income elastic as are fish for the Chinese, must have small income share.
3. See below.
4. Should charge MC. If the G division is charged a monopoly price, it will respond by using fewer W in production process, which is inefficient. Think about what would be the optimal sales structure in the case of a patented product.
5. Depends on the definition of productivity. If productivity is marginal product, then unionization must by the act of driving up the wage rate cause marginal product to increase, and this does indeed come out of the stockholders’ hide.

Answers to Comp Questions

September 11, 1998, Section I:
3. In an industry whose firms produce under conditions of increasing returns to scale, it is not possible to pay each factor of production the value of its marginal product.

The economics of the problem:

To say that firms in an industry produce under conditions of increasing returns to scale is to say that the industry will be characterized by a peculiar equilibrium. Increasing returns mean that average cost is falling for each firm. Traditionally such an industry would be labeled "natural monopoly." We expect that one firm would dominate all others if regulatory authorities do not intervene in the process.
If a monopoly market develops, then the question of paying inputs the value of their marginal product is moot. Monopolists pay the marginal revenue product. Even so, the problem is not without merit. Government intervention in the form of price regulation attempts to stop natural monopolies from extracting consumer surplus. The problem faced by regulators is exactly that it is impossible to force the natural monopolist to pay inputs the value of the marginal product. This problem is neatly characterized in the familiar picture of market demand cutting the average cost curve in its falling range. Because demand cuts marginal cost where it lies below average cost, the regulator cannot force the firm to produce at a price equal to marginal cost without forcing the firm to take losses.

The model of cost minimization tells us that marginal cost is equal to the ratio of input price divided by marginal product, which is equalized across all inputs. When price is equal to marginal cost, as it is in the case of a competitive equilibrium, then by cross multiplying we have the result that input price is equal to price times marginal product or the value of the marginal product for each input. Hence, if regulators try to force the natural monopolist to produce at the point where demand intersects marginal cost, which would imply paying inputs a wage equal to the value of their marginal product, the sum of these payments, which is average cost times quantity is greater than the revenue, price times quantity.

QED: The answer is true.

The answer to this question can also be demonstrated using Euler's Theorem and assuming a homogeneous production function with increasing returns. Euler's Theorem says that the sum of the first partials of a homogeneous function times the levels of the variables is equal to the degree of homogeneity times the value of the function. That is, where output, \(q\), is a homogeneous function of degree \(r\) of two inputs, \(x_i\):

\[ x_1 f_1 + x_2 f_2 = rq \]

If the inputs are paid a wage equal to the value of their marginal product, we have:

\[ x_1 w_1 + x_2 w_2 = x_1 \cdot pf_1 + x_2 \cdot pf_2 = r \cdot pq \]

If the degree of homogeneity is one, i.e., \(r=1\), then input payments exactly equal revenue, \(pq\). However, if the production function is characterized by increasing returns, \(r>1\). In this case, Euler's Theorem says that if inputs are paid the value of their marginal product, total input payments will exceed revenues.
II. Demand (30 points)
In an isolated mountain village, the only crop is corn. Good harvests alternate with bad harvests. This year the harvest will be 1,000 bushels. Next year it will be 150 bushels. There is no trade with the outside world. Corn can be stored from one year to the next, but rats will eat 25 percent of what is stored in a year.

Assume only two periods are relevant. The villagers have Cobb-Douglas utility functions of the form $U(c_1, c_2) = c_1^{c_2}$ where $c_1$ is current (this year) consumption and $c_2$ is consumption next year.

a. What is the expression for the opportunity set of consumption combinations now and later?
   
b. How much corn will the villagers consume this year and next year?
   
c. How much will the rats eat?

Now assume that a road is built to the village so that trade with the outside world is possible. Villagers can now buy and sell corn at the world price, which is $1 per bushel. They can also access the world banking system and borrow or lend at an interest rate of 10 percent.

d. What is the expression for the opportunity set of consumption combinations with trade?
   
e. How much corn will the villagers consume now in each period?
   
f. How much (if anything) would the villagers conceivably be willing to contribute to finance the construction of the road? Explain.

a. $c_2 = 900 - 0.75c_1$; b. $600/450$; c. 100; d. $c_2 = 1250 - 1.1c_1$; e. $568/625$; f. Min exp given the price set with the road s.t. $U = 600*450$. [$c_1 = 495; c_2 = 546] => c_2$ intercept 1091 compared to 1250. Discount back at 10% yields 145 apprx.
III. Supply (30 points–answer both questions)

1. (12 points) History and current experience suggest that rental car fees are regularly lower in Florida than the rest of the nation. For instance, Alamo is currently renting cars for $25 per day in Florida and $29 per day in all the rest of the nation where they have outlets. Why is it that rental car prices are regularly lower in Florida than in the rest of the United States? Develop a theoretical explanation and a way of testing your explanation.

2. (18 points) Consider two different plans to raise state tax collections. Both plans will tax retail business establishments in the state. (You can assume a competitive industry with a large number of homogeneous firms.) One plan imposes a unit sales fee for each unit quantity of output sold, a tax on output. The other plan imposes an annual fixed license fee for the right to operate in the state, a tax on the facility. Both plans are designed to raise exactly the same amount of total tax revenues.

   a. In the long and short run, which plan will raise price more?
   b. In the long and short run, which plan will have the greater impact on the number of firms in the industry?
   c. Which plan is more welfare efficient, that is, it has the least dead-weight loss?

1. More price searching=>higher # of discounted air fares=> lower car rental prices.

2. To answer this question, it is valuable to develop the idea of a competitive per firm demand curve. Assume a competitive market. Divide the market quantity demanded by the number of firms in the industry. This gives a per firm demand curve. In equilibrium, this demand curve intersects the average cost curve of the firm at its minimum point. The per firm demand curve can be used to measure the effect of the tax plans.

The short run is defined as the period during which the number of firms in an industry is fixed. Hence, in the short run, the per firm demand curve does not shift. The per unit tax in the short run shifts the MC of the firm up. This new MC intersect the per firm demand curve at a higher level. This then describes the new market equilibrium. The per firm tax has no effect on MC. Hence, in the short run it has no effect on market price.

In answer to part b, in the short run, neither tax plan has any effect on the number of firms because that is the definition of the short run. What happens to the number of firms in the long run is the real question. In the case of both taxes, the number of firms falls. To answer the question of how many firms exit the industry, let’s consider how the per firm demand curve shifts as firms leave. As firms leave, the per firm demand curve pivots outward on its vertical intercept. If the industry starts with 100 firms, then the slope of the per firm demand curve is 100 times the slope of the market demand curve. If 50 firms leave, then the per firm demand curve shifts out until it is only 50 times the slope of the market demand curve.

In the case of the unit tax, the MC and AC curves shift up horizontally by the amount of the tax. The number of firms in the industry must decline until the per firm demand curve again intersects the new AC at its minimum point. Call this new number of firms, $n_1$. 
Now let’s consider the thought experiment, is it possible that the per firm tax could result in the same tax revenues at the same market equilibrium price as the unit tax. Since a per firm tax does not shift MC, it is clear that the per firm tax that would cause the market to be in equilibrium with $n_1$ firms would produce a much lower level of taxes. Hence, to equate the tax revenues for the two taxes, the per firm tax will cause the number of firms to be less than $n_1$. This makes sense because with a per firm tax, companies can avoid the tax by getting bigger.

Now let the number of firms decline some more up to the point where the per firm demand curve intersects the old MC at the market price that results from the unit tax. The question is, does a per firm tax that results in this market equilibrium price yield tax revenues of the same amount as the unit tax. The answer is, “No” and the reason can be deduced in the following way.

With a per firm tax, the individual firms produce more, but the number of firms is smaller. With the per firm demand curve these two effects exactly offset each other. However, the amount of the per firm tax divided by the number of units produced by the firm is less than the unit tax. Hence, tax revenues from the per firm tax are still less than the unit tax. To equate tax revenues, the amount of the per firm tax has to be higher. This means that the per firm tax will result in a higher market price than in the case of the unit tax. Hence, the per firm tax is not as efficient as the unit tax.
IV. Imperfect Markets (30 points)

Increasingly, the practice of long distance providers is to charge a minimum monthly fee in conjunction with a low per minute charge per call. For example, national advertisers such as 10-10-321 and 10-10-811 both do it.

a. Explain this practice as a price discrimination scheme. In particular, what is the effect of the minimum charge? What is the relationship between the minimum charge and the total bill of the marginal customer? What is the relationship between the minimum charge and the total bill of the average customer?

b. Is it possible that this practice is not price discrimination but is instead cost-based? What empirical evidence would you use to distinguish between a cost-based explanation and price discrimination?

c. If the practice is price discrimination, is it possible that such a practice can exist in a competitive market? Alternatively, are we forced to assume that the long distance telephone market is monopolized if this practice of charging a minimum bill is shown to be price discrimination?

Answer:
1 Walter Oi’s Mickey Mouse results. Minimum charge excludes some buyers. Minimum charge is total bill for marginal customer. The relation between minimum charge and total bill for the average customer depends on the distribution of demanders. With a normally distributed population of demanders, it is generally efficient to knock out around a third of the population with the minimum bill. Hence, the difference is something more than one-half of a standard deviation of the level of bills across customers.

2 Of course, there might be some fixed costs of serving customers that the minimum charge attempts to capture. However, from the Oi model, the empirical issue hinges on the marginal price. In the simple, purely competitive model, the marginal price should be equal to marginal cost. In this telephone example the marginal price is obvious above marginal cost.

3 The profession seems to accept the idea that a market can reach a zero profit equilibrium but do so by discriminatory pricing. The argument has taken various forms, but the basic idea is that there are fixed costs of operation that can only be recovered by price discrimination.
V. Applied Economics (50 points)--Answer both questions

1. (18 points–6 each) Bees perform two economically relevant activities: They pollinate flowering plants and trees (including, for example, fruit trees); and they produce honey that can be consumed by humans. Bee keeping is an unusual industry in the following regard. Sometimes bee keepers are paid to place their hives in a field and sometimes the bee keepers must pay for this privilege. Several questions are presented by this market structure
   a. What causes the terms of trade to reverse in this manner? Explain.
   b. What determines how many hives there will be in the beekeeping industry? Explain.
   c. If imports of honey are restricted what will happen to the frequency with which bee keepers must pay to locate their hives, as opposed to being paid tp locate them? Explain.

2. (32 points–8 each) The Endangered Species Act (ESA) regulates (to the point of prohibiting) the development of land that is known to be a habitat for endangered species. This makes it profitable for landowners to purge their land of any such species prior to their discovery on the parcel of land to be developed. (This practice is sometimes known as “shoot, shovel, and shut up.”) Recently the journalist Gregg Easterbrook proposed a modification of the ESA that would preserve wildlife habitat without the aforementioned incentives of the current law. His proposal is that the federal government charge all developers (not simply those who have endangered species on their property) a $1,000 per acre fee to be paid in conjunction with building permits. The proceeds of this fee would be used to purchase land best suited for wildlife habitats.

An environmental economist has commented on the Easterbrook proposal. Excerpts from his comments are reprinted below, with numbers added for purposes of this question:

[1] “What is good [about Easterbrook’s proposal]... is that it removes the incentive for an owner to get rid of listed species.”

[2] “What is bad is that Easterbrook does not recommend respect for property rights. Rather, he is offering a plan that would allow landowners to buy out of some land regulations. Any landowner, by paying $1000 per acre, could win control of the land that he or she ‘owns.’”

[3] “The plan might be legitimate if it replaced taking from the few with a general tax on the many. But Easterbrook still proposes that all the cost be borne by landowners who develop their land and those who buy it....But why should those who want to build be required to carry a burden that all society should carry if all society truly benefits from protection of these species”

[4] “Furthermore, the proposal leaves in bureaucrats’ hands most of the decisions about protecting species (which species should have priority? Which populations? What level of protection?) A true free market solution would leave these decisions in the hands of individuals and voluntary associations...Instead of political fights, we...want private individuals and associations to protect habitat and species in the ways they know best. We want Nature Conservancy preserves, Audubon Society refuges, local land trusts, and voluntary groups that put up bluebird and purple martin nesting boxes. Let’s not turn them over to a federal bureaucracy.”
Evaluate, from the standpoint of economic efficiency, the statements of this environmental economist in each of the numbered passages above. Be explicit, thorough, and succinct.

Ans: ESA

1 True, because there would be an incentive to announce to the world that an endangered specie inhabited the property in hopes that the wildlife fund manager would bid on the property along with the development company.

2 Actually, the proposal increases the respect for private property. Under the tax plan, development is driven by market forces. If the land has development value in excess of $1000 over its alternative use and if its wildlife value is less than its development value, then it can be developed. This is superior to the current wildlife act which prohibits all development of wildlife land. Only problem is that $1000 is arbitrary—remember the French Revolution.

3 Coase Theorem—does not matter who pays except for income effects. Note the symmetry. Those demanding new construction are as much the cause of the problem as those demanding protections of species of animals. Also, could use money to subsidize construction in places that do not hurt habitat. This would reduce the market value of development in wildlife sensitive places. (However, too much potential for corruption.)

4 Consider the equilibrium of the market now and under such a proposal. In both cases, there is land which is desirable for development. Some of this land is habitat for wildlife. Now, that wildlife is destroyed and development proceeds. Under the tax plan, the question is whether the development is worth $1000 extra per acre, regardless of whether there is wildlife or not. If it is, then development plans are initiated. If wildlife is found, someone be it government or civic groups must determine whether the wildlife is worth more or less than the development. Presumably, all interested parties can pool their resources.

On Bees and Honey

Bee keeping is an unusual industry in the following regard. Sometimes bee keepers are paid to place their hives in a field and sometimes the bee keepers must pay for this privilege. Several questions are presented by this market structure:

1. What causes the terms of trade to reverse in this manner?
2. What determines how many hives there will be in the industry?
3. What determines whether bees are substitutes or complements with land?
4. If imports of honey are restricted what will happen to the frequency of when bee keepers must pay to locate their hives?

The determinant of who pays is the value of the pollination services provided by the bees relative to the value of nectar in making honey. When pollination is sufficiently valuable, farmers are forced to pay in order to induce bee keepers to place hives on land needing pollination services. Clearly there must be a continuum. At times when pollination is not important, bee keepers pay, maybe because bees are a nuisance to farmers, maybe because bees take up space that could be profitably tilled, maybe because of scarcity of good nectar land. As the value of pollination
grows, the price charged for rental of nectar land falls, reaches zero, and becomes negative, that is, the farmer pays the bee keeper. The answer to **Question 1** is that the existence of both positive and negative payments to bee keepers means that scarcity is a factor on both the margins of pollination and nectar collection.

To answer the other questions there are two different ways to model the industry equilibrium. One considers honey and fruit as joint products of bees and land. The generality of the model does not give many answers. The other model focuses solely on bee keepers.

Let’s go the second route and simplify to the extreme. Let’s say there are two discrete times of the year. For half the year, bee keepers are paid by farmers; during the other half of the year, the bee keepers must pay the farmers. Assume that there are two inputs in making honey: land and bees. Assume that the price of land in the bee keepers profit function has a negative value half the time and positive the other half. That is, when the bee keeper is paid for pollination, the price of land is negative. Formalize this as follows:

\[
\max_{l,b} \pi = P_h h(l,b) - w_l l - w_b b
\]

where \( h \) is honey, a function of land, \( l \), and bees, \( b \). The \( w_i \) are the prices of the inputs. When the price of land is negative, the use of this input adds to profits.

During the pollination period, the relation between land and bees is determined by the farmer. That is, the bee keeper must put bees in place in sufficient density to achieve optimal pollination. During the non-pollination period, let the production function, \( h(,) \), be constant returns to scale Cobb-Douglas.

During pollination season, the incentive would be to expand number of bee hives to the point where the value of the marginal product of bees in making honey (given the externally imposed land constraint) plus the payment for pollination is equal to the cost of bees. However, this would be too many bees in the off season. Off season, the optimal number of bees is determined by equating the margins of bees and land in making honey. Land is now costly and the marginal revenue product of bees is lower. Thus, the answer to **Question 2** is that the number of hives optimally will fall somewhere between the number optimal in the pollination season and the number optimal in the off season.

During the pollination season, the amount of land serviced by bee keepers varies inversely with the price of bees. As \( w_b \) goes up, pollinated land goes down. However, it does not make sense to talk about land and bees as substitutes and complements during the pollination season because land in the pollination season is really a proxy for one of the outputs of bee keeping.

During the off season, bee keepers will use land in accordance with their production function, which is assumed to be C-D. Land will have a downward sloping demand curve as will bees. However, because the optimal number of bees is determined by averaging across the on- and off-pollination season, which causes the number of bees to be larger in the off season than it would otherwise be, the complementarity or substitutability of land and bees is slightly distorted.
In the normal C-D form, the substitution of inputs is determined by the following rule:

_Elasticity of the change in the use of _i_ when the price of _j_ changes is equal to (1) the production elasticity of _j_ plus (2) the cost share of _j_ times the demand elasticity of output._

In the standard C-D form, this is symmetric between _i_ and _j_ because it only depends on the elasticity of output demand, i.e., the cost share of each input is equal to its production elasticity. (The production elasticity is the input’s exponent in the production function.)

In the problem of bee keeping, because the number of bees is larger than what would be optimal in the off season, an asymmetry is created. The cost share of bees is larger than would otherwise be optimal in the off season. Hence, if the price of bees goes up, there is a bias towards the responsiveness of land to be negative or complementary. (Here I assume that in spite of the fact that the number of bees is biased upward, the output-constant substitution effect between bees and land will continue to be determined by the respective production elasticities.) Similarly, if the price of land goes up, there is a bias towards the responsiveness of bees to be positive, that is, bees will be substituted for land. These are only biases, however, because the issue still depends on the elasticity of the demand for honey.

The bottom line is that if the price of bees goes up, there will be less land pollinated in the pollination season and a tendency for there to be less land rented by bee keepers in the off season. The answer to **Question 3** is that land is most likely to be viewed as a complement to bee keeping.

The effect of an import restriction on honey will be to increase the price of honey. This will cause there to be more domestic bee hives and more demand for land in the off season. So, in answer to **Question 4**: The increase in the number bees will drive down the payment for pollination and the increase in the demand for land in the off season will drive up the rental price of land in that period.
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

February 6, 1998

You have three (3) hours to complete this examination. There are five parts, I-V. Point values are shown for each question. There are a total of 180 points and 180 minutes available. Please follow these instructions:

1. Write your assigned identification number on the top left-hand corner of each page. Do not write any other personal identifier on any page.

2. Start your answer to each question on a fresh piece of paper. You may, however, answer more than one TFU on a single page and you may answer more than one sub-question (for example, a, b, or c) on a single page.

3. Write on only one side of each sheet of paper.

4. At the end of the exam, assemble your answers in the order in which the questions were asked on the exam.

5. After assembling your exam in the manner specified in (4), number each page in the upper right-hand corner. If the material on a page is a continuation of an answer, be sure to clearly denote that fact.

6. As you answer the questions, always remember you are hoping to become an

\[ \text{Economist: A blackguard who sees things as they are,} \]
\[ \text{rather than as they should be.} \]
\[ \text{After Ambrose Bierce} \]
I. True, False, or Uncertain (60 points, 10 points each)

The statements below are either true, false, or uncertain. Tell us which and explain your reasoning.

1. Giffen goods can be expected to comprise a large portion of a person's budget.

2. Every good must have at least one substitute.

3. A monopolist will never be observed to have an elastic demand curve.

4. A factor of production employed by a competitive firm will never be observed to have an increasing marginal product.

5. It will not pay an employer to bear the costs of training her workers, if after completing training the worker can move to another job with another employer.

6. For an import quota and a tariff that have the same initial impact on trade, the tariff will have a larger impact over time than will the quota.
II. Demand (30 points)

Consider a couple (e.g., husband and wife) who will live for two periods, in a world in which the interest rate is zero.

In the first period, the couple has a fixed income of Y and chooses current consumption, C. Their accumulated assets (labeled A) at the end of the period will be the difference between their income and their current consumption.

In the second period, the couple will have no income. However, they will use their accumulated assets to pay for their consumption in the second period (called retirement consumption, or R) and also to pay for their child’s education. The amount that they will spend on education will be E (for educational outlays).

Subject to the above restrictions, the couple chooses their first-period consumption C, their second-period retirement consumption, R, and their educational outlays, E, to maximize their utility U, where \( U = U(C, R, E) \).

a. Give the condition(s) that must hold for utility maximization. Give an economic interpretation of the mathematical result. (HINT: For the purposes of answering the questions that follow, substitute for \( C \) and \( R \) in writing the utility function, so that the variables \( A \) and \( E \) appear explicitly.)

Now make the following additional assumptions:

Scholarships (S) for education are available. Now the amount that the couple spends on education will be \( E + S \). The college allocates the scholarship funds to each family based on the following formula:

\[
S = \alpha (E - \theta A), \text{ with } 0 < S < E
\]

Where
\[
\alpha \text{ is a constant } (0 < \alpha < 1), \text{ and}
\]
\[
\theta \text{ is a constant } (0 < \theta < 1).
\]

b. Give the condition(s) that must hold for utility maximization. (Again, use the hint given above.) Explain the impact of the availability of scholarships on the couple’s consumption and savings.

c. Give economic interpretations of \( \alpha \) and \( \theta \).

d. How does the marginal rate of substitution (MRS) between \( C \) and \( R \) change as \( \alpha \) changes? Give an economic explanation of this result explaining how and why consumption patterns change as \( \alpha \) changes.

e. How does the MRS between \( C \) and \( E \) change as \( \theta \) changes? What about the MRS between \( C \) and \( R \) as \( \theta \) changes? Give an economic explanation of these results, indicating how the allocation of funds toward current consumption and toward savings changes as \( \theta \) changes and explaining why.
III. Supply (40 points--answer both questions)

1. (30 points) Assume that sailboat construction is characterized by the following production function:

\[
q = K^{0.3} L^{0.1} F^{0.6}
\]

where \( q \) is output, \( K \) is capital, \( L \) is labor, and \( F \) is fiberglass.

Sailboat construction is a competitive industry. The latest available data indicate that industry revenues last year were $10 billion.

a. How much did the industry spend on labor last year? Convince us.

b. If fiberglass is used only to make sailboats, what were total revenues of the fiberglass industry last year? Convince us.

c. Does your answer to part (b) depend on whether or not the fiberglass industry is competitive or monopoly? Explain.

d. What is the output-constant elasticity of demand for each factor of production?

It is well known that the demand for sailboats is unit elastic.

e. Based on this knowledge of the demand elasticity for sailboats, what must be the elasticity of demand for labor and capital in this industry? Convince us.

f. Are labor and capital substitutes or complements? How do you know?

2. (10 points) A graduate student in applied economics claims to have estimated a production function for kumquats that looks like this:

\[
\ln q = 14.6 + 0.618 \ln K + 0.782 \ln L
\]

where \( q \) is the output of kumquats, \( K \) is capital, and \( L \) is labor, and “ln” means natural logarithm.

a. According to these estimates, will the factors of production in this industry be paid the value of their marginal product? Convince us.

b. Is the kumquat industry competitive?
IV. Imperfect Markets (30 points--answer all 3 questions)

1. (10 points) Consider a domestic monopolist that is protected, by a prohibitive tariff on imports, from the perfectly competitive world market. Suppose that initially the monopolist sells some, but not all, of its output abroad, in the world market.

   a. Characterize the initial equilibrium for the monopolist, either diagrammatically or algebraically.

Now suppose the monopolist's costs rise, and yet it still continues to sell some of its output abroad, in the world market.

   b. What will happen to the domestic price of its product as a result of this cost increase? Convince us.

2. (15 points) Suppose the Octopus Corp. has a monopoly on light bulbs. Its engineers discover a way to double the life span of the company's light bulbs, without any additional costs, i.e., the production costs of the new bulbs are the same as those of the old bulbs.

   a. Under what conditions, if any, will Octopus suppress the invention, i.e., choose not to produce any of the new bulbs? Convince us.

   b. Under what conditions, if any, will Octopus choose to produce only the new bulbs? Convince us.

   c. If the new bulbs were more costly to produce than the old bulbs, how, if at all, would your answers to (a) and (b) change?

3. (5 points) Several years ago, the City of Seneca sold the right to exercise a natural monopoly over the cable TV franchise to the highest bidder (Northland Cable). The economist working as a consultant for the City claimed that because the competition for the franchise was open to all potential bidders, the welfare cost of the monopoly was thereby eliminated. Do you agree or disagree with the City's economist? Explain.
V. Applied Economics (20 points)

Much of the tax receipts used to finance federal government operations comes from the income tax. In honor of the impending federal budget surplus, we thus wish to make the following inquiries of you.

a. A labor economist claims that a compensated tax on wage income must reduce the quantity of labor supplied by an individual, while an uncompensated tax on wage income may increase or decrease the quantity of labor supplied by an individual. Are these claims correct? Convince us.

b. Empirical estimates of uncompensated labor supply functions indicate that individual labor supply curves are very close to vertical. It has been argued that a tax on wages is therefore quite efficient, because the tax clearly has negligible allocative effects. Is this argument correct? Convince us. (HINT: Be explicit about the measure of welfare that you wish to discuss.)

Presumably, the receipts of the taxes you discussed in parts (a) and (b) are put to some use—a fact that you probably ignored in answering those questions. Although that was a good strategy for those questions, we are now going to force you to abandon it to answer the last two questions of this section.

c. Suppose that the proceeds of the tax are simply handed back to taxpayers in "lump sum" form; that is, each of $n$ taxpayers is given $1/n$ of the tax proceeds, without regard to their wage, hours worked, etc. Will this eliminate the loss suffered due to the tax paid by the "typical" taxpayer? Convince us.

d. In light of your answers to (a), (b), and (c), how do you explain the existence of government? Convince us. (HINT: If your proposed answer relies upon "rent-seeking" or any closely-related concept, don't bother writing it down: it will get a score of 0.)
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

September 12, 1997

You have three (3) hours to complete this examination. There are five parts, I-V. Point values are shown for each question. There are a total of 180 points and 180 minutes available. Please follow these instructions:

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2. Start your answer to each question on a fresh piece of paper. You may, however, answer more than one TFU on a single page and you may answer more than one sub-question (for example, a, b, or c) on a single page.

3. Write on only one side of each sheet of paper.

4. At the end of the exam, assemble your answers in the order in which the questions were asked on the exam.

5. After assembling your exam in the manner specified in (4), number each page in the upper right-hand corner. If the material on a page is a continuation of an answer, be sure to clearly denote that fact.

6. As you answer the questions, always remember you are hoping to become an

   Economist: A blackguard who sees things as they are, rather than as they should be.
   After Ambrose Bierce
I. True, False, or Uncertain (60 points, 6 points each)

The statements below are either true, false, or uncertain. Tell us which and explain your reasoning.

1. If Professor Ferc claims that the demand for electricity is given by 
   \[ \ln Q_e = -.62 \ln P_e + .48 \ln P_g + .50 \ln I \]
   (where \( e \) and \( g \) refer to electricity and natural gas, \( P \) is price, \( Q \) is quantity, and \( I \) is income), the Professor should be fired.

2. Mark consumes only two goods, beer and chicken wings. In 1995 he devoted 40% of his expenditures to beer and 60% to chicken wings. In 1996 the price of beer rose by 25%, Mark's income rose by 10%, and he continued to allocate his expenditures in the same proportions. In 1997 the prices of beer and wings were unchanged, Mark's income fell by 10%, and he still spent the same proportion of his income on beer. Based on this information, we can conclude that the elasticity of Mark's demand for chicken wings with respect to the price of beer is zero in the neighborhood of the observed price variations.

3. Because of income effects, the equivalent variation measure of welfare change is larger than the compensating variation measure.

4. In a competitive industry in which all firms have the same Cobb-Douglas production function, the long run supply curve must be horizontal.

5. If capital and labor are used in fixed proportions to produce kumquats, then if the demand for kumquats is unit elastic, the demands for labor and capital will both be unit elastic.

6. There are two checkout lanes at Zabar's supermarket. The clerk at Lane 1 is twice as efficient as the clerk at Lane 2. Therefore, the line in Lane 2 will be twice as long as the line in Lane 1.

7. To maximize profits, a price discriminating monopolist selling in two markets will seek to equate marginal revenue in the two markets.

8. A rational consumer who expects the relative price of personal computers (of a given computing capability) to fall by 10% over the next year will not buy a PC now if the real rate of interest is less than 10%.

9. A monopoly will always produce goods of lower quality than would be supplied if those goods were produced by a perfectly competitive industry.

10. On average, Clemson faculty members are football fans.
II. Utility Maximization (40 points)

1. (30 points) Assume preferences between consumption, C, and leisure, L, are given by

\[ U = \theta \ln C + \alpha L \]

Assume that each individual is endowed with money income of \( A \) and is also endowed with exactly one unit of leisure time. It is possible for an individual to sell some or all of his or her time (to "firms," which use it to produce the consumption good), thus enabling the individual to consume more than \( A \) dollars worth of the consumption good and less than one unit of \( L \). It is not possible for an individual to consume more than their endowed one unit of leisure. "Work" (i.e., leisure that is sold) is paid \( w \) per unit time, and the price of consumption is \( p \).

a. Sketch a picture of the individual's maximization problem, labeling key points on the individual's budget constraint. Please be sure to sketch the constraint specified in this problem, and not in some other problem.

b. Write out the individual's maximization problem.

c. Solve for the optimal choice of consumption and leisure. (Query: Do the first order conditions summarize all plausible optima?)

d. Verify that the weighted sum of income elasticities is 1. (Query: Are the income elasticities constants, or do they depend on the optimum chosen by the individual?)

e. Use your results in part (c.) to solve for the expenditure function and for the individual's compensated demand curves for consumption and leisure.

2. (10 points) The new tax law (recently signed by President Clinton) gives individuals a $1500 tax credit for college expenses. Two individuals, Tom and Ben, will soon begin college and are analyzing the benefits of this tax credit to them. Each student will be paying for his education himself (i.e., receiving no scholarships, gifts, etc.).

Tom indicates that he would have preferred a check from the U.S. Government for $1500 rather than the tax credit. He explains that the cost to the Government would have been the same (i.e., $1500 for him). Therefore, he thinks this is another example of how the Government tries to help its citizens, yet blunders in its delivery of the help.

Ben disagrees with Tom. Ben doesn't care whether the Government gives him $1500 in cash or the $1500 as a tax credit. He gets $1500 in each case. Ben says if one actually gets the tax credit at the same time that he would have gotten the cash, then everyone should be indifferent between the two choices. Ben says that Tom is just complaining without justification.

Explain how each student's opinion either is, or is not, consistent with economic theory. Tom spends $1500 on education under the credit program but would not have if he had gotten a check. Ben spends $1500 or more under either system.
Consumers buy appliances (e.g., washing machines) that last for a number of years. As the consumer keeps the appliance for more years, he spreads the initial cost of the appliance over more years. But he also incurs larger repair bills, because older appliances require more frequent repairs.

To answer the questions below, assume the following:

\[ P = \text{purchase price of an appliance}, \]
\[ w = \text{price of an appliance repair}, \]
\[ n = \text{total number of repairs over the useful life of the appliance}, \]
where
\[ n = \frac{u^\beta}{a} \]
and
\[ u = \text{useful life of the appliance } (u \geq 0), \]
\[ a = \text{durability factor } (a > 0), \] and
\[ \beta > 1. \]

Assume throughout that
- The interest rate is zero.
- The scrap or trade-in value of the appliance is zero.
- The price of a new appliance (i.e., \( P \)) is constant through time.
- The energy usage for an appliance is the same, regardless of the age of the appliance.

a. What is the annual cost (or implicit rental price) for an appliance?

b. Explain how a consumer decides how long to keep the appliance. That is, determine the consumer's choice of the useful life (\( u \)) of an appliance.

c. Demonstrate that \( \beta \) is the elasticity of the total number of repairs over the useful life of the appliance with respect to its useful life.

d. Maytag (a manufacturer of appliances) advertises that its appliances need fewer repairs than appliances manufactured by other firms. Not surprisingly, Maytag appliances have higher purchase prices than appliances made by other firms. If Maytag appliances do need fewer repairs each year and do have higher prices than other appliances, would you expect Maytag appliances purchasers to hold their appliances longer than purchasers of other appliances? Explain. (Assume that \( \beta \) is the same for all appliance manufacturers.)

e. (Much harder--don't waste time here.) If Maytag appliances of a given age need, say, one-half as many repairs as any other manufacturer's appliances of the same age, by how much will the price of new Maytag appliances exceed the price of other new appliances?
IV. Pricing (20 points)

Cap'n Dan's Cruises (CDC) is the only cruise line company to serve the small tropical islands of East and West in the Caribbean. For simplicity, you may wish to assume that CDC's costs depend only on the total number of passenger-trips CDC makes (where a "passenger-trip" means one passenger carried to one island).

a. Write out the profit-maximizing problem faced by CDC and solve for the optimum. Sketch a picture of what you have just done, labeling any key features.

b. How will CDC change its prices if the island of West begins to charge a disembarkment tax of $k per person visiting the island? In particular, how will the price of cruises to the island of East change?

c. What would happen to the price of cruises to West if the island East were blown away by a hurricane?

d. How would your answers to (b) and (c) change if consumers regarded trips to East and West as perfect substitutes?
V. Applied Economics (30 points)

Suppose that the operators of taxicabs must have a government-issued license to operate. If they have a license, they may supply as many taxicab services as they care to. If they attempt to operate without a license, they are immediately shot and their bodies are fed to the crabs. Licenses are "freely transferable" (i.e., may be purchased and sold) once they have been issued by the government.

The market demand for taxicab services ("rides") is as follows:

\[ P = 100 - Q \]

where \( P \) is the price per ride and \( Q \) is the quantity of rides consumed. The marginal cost curve of each and every current and prospective taxicab operator is as follows:

\[ MC_i = 10 + q_i \]

where \( q_i \) is the number of rides produced by the \( i \)th taxicab operator, and \( MC_i \) is the marginal cost of operating at that rate of output. All costs (except the cost of a license--see below) are variable; that is, they depend on output in exactly the manner shown above.

Initially there are fifty (50) taxicab licenses.

a. What will be the price of a license?

b. Suppose there are complaints among prospective taxicab operators that taxicab licenses are "too expensive" for them to afford. Why are these complaints stupid?

c. Despite your eloquent answer to the previous question, the government decides to issue more licenses. Specifically, it decides that $10 per license is a "fair and just price" for licenses. How many licenses must the government issue to achieve this price?

d. How many licenses would the government have to issue to drive the price of a license to zero? Explain.

e. Will increasing the number of licenses make prospective taxicab operators better off? What about existing taxicab operators? What about taxicab riders? Explain.

f. How, if at all, do your answers to part (e) depend on whether the government sells new licenses or simply gives them away? Explain, being sure to distinguish among the various affected groups.

Answers to the Fall '97 Microtheory Comp

I. TFU
1. Sum of elasticities in demand function must be zero because demand functions are homogeneous of degree zero.

2. Convert demand function to budget share terms:
\[ x_i = aP_1^\theta M^\gamma P_2^\delta \]
\[ \frac{P_i x_i}{M} = aP_1^{\theta+1} M^{\gamma-1} P_2^\delta \]

If income increases and budget share stays constant, income elasticity must be unitary. If price changes and budget share stays constant, then price elasticity must be unitary. From homogeneity condition, if price and income elasticity are unitary, then cross price must be zero. If income elasticity is unitary and cross price is zero for one good, must also be true for the other good.

3. In absolute value the relation between EV and CV depends on the direction of the welfare change.

4. Long run supply curve is a result of resource price effects as the number of firms in the industry expands. Not a result of the production function of the firms. If all firms have a constant returns to scale function, then number of firms is indeterminant. If all firms have decreasing returns to scale and there is no fixed cost, then number of firms infinitely large. If all firms have increasing returns to scale, then natural monopoly.

5. Depends on the cost share of the input (and the returns to scale which may or may not be constant even though we have a fixed proportions production process altho such is usually assumed).

6. Lane 1 is twice as efficient, then lane 1 line will be twice as long. Queuing theory says that waits have to be same.

7. Marginal revenues must be equated between markets and also equated to marginal cost.

8. Question of buying computer depends on productivity of computer. Consumer will wait for lower price if productivity of old computer less than the interest adjusted savings from waiting.

9. Monopolist will produce profit maximizing quality. Generally, in raising the price the lower value customers are excluded from market and lower quality products are not produced.

10. Since football is relatively cheap to enjoy, labor market sorting will send football fans to Clemson.

II. 1(Note on c: Because of endowment income, corner solution of no work is “plausible.”)

II 2. The fact that Tom would prefer that the government do something different means that he would change his behavior. The only way that he could change his behavior is to work less. Since that is what the government does not want to encourage, the program is a good one. [One interpretation of this question is that the check from the government can be spent on anything, not just education. Hence, this is a simple shift in the budget constraint with a corner missing. Like foodstamps.]

III. The consumer buys a washing machine if the value of the machine’s use over the life of the machine is greater than or equal to the cost of the machine plus the maintenance cost. We model the problem in time as opposed to washes, based on the assumption that the number of washes and time are perfectly correlated. Average cost of the washing machine is the purchase price plus maintenance divided by the optimal life. Assume that the value of washing is exactly equal to this average cost. The optimal life is determined where the marginal maintenance equals the value of washing, which is equal to the average cost. The optimal life is found by equating the average cost of washing to the marginal maintenance cost. The average cost is the integral of the maintenance function up to \( u^* \) plus the price of the machine divided by \( u^* \). From this it is obvious that if Maytags require less maint. at each point in their life compared to the competitive margin, then they will be operated longer. Remember, the operation margin is determined by equating marginal maintenance expense to the value of washing. This will also mean that Maytag can charge more for its machine. In fact, given the maintenance cost
function, if Maytags require half the maintenance they will be exactly twice as expensive.

IV. This is the standard price discriminating monopolist problem. In the standard model there is no cross price elasticity and no restriction on cost. The result is that if a unit tax is levied in one market and if marginal cost is upward sloping, then output will rise and price fall in the other market. Thus, if West imposes a tax under these circumstances, price will fall for cruises to East. A hurricane is like an exclusionary tax. So if East is blown away, the cruise company will lower the price to West in order to account for its lower cost because of the lost output to East. However, if there is positive cross price elasticity between the two islands, then there are offsetting effects. Indeed, if cruises to the two places are perfect substitutes, there is no change in price from either event because essentially all the consumers go to the lower cost destination. Hence, if West imposes a tax, no one goes there anymore. If East is blown away, then everyone that would have gone there, goes to West instead.

V. Taxi cab medallions limit the number of cabs. However, no cab has individual pricing power. The model is like the short-run competitive equilibrium with fixed number of firms. Mathematically,

\[ P=100-Q; \ MC=10+q; \ Q=nq; \ P=MC; \ 100-nq=10+q; \] solve for \( q \).

Price of medallions is based on the net cash flows (profit per instant of time) from being a cabby given a fixed number of cabbies in the market. Discount cash flows at some discount rate, say 10%. This gives a reasonable number to compare to the $10 objective of the city council. In order to drive the price of medallions to zero, council must issue an infinite number. Essentially, no medallion constraint.
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

February 7, 1997

You have three (3) hours to complete this examination. There are five parts, I-V. Point values are shown for each question. There are a total of 180 points and 180 minutes available. Please follow these instructions:

1. Write your assigned identification number on the top left-hand corner of each page. Do not write any other personal identifier on any page.

2. Start your answer to each question on a fresh piece of paper. You may, however, answer more than one TFU on a single page and you may answer more than one sub-question (for example, a, b, or c) on a single page.

3. Write on only one side of each sheet of paper.

4. At the end of the exam, assemble your answers in the order in which the questions were asked on the exam.

5. After assembling your exam in the manner specified in (4), number each page in the upper right-hand corner. If the material on a page is a continuation of an answer, be sure to clearly denote that fact.

6. As you allocate your time among questions, always remember:

   It has been related that dogs drink at the river Nile running along, that they may not be seized by the crocodiles.
   Phaedrus, fl. c. A.D. 8
I. True, False, or Uncertain (60 points total; 6 each)

*The truth sometimes not sought for comes forth to the light.*

Menander, 342-292 B.C.

1. If the demand for X is unit elastic then X does not have any close substitutes, because the amount spent on X (and thus on all other goods) is invariant to changes in the price of X.

2. The U.S. Consumer Price Index overstates the true inflation rate.

3. The observed worldwide tendency for a country's birth rate to decline as its per capita income rises implies that children are inferior goods.

4. If every firm in a competitive industry uses a constant-returns-to-scale production technique, then the long-run supply curve of that industry is perfectly elastic.

5. The marginal cost curve of any firm is that firm's supply curve.

6. If plant size is optimal, short run marginal cost must equal long run marginal cost.

7. Employers in seasonal industries, such as housing construction in cold climates, must pay their workers a higher hourly wage than they would if they were in year-round operation.

8. Patents grant a legal monopoly over a new product or process for a period of 17 years. Such an arrangement imposes an efficiency loss (relative to unregulated competition) due to underproduction of the patented item.

9. If there were a readily identifiable genetic marker for all diseases, there would be no market for medical insurance.

10. If the crude oil industry is perfectly competitive, then (neglecting the costs of drilling) the present value of an oil deposit of volume B (in barrels) is equal to $P_tB$, where $P_t$ represents the current price per barrel.
II. Demand (40 points total, divided as shown)

*De gustibus non disputandum.*

Anon. Latin Proverb

1. (20 points) Ralph has the following utility function

\[ U = \ln X + \alpha \ln Y \]

which he must maximize subject to the constraint

\[ I = P_x X + P_y Y \]

where \( P_x \) and \( P_y \) are the prices of goods X and Y, and I is income.

Based on this information, answer these questions:

a. Does economic theory place any restrictions on (i) the sign or (ii) magnitude of the parameter \( \alpha \)? Explain.

b. Under what conditions, if any, are Ralph's indifference curves convex to the origin? Under what circumstances, if any, can Ralph's indifference curves be positively sloped? Convince us.

c. Derive Ralph's ordinary demand functions for X and Y. What are Ralph's price and income elasticities of demand?

d. Derive Ralph's
   (i) indirect utility function,
   (ii) compensated demand curve, and
   (iii) expenditure function (also called his consumer cost function).

2. (20 points) The wife of one of your examiners has been offered a new job. Part of the fringe benefit package is that her new company will pay for 50% of the cost of all of her restaurant meals--any time, any place.

   (a) How should she value this fringe benefit when comparing the new job with the old job?

   (b) Is it possible that the value she places on this fringe benefit could equal or exceed the cost of the fringe benefit to her new company? Explain.

Suppose you pass this exam and are offered a job as a result.

   (c) How much would a company car--just one, but at a zero price--be worth to you if it were part of the offered employment package?

   (d) Is it possible that the value you place on this fringe benefit could equal or exceed the cost of the fringe benefit to your new company? Explain.

Do your answers to parts (b) and (d) suggest how a cost-minimizing employer might structure the types of fringe benefits offered employees? Explain briefly.
III. Supply (30 points total, allocated as shown)

*The problem with the law is lawyers.*

Clarence Darrow, 1857-1938

1. (18 points) Firm A signed a contract to deliver $Q$ units to Firm B by the end of the year at a fixed per unit price of $P_1$. The contract will occupy Firm A's entire production capacity during the period (i.e., $Q = \text{full capacity output}$). The cost function of Firm A is

$$C = F + \alpha q \quad \text{for } q \leq Q$$

where $F$ = fixed costs and $\alpha$ is a constant. In addition, Firm A must pay a tax of $T$ dollars per year to the local government.

After signing the contract, the price of a major input increases significantly, causing Firm A's marginal cost to increase to $\beta$. Firm A will lose money by fulfilling its contract because $\beta > P_1$. Therefore, Firm A wonders whether it should fulfill the contract that it signed.

If Firm A does not fulfill the contract that it signed, then Firm A will have to reimburse Firm B for any excess amount that Firm B pays for the product. Firm A estimates that Firm B will have to pay $P_2$ per unit (where $P_2 > P_1$) and thus it (Firm A) will have to pay $P_2 - P_1$ for each unit not delivered.

Firm A is then approached by Firm C, which wants Firm A to deliver $Q$ units to it by the end of the year at a fixed per unit price of $P_3$, where $P_2 > P_3 > \beta$. Firm A has only enough production capacity to fulfill one contract (i.e., either the contract with Firm B or the one with Firm C).

a. Is it possible to determine which contract Firm A should fulfill, if its objective is to maximize profits? Explain.

b. Under what circumstances, if any, should the firm simply shut down? *Be specific.* Explain.

2. (12 points) Suppose South Carolina wants to ensure that legal services are provided to the poor. Analyze the effects of each of the following options on the labor supply of lawyers.

a. All practicing lawyers in South Carolina would be required to devote 10% of their work time to the poor, free of charge.

b. All practicing lawyers in South Carolina would be required to provide 200 hours of work each year to the poor, free of charge.

c. All practicing lawyers in South Carolina who earn more than $50,000 per year would have to donate $5,000 to a fund that would be used to provide legal services to the poor.
IV. Applied Economics (30 points, allocated as shown)

*The wrong way always seems the more reasonable.*
George Moore, 1852-1933

1. (18 points) Curt Flood recently died. Flood was a centerfield for the Saint Louis Cardinals baseball team in the 1960s. He spent the last years of his career fighting the 'reserve clause' in major league baseball in court. The reserve clause effectively bound a player to a team for life, because a player could not change teams without permission. Flood lost his legal battle, but in the wake of the struggle, free-agency was introduced to baseball, and the reserve clause was essentially eliminated. As a consequence of this change, Professor Gerald Scully reports, over the past 20 years major league player salaries have risen to nearly 60% of total receipts, up from only about 20% before.

   a. Analyze the impact of the elimination of the reserve clause, and thus the introduction of free agency, on the prices of tickets to major league baseball games.

   b. Analyze how the introduction of player free agency affected player movement between teams.

   c. Describe how you would subject your theory on player movement before and after free agency to empirical scrutiny. *Be specific.*

2. (12 points) Assume that the demand for A is inelastic, but the supply is elastic. Assume that the demand for B is elastic, but the supply is inelastic. If a unit tax of t is imposed on both products, which price will increase more? Which product will generate higher tax revenues for the state? Explain.
V. Hmmm . . . . (20 points)

We hold these truths to be self-evident, that all men and women are created equal.

Elizabeth Cady Stanton, 1815-1902

A firm sells its output in a perfectly competitive market. Its production function is as follows:

\[ Q = L_1 + L_2 \]

where \( Q \) = quantity of output, 

\( L_1 = \) quantity of labor from women, and 
\( L_2 = \) quantity of labor from men.

The wage rate paid to women (\( w_1 \)) and the wage rate paid to men (\( w_2 \)) is determined as follows:

\[ w_1 = \alpha_1 + \beta_1 L_1 \]
\[ w_2 = \alpha_2 + \beta_2 L_2 \]

where \( \alpha_i \) and \( \beta_i \) are constants.

a. Determine the quantity of labor that the profit-maximizing firm will purchase from women and from men.

b. Are women employees more productive or less productive than men employees? Or are they equally productive? Explain.

c. Are women employees paid more or less than men employees? Or are they paid the same? Explain.

d. Will this firm hire all women, all men, or some combination of both sexes? Under what conditions, if any, would the firm hire only women? Only men? Could a change in output price ever induce the firm to switch between being a single gender work place and being a dual gender work place? Explain.

e. Suppose the firm is observed to hire only members of one gender. Is that observation evidence of discrimination on the part of the firm? Explain.
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

September 6, 1996

You have three (3) hours to complete this examination. There are five parts, I-V. Point values are shown for each question. There are a total of 180 points and 180 minutes available. Part I is worth 60 points; all other parts are each worth 30 points. Please follow these instructions:

1. Write your assigned identification number on the top left-hand corner of each page. Do not write any other personal identifier on any page.

2. Start your answer to each question on a fresh piece of paper. You may, however, answer more than one TFU on a single page and you may answer more than one sub-question (for example, a, b, or c) on a single page.

3. Write on only one side of each sheet of paper.

4. At the end of the exam, assemble your answers in the order in which the questions were asked on the exam.

5. After assembling your exam in the manner specified in (4), number each page in the upper right-hand corner. If the material on a page is a continuation of an answer, be sure to clearly denote that fact.

6. As you allocate your time among questions, always remember:

   Time is the rider that breaks youth.
   George Herbert, 1593-1633
I. True, False, or Uncertain (60 points total; 6 each)

. . . the best test of truth is the power of the thought to get itself accepted in the
competition of the market . . . .

Oliver Wendell Holmes, Jr., 1841-1935

1. On a 3 hour exam worth 180 points, the rational test taker spends as many minutes on a
question as that question is worth in points.

2. The weighted average of income elasticities will equal unity only if indifference curves are
downward sloping, i.e., only if all commodities are scarce goods.

3. The Laspeyres price index is biased downward as a measure of changes in the cost of living.

4. In a barter economy, the rate of interest can never be negative.

5. If the real wage rate is increasing over time, then more reliable durable goods should sell at a
growing premium over less reliable durable goods.

6. The optimal tax rate on a good is inversely proportional to its elasticity of demand.

7. A sports franchise owned by an individual who gets no utility from winning should be more
profitable than a sports franchise owned by an individual who gets positive utility from winning.

8. The wage rate earned by a professor who enjoys being a professor should be lower than the
wage rate earned by a professor who dislikes being a professor.

9. Because all costs can be avoided in the long run but not the short run, the long run marginal
cost curve can never be above the short run marginal cost curve.

10. For a fixed-proportions production function, the own-price elasticity of demand for any
factor must be less than the own-price elasticity of demand for the good produced using that
factor.
**II. Demand** (30 points total, allocated as shown.)

*From each according to his abilities, to each according to his needs.*

Karl Marx, 1818-1883

Answer question 1 and either question 2 or question 3.

1. (24 points) Suppose Emma's utility function is given by

\[ U = x + \ln(yz) \]

where \( x, y, \) and \( z \) are the amounts of each of these goods that she consumes, and the notation "\( \ln \)" means "natural log." Emma has income of \( M \) and faces constant prices of \( p_x, p_y, \) and \( p_z. \)

   b. Derive her ordinary demand curves for these goods.
   c. Derive her price and income elasticities for these goods.
   d. Derive her indirect utility function.
   e. Derive her expenditure function (also known as her consumer cost function).
   f. Derive her compensated demand curve for each good.

Answer either question 2 or question 3. Do not answer both . . . under any circumstances.

2. (6 points) There is a common practice in retail food stores to charge wholesalers for shelf space. (Thus, for example, Coca-Cola must pay Winn-Dixie a rental fee for each linear foot of shelf space occupied by its products in each Winn-Dixie store.) These fees vary considerably across products and brands of products.

Suggest an economic explanation for these fees and propose a test of your hypothesis. To receive any credit for your proposed test, it must be based on observable behavior, and not on whatever people might claim to be the (alleged) reasons for their actions.

3. (6 points) The inverse demand for a commodity is given by

\[ P = a - bQ \]

Where \( P \) is the price of the good in dollars per pound and \( Q \) is the quantity consumed, in pounds, and the parameters \( a \) and \( b \) are constants. The supply of this same commodity is given by

\[ Q = X \]

where \( X \) is the amount harvested, in pounds. Suppose the amount harvested is either \( x \) (when the weather is poor) or \( 2x \) (when the weather is good), and that the probability of good weather and bad weather are each 0.5.

What determines whether the price or the quantity of this good will be more variable? Convince us.
III. Supply (30 points)

One who is serious all day will never have a good time, while one who is frivolous all day will never establish a household.

Ptahhotpe, Twenty-fourth century B.C.

This is one question with multiple parts. Answer it. (30 points)

The two largest programs designed to help poor, single mothers are Aid to Families with Dependent Children (AFDC) and Medicaid. AFDC payments are cash payments that may be spent on any good. Medicaid may be thought of as vouchers that may be spent only on medical care.

Assume that consumers maximize utility, $U = U(L, C)$ where $L$ is leisure in hours per year and $C$ is consumption in dollars per year. The wage rate before taxes is equal to $w$. The mother has a time endowment of $T$ hours per year that she may allocate between leisure and market work, $h$, also measured in hours per year. At zero hours of market work, the mother receives a certain level of AFDC benefits, known as the guarantee level, $G$. In addition, she receives medical benefits in the form of Medicaid, in the amount $M$. Assume that individuals have no other non-labor income. Assume that labor income is taxed at the federal level at a rate $J_{FED}$.

AFDC benefits are reduced for persons earning labor income, by amounts that depend on how much labor income is earned. The implicit rate of taxation of AFDC benefits is very high. For example, in the state of Pennsylvania, AFDC benefits are reduced by amounts ranging from $0.67 to $1.00 for every $1.00 earned in the labor market. Denote the implicit tax rate on AFDC benefits (including federal taxes on labor income) $\tau_{AFDC}$. Medicaid is not taxed at all.

a. Assume initially that eligibility for Medicaid is limited to those individuals receiving AFDC. Being sure to label all relevant features, draw the budget constraint for a person who faces the following parameter values:

$w = $12/hour
$T = 2,000$
$G = $3,000/year
$M = $1,000/year
$J_{FED} = 25\%$
$\tau_{AFDC} = 75\%$

b. Suppose eligibility for Medicaid is expanded so that persons earning up to $12,000 year may receive $M$, whether or not they are not receiving AFDC. Draw the effects of this policy change on the budget constraint, using the same diagram you drew above.

c. Analyze the impact of this expansion of Medicaid eligibility on the following:

i. The rate of participation in AFDC;
ii. the rate of participation in the labor force; and
iii. the number of hours worked per year.
d. Which of the following will be larger in magnitude: The change in the AFDC participation rate or the change in the labor force participation rate?
IV. Applied Economics (30 points total, allocated as shown)

*Taxes are what we pay for civilized society.*

Oliver Wendell Holmes, Jr., 1841-1935

There are two questions. Answer both.

1. (18 points, 3 for each of six parts) Last year the City of Clemson considered the possibility of imposing an "impact fee" on all new residential construction within the City. The fee would be paid by the builder whenever a new residence was constructed. Two possibilities were explored: (i) a fixed amount per residence, independent of the size or value of the new home; and (ii) a fee that was a fixed percentage of the value of the new construction.

   a. Illustrate graphically the impact of each of these options on the budget constraint of a representative individual.

   b. For a given amount of revenue collected by the City, which type of fee would discourage more new construction within the City? Convince us.

In the end, the City designed to implement a program that comprises two elements: The City (i) imposes a fixed impact fee on each new unit of residential construction, with the size of the fee independent of the size or value of the new homes, and (ii) spends the proceeds of the impact fees collected to support recreation and public safety (for example, police and fire).

Analyze the effect of this program on the following:

   c. The price of vacant residential lots within the City compared to vacant residential lots outside the City.

   d. The price of *new* houses inside the City compared to the price of *existing* houses inside the City.

   e. The relative prices of houses of different sizes within the City.

   f. The price of new houses inside the City compared to similar new houses located outside the City.

*Turn to the next page for the second question in this section.*
IV. Applied Economics (con't)

2. (12 points) Assume that all health insurance is provided by private health insurance companies. Initially, these companies are not legally required to provide insurance coverage for pre-existing illnesses, and in fact they do not provide such coverage. (A pre-existing illness is one that the policy holder had at the time the insurance policy initially was issued.)

Now suppose a law is passed requiring health insurance companies to provide coverage to policy holders for pre-existing illnesses.

a. What will be the effect of this law on the following?
   i. the price of health insurance coverage
   ii. the number and age distribution of people who buy health insurance
   iii. the price of medical services
   iv. the price of common stock of health insurance companies.

   Explain your answers briefly but carefully.

b. Under what circumstances, if any, would private health insurance companies willingly provide coverage for pre-existing illnesses, in the absence of some government requirement? Explain.
V. Monopoly . . . and More

All things are filled full of signs, and it is a wise man who can learn about one thing from another.

Plotinus, 205-270

This is one question with multiple parts. Answer it. (30 points)

The learning curve is a process by which a firm experiences falling average cost as output increases. The leaning curve is not merely some fixed cost effect. (A fixed cost effect means that the firm incurs expenses at the beginning of a project and the more it produces, the lower is average fixed cost.) The learning curve phenomenon means that the whole U-shaped average cost curve shifts down as accumulated output grows. There is an implicit time dimension to the problem.

Consider a non-storable good whose production is characterized by the learning curve phenomenon. Assume that demand for this good is constant through time. Answer the following:

a. How will a monopolist price its product over time? Will price go up or down over time? Derive this result explicitly.

b. Can there be a competitive market for such a good? How, if at all, does your answer depend on whether the amount of learning by a specific firm (i) depends solely on output produced by that firm, or (ii) it instead depends on the level of output produced by the industry as a whole?

c. If the market is competitive, what price will prevail? Will price go up or down over time? Convince us.
Comprehensive Examination in Microeconomic Theory

Preliminary to candidacy for the Ph.D. in Applied Economics

February 2, 1996

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1. Write your assigned identification number on the top left-hand corner of each page. Do not write any other personal identifier on any page.

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3. Write on only one side of each sheet of paper.

4. Number each page in the upper right-hand corner. If the material on a page is a continuation of an answer, be sure to clearly denote that fact.

5. As you allocate your time among questions, always remember:

   Time is flying never to return.
   Virgil, 70-19 B.C.
I. True, False, or Uncertain (40 points; 5 each)

An error is the more dangerous the more truth it contains.
Henri-Frederic Amiel, 1821-1881

Do all of the following TFUs. For each of them, state True, False, or Uncertain and explain your reasoning. Remember that each is worth only five points; allocate your time accordingly.

1. Competitive markets generate an efficient allocation of goods.

2. An individual who holds a fully diversified portfolio of international capital assets will always oppose the imposition of barriers to international trade.

3. Immigration always increases the aggregate income of people already living in the country of destination if the aggregate production function is linearly homogeneous.

4. Labor's share of an industry's costs is the elasticity of output with respect to labor if and only if the industry's production function is of the Cobb-Douglas type.

5. Ceteris paribus, an industry's demand for a factor of production is always less elastic, the smaller that factor's share of total industry costs.

6. If a firm has two plants that differ in efficiency, the firm will operate only the more efficient of the two.

7. A binding legal ceiling on interest rates will increase the amount of money loaned if the lender is a monopolist.

8. A ban on the sale of used textbooks would cause an increase in the equilibrium price of new books, at least until new publishing firms entered the market.
II. Not Too Demanding (40 points, allocated as shown below)

[Under a] system of natural liberty . . . every man, as long as he does not violate the laws of justice, is left perfectly free to pursue his own interest in his own way . . . .

Adam Smith, 1723-1790

Do all three questions

1. (12 points) Useful economic theories have the power to (i) reveal the linkages between apparently unrelated events, and (ii) resolve seeming contradictions in what we observe around us. Suppose the following facts to be true:

Over the past few years,

(i) the penalty for driving under the influence (DUI) of alcohol has been raised substantially; even so, the popularity (consumption) of beer produced by "upscale" micro-breweries has increased substantially.

(ii) the price of paper (used in book production) has increased substantially; even so, the popularity (consumption) of hard-back books has increased substantially.

a. What seeming contradictions do you see in these facts?
b. How does the law of demand help resolve these apparent contradictions?
c. Propose a way to test your proposed resolution (i.e., specify one or more additional facts (predictions) that should be observed if your explanation is correct).

2. (12 points) Suppose Jake consumes only two goods, X and Y, and his utility is given by

\[ U = (X \cdot Y)^{\frac{1}{n}} \]

a. Derive Jake's indirect utility function.
b. Derive Jake's expenditure function.
c. Is Jake rational? Explain why or why not.

3. (16 points) Let

\[ E = \frac{\sum_i p_i' x_i'}{\sum_i p_i' x_i^0} \]

\[ L = \frac{\sum_i p_i^0 x_i^0}{\sum_i p_i^0 x_i'} \]

\[ P = \frac{\sum_i p_i' x_i'}{\sum_i p_i^0 x_i'} \]
Under the following conditions, what if anything can be said about the change in the consumer's real income between periods 0 and 1:

a. \( E > \max \{P, L\} \)

b. \( E < \min \{P, L\} \)

c. \( L > E > P \)

d. \( P > E > L \)

Answer for each condition separately, being sure to demonstrate the basis for your conclusion.
III. Firms and Markets (40 points)

Perhaps someday it will be pleasant to remember even this.
Virgil, 70-19 B.C.

Do both equally-weighted questions.

1. Consider a profit maximizing firm in a competitive market for both her product and for the labor and capital she uses. She has a continuous production function for output that depends only on the capital and labor inputs.

   a. Specify the problem faced by the firm. Make whatever assumptions you wish, but be explicit if you wish to receive credit for your effort. NOTE: Look ahead before deciding on what you want to assume!
   
   b. Are the isoquants associated with your production process convex?
   
   c. What conditions are sufficient to determine the output produced by, and the inputs used by, the firm?
   
   d. What shares of revenue go to labor, capital and the owner of the firm?
   
   e. Reproduce the conditions in (c) using the production function:

   \[
   f(L, K) = (L^\alpha K^{1-\alpha})^\gamma; \alpha < 1
   \]

   Does this function satisfy the assumptions you made in (a)? How would you derive the labor demand curve of this firm? (Don't do the derivation unless you have time at the end. Merely describe the process.)

2. A well-known textbook has argued that a (binding) price floor for a good will yield an equilibrium in which quantities demanded and supplied are equal, because frustrated would-be suppliers will simply reduce the amount offered for sale until it equals the amount actually demanded at the mandated minimum price.

   a. Draw a supply and demand diagram for a good that might illustrate this proposition.

   Suppose the good in question is apartments. Let the supply of apartments be \( P = 5 + Q \) and the demand be \( P = 55 - 9Q \), where \( Q \) is the quantity of apartments in thousands and \( P \) is the monthly rental in dollars per apartment. Assume that the owners of apartments are risk-neutral expected-profit maximizers. Also assume that, if the vacancy rate is positive, the probability that a given apartment is rented is random and identical for all apartments.

   b. Fully characterize the equilibrium in this market. Once you have done so, also do a specific numerical illustration, assuming the price floor is set at \( P_f = 28 \).

   c. Demonstrate the effects on the vacancy rate of an increase in the price floor.

   d. Comment on the conclusions contained in this well-known textbook. Be specific.
IV. Econ . . . . Ag Econ . . . . or Applied Econ? (30 points)

*Not every soil can bear all things.*

Virgil, 70-19 B.C.

This is one question. Answer it.

A large number of ranchers in eastern Montana raise cattle. The only source of water for the cattle is a large but shallow lake. This lake is centrally located so that each ranch has direct access to it. Hence, cattle owned by any given rancher can drink from the lake without passing across land owned by another rancher. All of the land on these ranches (and only this land) drains into the lake. Manure runoff from the cattle leeches into the lake and this contamination sometimes kills some cattle. The hazard to the cattle from the runoff depends on the total number of cattle (and thus manure) on all of the ranches. Not surprisingly, the death rate among the cattle affects the number of cattle that the ranchers are willing to graze.

Over the past several years, the price of cattle has been stable, as have the prices of the other inputs used to raise cattle. At the same time, however, the water level of the lake has fluctuated for exogenous reasons. This has caused fluctuations in the death rate, which has enabled you to deduce the following demand function for cattle on the part of the ranchers:

\[ H = 20,000 - 20,000p \]

where \( H \) is the number of head grazed on all ranches, \( a \) and \( b \) are estimated from the data, and \( p \) is the proportion of cattle that die. You also have determined that the expected death rate is given by the following:

\[ p = 0.0001H \]

a. What is the equilibrium number of cattle if individual ranchers are free to determine how many cattle each will graze?

b. Suppose the ranchers come to appreciate the cost of freedom and decide to form a Cattleman's Association. The sole function of this association is to impose and collect fees from all of its members. Fees payable by any member are based strictly on the number of head he grazes. If the price of cattle was $600 per head during the sample period, what is the efficient fee? (Assume that proceeds of the fees are disposed of in a non-distorting manner.)

c. What is the dollar value of the welfare gain from charging the fee, compared to the situation in which no fee is charged and the ranchers are free to graze as much as they like? (If this is computationally too tedious, set it up or draw a picture and move on to (d) and (e).)

d. Under what conditions would you expect the ranchers to join together to solve the problem as you have solved it in (b)? Explain, briefly.

e. Suppose the conditions you specified in (d) were not satisfied, and that government action were deemed necessary to solve the problem. At what level—county, state, national, or perhaps international—should the government action take place? Explain.
V. Searching for . . . . (30 points)

The monopolists, by never fully supplying the effectual demand, sell their commodities much above the natural price, and raise their emoluments, whether they consist in wages or profits, greatly above their natural rate.

Adam Smith, 1723-1790

Do all portions of one of these two questions . . . . only ONE.

1. The lead article of the January 1996 issue of the Southern Economic Journal estimates an interesting model. It posits a demand and a supply function for government services. Factors entering the demand in this model are the extent of poverty (which the citizens may want alleviated) as well as certain interest group variables, such as representation of farmers or union members in the population. Factors entering the supply side are variables proxying the relative cost of producing government vs. private services and proxies for the cost of collecting taxes (such as purchases of business machines that produce auditable records, etc.). The relevant demand and supply side parameters of this model are estimated using 3 stage least squares.

(NOTE: This a theory question, not a public choice question.)

a. Although the structure of the supply side of the model is left unspecified, assume that there is only one agency that may supply the governmental services to the citizenry. Assume, moreover, that this agency operates as if it were a profit-maximizing firm. What ambiguities do you see in the estimates of the supply-side parameters in this model under these conditions?

b. The author supposes that a median voter model can be used to characterize the demand for these government services. Assume that this is true, i.e., that a single voter's preferences are expressed through the actions of Congress in seeking to secure government services. Thus, it is as if there were only a single voter buying government services. What ambiguities do you see in these estimates of the demand-side parameters in this model under these conditions?

2. The facts of this case are true: Bob is third generation proprietor of a family business. His company manufactures and sells cigars. Primarily the sales are mail order. Bob has been managing the business for about 10 years. Over the last five years, cigar smoking has experienced a resurgence of popularity. This has distressed Bob. Tobacco leaf prices are rising substantially. Because of this, Bob knows that he needs to raise his cigar prices but is reluctant to do so. His concerns are directed at his long-standing customers. In fact, he is so convinced that raising prices to his old customers is bad that he has held the line on price increases to them, while raising prices to new customers. He says that future price increases for old customers will be less than for new customers. Answer the following questions:

a. The model of pure competition says that Bob should be unconcerned about his customer base. Explain.

b. Use a model of imperfect information and search to explain why Bob’s concern might be rational.

c. Bob is essentially beginning to price discriminate among his customers. Would a model of price discrimination suggest that the price charged to old customers go up less in the face of cost increases than the price to new customers?
d. If price discrimination is the explanation of Bob’s decision-making, how can it be that there was no apparent price discrimination before the jump in input price?
Comprehensive Examination in Microeconomic Theory  
Preliminary to candidacy for the Ph.D. in Applied Economics  
September 1, 1995

You have three (3) hours to complete this examination. Answer questions I, II, and III, and also answer either question IV or question V. Point values are shown for each. There are a total of 180 points and 180 minutes available. Please follow these instructions:

1. Write your assigned number on the top left-hand corner of each page. Do not write any other personal identifier on any page.
2. Start each answer (Roman numeral) on a fresh piece of paper.
3. Write on only one side of each sheet of paper.
4. Number each page in the upper right-hand corner. If the material on a page is a continuation of an answer from the previous page, be sure to clearly denote that fact.
5. And finally, . . .

   Hold fast the time! Guard it, watch over it, every hour, every minute! Unregarded it slips away, like a lizard, smooth, slippery, faithless, a pixy wife. Hold every moment sacred. Give each clarity and meaning, each the weight of thine awareness, each its true and due fulfillment. Thomas Mann, 1875-1955
I. Answer it. (60 points; each of the ten counts equally)

There are no whole truths; all truths are half-truths. Alfred North Whitehead, 1861-1947

The following statements are all true, false, or uncertain. Tell us which and justify your answer. Your score will depend entirely on your answer (but don't forget to tell us whether the bottom line is T, F, or U.)

1. All behavior is efficient.
2. The First Law of Demand is most likely to be violated for goods that are a small part of the budget.
3. Every good must have at least one substitute.
4. A dollar's worth of money is worth more than a dollar's worth of anything else.
5. Profits are the rewards to entrepreneurs for their risk taking.
6. An industry that is monopolized will tend to produce goods of lower quality than it would if it were competitive.
7. If all firms in a competitive industry use a production technology that is linearly homogeneous, then the long-run supply curve of that industry is horizontal.
8. A doubling of the number of immigrants permitted into the U.S. would lower the average income of current U.S. residents.
9. An income tax distorts the choice between labor and leisure, while a general sales tax distorts the choice between consumption and saving.
10. If a firm is competitive in labor and output markets, all factors other than labor are fixed, and the production function is $X = AL^\alpha$, then the elasticity of the firm's demand for labor is equal to $\alpha$. 

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II. Answer it. (40 points; 10 for each portion)

You're a mouse studying to be a rat. Wilson Mizner, 1876-1933

Assume that you are asked to conduct an animal experiment to demonstrate the Law of Demand. You are given a rat and a cage that has the facility to distribute two flavors of soft drinks to the rat based on its willingness to press a lever above the drink dispensers. (NOTE: the notation "cc" means "cubic centimeters;" it is a measure of volume.)

a. Describe in detail how you would conduct the experiment. Explain it so that your undergraduate research assistant can conduct the experiment in your absence.

Now assume that you have been on vacation. Upon your return, you find that your assistant has completed the experiment. He presents you with the following information:

Test Conditions Consumption Choices

<table>
<thead>
<tr>
<th>Lever Presses</th>
<th>Cup Sizes (one cup per lever press)</th>
<th>Consumption Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Good A</td>
<td>Good B</td>
</tr>
<tr>
<td>350</td>
<td>.05cc</td>
<td>10.5cc 14cc</td>
</tr>
<tr>
<td>245</td>
<td>.1cc</td>
<td>14.7cc 9.8cc</td>
</tr>
<tr>
<td>350</td>
<td>.1cc</td>
<td>17.5cc 17.5cc</td>
</tr>
</tbody>
</table>

B. Do these data demonstrate the Law of Demand? If so, how?

C. Are goods A and B substitutes and/or complements? Explain carefully.

D. Do either or both goods have normal income effects? How can you tell?
III. Answer them. (80 points; 20 each)

It is difficulties that show what men are. 

Epicetus, c. 50-120

1. Naturalists are proposing that the South Carolina state government acquire land across the state that forms a corridor from the mountains to the sea. This corridor will be maintained as a hiking trail passing through all of the varied regions of the state. Proponents of this project claim that evidence obtained from land markets in the western states demonstrates that land abutting national and state parks commands a 60% premium over land not adjacent to such parks. They argue that the same phenomenon can be expected to result from the proposed trans-state hiking trail

a. Why does land adjacent to government owned parks sell for a premium compared to land not adjacent to government parks?

b. Do the owners of land adjacent to private parks, for instance, land next to Disney World in Orlando, enjoy a premium compared to land not adjacent? If so, is the premium larger or smaller than that associated with land adjacent to government parks?

2. Your firm manufactures slozits. Sadly, however, there are lots of other slozit competitors. But, as good luck would have it, one of your top-flight people in the Zunie office has uncovered an unusually high quality supply of globdocks, which as you know, are essential in the production of slozits. More critically, this manager has negotiated a long term supply contract for globdocks at a price that is 10% less than the current and recent market price. You have every reason to believe that this contact and means of supply can be kept secret.

a. Explain how this great luck will affect your pricing and output decisions.

b. How will this good fortune affect your profitability?

3. If long run total costs are always less than short run total costs, how can long run marginal costs ever be greater than short run marginal costs? Explain.

4. Suppose you own a large tract of timber (say, 10,000 acres) with mature trees available for harvest. The tract is in a remote area and has several streams and hills throughout the property. It will require some unusual and creative logging methods to extract the timber. You initially decide to cut the timber on only 5% of the property (500 acres). The highest bid you receive for the rights to harvest this timber is $500,000. At the last minute before signing the deal you decide instead to offer the whole tract for sale. How much do you expect to receive for the rights to harvest the entire tract, compared to what you would have received from the rights to harvest only 500 acres? Explain.
IV. Answer this question or question V. (60 points; all parts count equally)

Mathematics is the science which draws necessary conclusions. Benjamin Pierce, 1809-1880

Suppose a firm has the production function $x = K^{0.25} L^{0.25}$ and assume that factor prices are $w_K = w_L = $1.

a. Derive the firm's long run supply curve.

b. Suppose that $K$ is fixed at 1. Do the following:
   i. Derive the firm's demand for labor.
   ii. Derive the firm's short run supply curve.

c. Which is more elastic, the short run or long run supply curve? Why?

d. For what rate of output is $K = 1$ the optimal plant size?

e. Assume $K$ is fixed at 2. Compare both the slope and intercept of the short run supply curve with those features of the curve you derived in b(ii).

Suppose $p_x = $4. Also suppose a newly elected government announces that each per firm must pay a fee of $2.50 if it wishes to produce any output.

f. What will be the firm's output in the long run?

g. What will be the firm's output if it has fixed $K = 1$, the costs of which cannot be escaped?
V. Answer this or the preceding question IV. (60 points; all parts count equally)

All is well that ends well. John Heywood, c.1497 - c.1580

Job openings exist for bookkeepers for Jimbo's Waterbed Stores. The market for bookkeepers is highly competitive, i.e., a bid for a worker at his highest VMP outside the firm can be expected reasonably soon after job search begins. However, certain investments raise the productivity of bookkeepers while they continue to work at Jimbo's, but do not affect productivity anywhere else. Training does not affect bookkeeper productivity until next period. Expected productivity of bookkeepers on the outside (without the job-specific human capital) is \( w_2 = w_1 \) which is the untrained productivity inside the firm. Investment in human capital costs \( m \) and increases productivity at Jimbo's by \( m \) on average. Realized productivity at Jimbo's equals \( w_1 + m + \theta_1 \) where \( \theta_1 \) has a mean of zero and some positive variance. Realized wages on the outside equal \( w_2 + \theta_2 \), and \( \theta_2 \) has a zero mean and a positive variance. (NOTE: Neither \( \theta_1 \) nor \( \theta_2 \) is related to training.)

a. Assume that Jimbo's pursues a meet the market test model of awarding raises. Will bookkeepers willingly undertake this investment under these circumstances? Explain.

b. What problems will be introduced if Jimbo offers to compensate his workers for undergoing this training by paying them their MVP after the job-specific human capital investment has been made? What problems will be encountered if Jimbo simply pays for the training himself and keeps the rents earned on the training?

c. Assume that Jimbo offers prospective bookkeepers an inflexible wage contract involving the following conditions. People that are hired and themselves bear some portion (say \( \phi \)) of the cost of their training are guaranteed a wage of \( w_1 + \phi m \). These workers have no guarantee of employment, however, and may be terminated at will at any time. Nor may they negotiate for an increase above this wage. (The firm makes a commitment to let the worker go rather than pay a higher wage.) Such a contract solves some problems but introduces others. What is gained and lost by this inflexible contract?

d. Certain inefficient separations result from these inflexible contracts. Such an inefficient separation is characterized by the productivity of the worker while at Jimbo's exceeding his or her productivity at the new firm, once a separation has occurred. Explain how inefficient separations are possible with inflexible contracts.

e. Both prospective workers and Jimbo agree that the occasional inefficient termination is worth the cost. They will agree on a contract structure (involving the sharing of the cost of the training and a post-training wage increase) that minimizes the cost of such inefficient terminations. How does sharing of the cost of the investment and guaranteeing the worker a return on his share mitigate the cost of inefficient separations?

f. Assume that southern bookkeepers have a higher variance of \( \theta_2 \) than northern bookkeepers. What effect will this have on starting and post training wages of southern and northern bookkeepers?
Comprehensive Examination in Microeconomic Theory

preliminary to the candidacy for the Ph.D. in Applied Economics

Administered morning February 3, 1995

This examination is composed of five questions. Each question is equally important. Most of the questions have parts. There are major parts and minor parts. Each major part is an equally important component of each question. Each minor part is of equal importance within its major part. Expend your effort efficiently.

Please have the courtesy to obey the following guidelines in preparing your answers:

1. Write your assigned number on the top left-hand corner of each page. Do not write any other personal identifier on any page.

2. Start each answer on a clean sheet of paper. Leave large margins.

3. Write only on one side of each sheet.

4. Number each page in the upper right-hand corner. Denote both the question # and the page # associated with that question.

You have three (3) hours to complete this examination.
Question 1:

The early-1950s Arrow-Debreu model of a competitive economy in long-run equilibrium exerted a strong influence on a generation of microeconomic theorists and policy analysts. It has been suggested that:

A. The welfare-theoretic conclusions of the model provide the metaphysical basis for individual freedom expressed through free market activity;

B. The real-world departures from the assumptions of the model provide the foundation for the theory of market failure and the allocation function of government that was formulated from the late 1950s;

C. The "strong interpretation" of these market failures influenced the "structuralist" approach to government-led development in the developing economies from the 1950s through the 1980s;

and

D. The shift in focus from the "structural" to the "information" assumptions of the model is an important element of the transaction cost approach to microeconomic analysis.

Choose any one of the above four comments for discussion. Draw from the works of two or more authors of related theoretical and applied literature on the chosen area, and develop the relevance of the chosen statement regarding that area of microeconomic analysis.

Question 2:

A firm has two plants that produce the same product. Both plants exhibit a U-shape in average cost. One plant (the newer one) has a lower average cost at every level of output. The production manager has a monthly quota, i.e., he knows the exact amount that must be produced in total. He must decide how to allocate production between the two plants.

(a) Explain how the manager should decide how much to produce at each plant. An explanation using a mathematical expression(s) would be preferable.

(b) Will the manager produce all output at the lower cost plant? Will he produce at the minimum of the average cost curve for each plant? Will he produce at the minimum of the simple average of the average cost for each plant? Explain.
Price Theory Prelims

Question 3:

Consider the following demand and supply equations:

\[ D = a - b(P + t) \]

\[ S = c + dP \]

where

- \( D \) = quantity demanded,
- \( S \) = quantity supplied,
- \( P \) = market price,
- \( t \) = per unit tax, and
- \( a, b, c, \) and \( d \) are positive constants.

(a) How would the equilibrium price change as the per unit tax rate changes? Give an economic explanation of your mathematical result.

(b) The government wants to set the per unit tax rate so that total tax revenues are maximized. What per unit tax rate should the Government set?

(c) The per unit tax rate on gasoline was recently increased in the U.S. The tax increased by ten cents per gallon. What impact would you expect this tax increase to have on the market price? Under what conditions would the price increase by ten cents, by more than ten cents, by less than ten cents? Explain.

(d) The Clinton administration is considering raising the tax in cigarettes from the current 24 cents per pack to $2 per pack. Tobacco production is restricted by a system of acreage allotments, and only land in production as of about 1950 can be used to grow tobacco. Allotments (rights to use the land) can be bought, sold, and rented on an annual basis in the market. Suppose the current annual rental rate for an acre of tobacco growing land is $500 per acre.

(i) If the market interest rate is .1, what will be the selling price of an acre of tobacco land?

(ii) Why are farmers so vehemently opposed to an increase in the cigarette tax?
Question 4:

Suppose that the market demand for golf clubs is given by the function $Q = 100 - P$.

(a) Assume that golf clubs are produced in a perfectly competitive industry. Each firm in this industry has the long-run total cost ($TC$) function given by

$$TC = 26Q - 2Q^2 + Q^3$$

(i) Find the expression for long-run average cost (LRAC). Find the $Q$ that minimizes LRAC and determine the minimum LRAC.

(ii) Find the expression for long-run marginal cost.

(iii) Determine the long-run competitive price of golf clubs and the number of golf club producers.

(b) Find the expression for total revenue of the golf club producers. Define marginal revenue for the market and find the expression for it. Over what range of output is marginal revenue positive? Over what range is it negative?

(c) Suppose that one of the club manufacturers, the Palmer Company, succeeds in acquiring all of the other firms and, furthermore, gets Congress to pass a law prohibiting new firms from entering the market.

(i) Now that the Palmer Co. is the sole producer of golf clubs, what price will it charge and how many plants will it continue to operate if it can charge only one price?

(ii) Why might it only be able to charge one price? Can Palmer do any better if it is not so constrained?

(d) Given how Palmer acquired its monopoly, will Palmer necessarily make excess profits?
Question 5:

Consider the concept of the Giffen Good.

(a) Under what circumstances can a good be a Giffen good.

(b) Even a Giffen good has a negatively sloped *compensated* demand curve. Explain why.

(c) A well-known introductory textbook contained the following passage:

"One historical example of a Giffen good may have occurred in Ireland during the Potato famine of the 1840s. A blight wiped out the potato crop for three years running. This shortage of potatoes sent the price soaring. This high price of potatoes led the Irish peasants to consume more potatoes than they formally consumed...."

What error is contained in this analysis?

(d) Some sloppy economists have argued that a "backward bending supply curve of labor is an example of a Giffen good. Under what circumstances will an increase in the wage rate lead an individual to supply *less* labor. Explain why a backward bending supply curve *cannot* be an example of a Giffen good.

(e) George Stigler argued that there cannot be many examples of Giffen goods because, if one were empirically identified, this finding would certainly be a highly publishable result, and no reliable estimate of a positively sloped uncompensated demand curve occurring outside of a laboratory has been reported. One reason for this may have its origins in the dynamic properties of market equilibria. Explain.

(f) Assume initially that the price of meat is $4.00/lb and that the price of potatoes is $.20/lb. and that Michael Murphy (an Irish peasant) earns $3.80 per day, which is completely spent on food. Alcohol consumption does not enter into this question, and no one would pay anything to live where he lives. He operates under an additional constraint, however. Mike must consume at least 2,000 calories of food per day, or he will be unable to work and then will starve. Meat yields 1,000 calories per pound consumed while potatoes produce 200 calories per pound.

(i) Assume further that Mike prefers meat to potatoes, and will consume as much meat as he can while satisfying his calorie constraint. What combination of meat and potatoes does he select?

(ii) The potato blight severely damages the potato crop and causes the price to rise by 50 percent to $.30/lb. What effect does this price increase have on Mike's potato consumption?

(iii) Is the demand for potatoes as characterized in this question Giffen?
Comprehensive Examination in Microeconomic Theory

preliminary to the candidacy for the Ph.D. in Applied Economics

Administered morning September 2, 1994

This examination is composed of three questions. Each question is equally important. The questions have parts. There are major parts, labeled by bold letters, and minor parts labeled with bullets. Each major part is an equally important component of each question. Each minor part is of equal importance within its major part. Expend your effort efficiently.

Please have the courtesy to obey the following guidelines in preparing your answers, reflecting on the old proverb: Confusion fueled by annoyance leads to anger that is followed by rejection. Minimizing annoyance if not confusion is an important part of marketing your knowledge.

1. Write your assigned number on the top left-hand corner of each page. Do not write any other personal identifier on any page.

2. Start each answer on a clean sheet of paper.

3. Write only on one side of each sheet.

4. Number each page in the upper right-hand corner. Denote both the question # and the page # associated with that question.

You have three (3) hours to complete this examination.
Question 1.

A. Part one:

Is there any relation between income elasticity of demand and own-price elasticity?

Consider the following demand function for tea in Great Britain:

\[
\log(\text{tea}) = 15 - 0.2 \log(\text{price of tea}) + 0.4 \log(\text{income}) + 0.2 \log(\text{price of beer}) + 0.2 \log(\text{price of coffee})
\]

Under what circumstances is this demand curve inconsistent with the theory of consumer behavior?
Is the demand curve well specified?

B. Part two:

Two different tax plans are being considered by the state government. One plan increases the tax on gasoline by one penny per gallon sold. The second plan is designed to raise exactly the same amount of tax revenues by imposing a special business tax on filling stations. Compare the two plans. Assume that all firms are identical and that the market is competitive.

Identify the effects of the two different tax schemes on marginal and average cost for the firm.
Which plan has the bigger impact on the number of stations in the state?
Which plan raises price more?
Question 2.

Consider the production function of the following form:

\[ q = L^\alpha K^\beta \]

where \( K \) is capital and \( L \) is labor. Assume that the inputs are sold in a competitive market where the rental rate on capital is \( r \) and the wage rate is \( w \).

A. Assume that production in industry \( i \) is characterized by this function. Let there be a fixed cost, \( b \), associated with production at the firm level. Assume that production in industry \( i \) is competitive.

   Derive the first and sufficient second order conditions for profit maximization at the firm level.
   
   What assumptions must be made about the production parameters \( \alpha \) and \( \beta \) to ensure that the first and sufficient second order conditions are satisfied?
   
   Describe the nature of competition in the industry when the first and sufficient second order conditions are met.

B. Most recently about 100,000 Cubans have fled their homeland in an attempt to enter the U.S. They are being returned to U.S. occupied Cuba at the Marine base on Guantanamo Bay. Assume that production in the entire U.S. economy is described by the production function identified above. Further assume that capital is owned by the current labor force of the U.S.

   Under what circumstances of production is it beneficial to current U.S. citizen to bar entry to the Cuban exiles?
   
   What other considerations enter into the policy calculus currently employed? What is the economic content?

C. Some economists claim that Japanese firms do not maximize profits. Rather they maximize value added, that is, the difference between revenues and material costs. Rewrite the production function identified above in these terms. Let

\[ M = M^\gamma \]

where \( M \) is material input bought from other firms at a competitive price. Assume as in part A that there is a fixed cost of doing business. Also assume that the conditions identified in part A that are required for a well defined market equilibrium hold.

   In what ways, if any, would the input and output decisions of the value-added maximizing Japanese firm differ from those of its profit maximizing U.S. counterparts. Are the differences in behavior, if they exist, empirically distinguishable?
Question 3.

The tournament literature compares the economic outcome of a market where people are paid a share of a purse to the outcome of a market where they are paid on a piece rate. Consider a simple tournament setting where two people are ranked against each other. In the tournament, workers are paid prizes according to the ordinal ranking of their productivity. With piece-rate pay, they receive exactly what they produce.

Assume that workers expend effort, which has a marginal cost or disutility. This effort becomes production. However, the transformation occurs with error. That is, the model assumes that work generates a random distribution of output. Consider this distribution to be normal.

In other words, workers work. Sometimes their efforts payoff with large output, sometimes with small. With piece-rate pay, workers get their output, large, small, huge, tiny, or just average. In the tournament, worker are judged by the size of their output and then paid a guaranteed prize that is larger for the more productive worker and smaller for the less productive. The higher prize is above the level of average productivity and the lower prize is below the average. There is an optimal spread between the prizes.

Prove: A tournament can be constructed so that the expected earnings of both workers is identical to that achieved when workers are paid piece rate.

Prove: A tournament will cause workers to expend more effort which generates higher expected productivity than would be the case if there were no prize differential. That is, a tournament will generate more product than would occur if each worker were paid an hourly wage or a fixed income independent of productivity.

Prove: The optimal spread is a function of the cost or disutility of effort that workers must expend in order to attain an expected level of productivity. (Hint: In the previous question you are asked to demonstrate why the spread does not collapse to zero. Here you are asked to show why the optimal lower prize is not zero and the higher prize extremely large. The answer does not hinge on risk aversion, though you may use this concept if it helps you think about the problem. The question asks you to link the optimal spread to the onerousness of work.)

Prove: That a tournament with the optimal spread can induce workers to exert the same effort and achieve the same expected productivity that they would under piece-rate pay.

Prove: A tournament will reduce the variance of the earnings of the workers compared to piece rate pay.

In demonstrating these propositions, use whatever tools you are most comfortable with. For instance, the first and last parts can be demonstrated fairly simply.
Comprehensive Examination in Microeconomic Theory

preliminary to the candidacy for the Ph.D. in Applied Economics

Administered May 12, 1994

This examination is composed of four questions. Each of these questions is broken into several parts. Each part of each question is of equal importance in determining your performance on this examination. Allocate your efforts accordingly. A perfect answer to part F of question 3 is no more valuable than a perfect answer to part A of question 4.

Please have the courtesy to obey the following guidelines in preparing your answers, reflecting on the old proverb: Confusion fueled by annoyance leads to anger that is followed by rejection. Minimizing annoyance is an important part of marketing your knowledge.

1. Write your assigned number on the top left-hand corner of each page. Do not write any other personal identifier on any page.

2. Start each answer on a clean sheet of paper.

3. Write only on one side of each sheet.

4. Number each page in the upper right-hand corner using the convention of [Question # / page # of related answer].

You have three (3) hours to complete this examination.
Question 1.
Suppose that you are an economist at the Public Service Commission in the State of Mississippi. The commission is recently formed and is considering a number of pleadings. The principal utility in the state, Mississippi Power & Light, has presented testimony that its production function has the following properties:

\[ Q = F^5K^7 \]

where \( Q \) is electricity production, \( K \) is capital, and \( F \) is fuel. It is also determined that MP&L is able to buy inputs in a perfectly competitive market. Several issues are at play in the hearings. You are asked to respond to the questions of the commissioners and their technically trained staff. Give a clear, simple answer directed at the commission members and be as precise as possible in the answer directed at the technically trained staff. The first issue raises the following question:

A. What effect does an increase in fuel price have on the marginal and average cost of service?

The commission, no doubt satisfied with your answer, moves on. The commission seems rather set on adopting the standard “fair rate of return” rule of regulation. However, one commissioner asks:

B. What would be the difference between the average cost pricing implied by the proposed standard and the outcome of monopoly if the only regulatory rule was that MP&L must charge one price to all customers?

The commissioner asserts that consumption obeys the following single price demand relation:

\[ Q = AP^{-3} \]

where \( P \) and \( Q \) reference price and quantity.

Next, the issue of price discrimination is raised. MP&L claims that across their two classes of customers, the demand relations are best represented in exponential form as above. Residential demand is

\[ Q_r = AP_r^{-4} \]

while the commercial demand is

\[ Q_c = AP_c^{-3} \]

where \( r \) and \( c \) reference the type of demander. The commissioners ask the following three questions:

C. What would be the monopoly profit maximizing price ratio of commercial and residential service?
D. What effect would an increase in fuel price have on the profit maximizing price ratio between residential and commercial customers?

E. What value of the price ratio between commercial and residential consumers will maximize consumers’ surplus while allowing MP&L to cover costs?
Question 2.

Ramone claims to have estimated the demand curve for university attendance. Using data for individual private schools, his estimates are given in the following table.

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>.445</td>
</tr>
<tr>
<td>Income per capita in the state</td>
<td>.555</td>
</tr>
<tr>
<td>Library volumes</td>
<td>.666</td>
</tr>
<tr>
<td>Enrollment over last five years</td>
<td>.888</td>
</tr>
<tr>
<td>Faculty teaching loads</td>
<td>-.333</td>
</tr>
<tr>
<td>Tuition</td>
<td>-.222</td>
</tr>
</tbody>
</table>

All variables are expressed in logs. The dependent variable is the log of the number of applications received. The mean number of applications submitted by individuals wishing to attend college last year was 3.7. Indeed, in some years when conditions were tight, students submitted applications to more than 5 schools each.

A. How good is this demand curve based on the results derivable from the theory of consumer behavior. That is, is the demand curve consistent with the Slutsky equation? What about the homogeneity conditions?

B. What effect will multiple school applications by students have on the interpretation of Ramone’s demand regression? Is the true price elasticity of demand greater or less than the estimated value based on this consideration?

C. When mean school SAT scores are entered into the regression, the coefficient on tuition drops to -.333. Explain why this is the case.

Acting on his dissertation director’s advice, Ramone reran his regression using school admissions as the dependent variable. Much to his confusion, the coefficient on tuition flipped signs and remained doggedly positive in spite of the application of severe torture. His friend Javier observed that it might have something to do with the fact that universities do not price to clear the market, but rather accept some applicants on grounds other than willingness to pay.

D. How could changing the dependent variable from applications to admissions generate a positive coefficient on tuition?
Question 3.
Traditionally, one views agricultural and food markets as characterized by volatile prices in the absence of government intervention. This results from random quantity shocks caused by unpredictable factors such as weather and pestilence. In simple terms, farmers expend resources that will yield an expected level of produce. Random shocks either increase or decrease the actual quantity taken to market. The figure below shows the basic model:

Farmers engage in resource expenditures that will yield $Q_0$ units of output on average. However, the vagaries of nature either increase the bounty brought to market to the level $Q_b$, which then drives market price down to $P_b$, or nature causes deficiency of $Q_a$ to occur and market price rises to $P_a$. For simplicity let’s assume that quantity alternates between $Q_a$ and $Q_b$, that there are no middlemen or speculators acting to arbitrage the supplies across time, and that demand is linear. Assume that supply is characterized by linearly homogeneous production in labor and land. Labor is perfectly elastically supplied to the farm sector. Land, however, is not. As output grows, the price of land rises, which gives rise to a positively sloped supply curve for agricultural produce.

Often, governments seek to stabilize prices, founding their actions on the argument that government intervention will enhance welfare. The typical program stabilizes price at $P_g$. In the bountiful years, government buys quantities in excess of $Q_0$ at price $P_g$ and stores them. Then in the years of supply shortfalls, government sells the stocks, which holds price down to $P_g$.

A. Identify the welfare gains and losses to consumers resulting from price stabilization.

B. Identify the revenue gains and losses to producers resulting from price stabilization.

C. When government stabilizes price at $P_g$, will this cause farmers to change $Q_0$, the average or targeted amount of produce that they plan to bring to market?

D. What is the effect of government price stabilization on the relation between labor and land? Does this depend on demand elasticity?
E. On the basis of these considerations, can you predict which goods, elastic or inelastic, that government is likely to target for price stabilization?
Question 4.
Much solid waste from municipalities can be recycled. For example, waste products such as paper, glass, plastic, metal, and oil can be recovered, reprocessed, and reused rather than buried in landfills. A local politician argues that each municipality should set recycling goals. He states that each municipality should recycle 25 percent of its waste. This proposal raises the questions of how much recycling is optimal and what institutions can be employed to achieve the optimal amount.

A. Based on economic efficiency what considerations determine the optimal amount of recycling? Are there externality considerations that make the competitive, market-generated level of recycling inefficient?

B. Should recycling standards be uniform across the country or even across counties?

C. Assume that the political process determines that the level of recycling in the state should increase from its current, market-driven level of 5 percent to a level of 25 percent of all the solid waste generated by private residences. Comment on the following proposals for achieving this goal:

1. Fine any individual who deposits recyclable waste in non-recyclable waste collections. Assume the fines are escalating as the number of offenses increases.

2. Charge a fee to individuals who deposit recyclable waste in non-recyclable waste collections. This fee is not escalating.

3. Subsidize the pick-up of recyclables.

4. Subsidize the facilities involved in the converting waste into new products. (These subsidies could take the form of lump-sum payments to defray start-up costs or reductions in taxes.)

PRIVATE
INSTRUCTIONS:

This examination has two portions. Microeconomics is first from 8:30am until 11:30am. Macroeconomics is 1:30pm until 4:30pm. You must take both portions. You must answer all questions, and you cannot use notes, books, or other materials from outside.

Each of you will be assigned a number. Write your number on the top of each page of your answers. Do not write your name anywhere on materials that you hand in. Do not write on the back of any page that you hand in. Leave ample margins.

In answering all of these questions, it is important to show the work that leads you to your answer. All algebra, calculus, and graphs should be neatly presented and fully labeled and explained.

There are five questions in the microeconomics examination. All count the same. Use your time accordingly. Each question is broken into several parts. Each of these parts is equally important. Plan your answer will this in mind. Write your answers so that it is clear which part of each question you are addressing.
I. Bill maximizes a utility function $U = f(z_1, z_2)$, where $U$ has standard neoclassical properties, $z_1$ is video movie-watching activity and $z_2$ is all other activities. The home production functions for $z_1$ and $z_2$ are given by:

$$z_1 = \min[T_1/\alpha, X_1]$$

$$z_2 = \min[T_2/\beta, X_2],$$

where $T_1$ is the total amount of time devoted to watching videos, $T_2$ is the total amount of time devoted to all other activities, $X_1$ is the number of videos rented per period, and $X_2$ is the amount of the composite good devoted to all other activities. These functions represent the idea that a unit of video watching requires $\alpha$ units of time and one unit of $X_1$. Bill faces a budget constraint and a time constraint:

$$M = P_1X_1 + P_2X_2$$

$$T = T_1 + T_2,$$

where $M$ is a fixed amount of money income (Bill does not work, but receives checks from an aunt's estate) and $T$ is the total amount of time available per period.

A. Rewrite the time constraint by expressing $T$ as a function of $X_1$ and $X_2$ (as opposed to the $T_i$).

B. Suppose that $P_1 = P_2 = $5, $M = $75, $\alpha = 2$, $\beta = 1$, and $T = 20$. Draw the budget and time constraints in $\{X_1, X_2\}$ space. Solve these two equations in two unknowns to find the intersection point and indicate the intersection point clearly on the diagram. Indicate the feasible set.

C. Suppose that Bill's utility function is given by $U = z_1z_2$. Find Bill's consumer optimum. (IMPORTANT HINT: Use your answer above to check your answer here.)

D. Suppose that the place where Bill rents his videos starts a video club that charges a membership fee of $35 per period which allows members unlimited access to movies at no additional cost. Show that Bill will not join the club at $35, or for that matter, at any fee. Briefly explain why not.

E. Suppose that the video store begins to offer a delivery service and does not require that you rewind the tapes if you are a club member. This lowers the time price of video watching from $\alpha = 2$ to $\alpha = 1.5$. Will Bill now join the club?

F. Some people join the club and some do not. What observable characteristics can we appeal to in order to predict who will join the club?
II. Assume you are participating in a multidisciplinary research project. The purpose of the project is to investigate the competition between cattle and deer on national forest land where animals are allowed to freely wander or range. Based on data generated by wildlife specialists you estimate the following production functions for cattle and deer:

\[ Y_1 = X_1^\alpha - \gamma Y_2 \]
\[ Y_2 = X_2^\beta \]

where: \( X_1 \) = units of forage (food) consumed by cattle on the range;
\( X_2 \) = units of range forage consumed by deer;
\( Y_1 \) = production of cattle per season on the range; and
\( Y_2 \) = production of deer per season on the range.

A. Assume \( X = (X_1 + X_2) \) is fixed at \( K \), the number of units of forage produced in a normal year. Derive the production possibilities curve of the form \( X = h(Y_1, Y_2) \).

B. Determine whether deer and cattle are joint products or technically independent products. If they are not independent, are they technically complementary or competitive? Assume you find that * in the cattle production function is not significantly different from zero, so you drop this term from the function. Does this change your answer?

C. Assume the U.S. Forest Service (USFS) charges local cattle growers a grazing fee of \( P_1 \) dollars per animal per season. The deer pay no grazing fee, but it is possible for the Wildlife Department to regulate their numbers by regulating hunting laws. Set up the appropriate optimization problem and derive the first order conditions for determining the number of cattle and deer that will maximize the USFS's revenue from grazing fees. Assume the USFS regards the range forage as a free input.

D. Show graphically what is happening in the maximization problem above. You may assume that the production possibilities equation you derived in (A) is negatively sloped and concave from below.

E. Assume that a market deer develops such that ranchers are raising their own deer and then feeding them on the range. Let deer have a price \( P_2 \) but the USFS does not have the authorization to charge a grazing fee for deer. Discuss the effect this has on the cattle grazing fee if the USFS is attempting to maximize grazing fee revenue.
III. In many natural resource situations the stock of the resource has a natural regeneration rate. For instance, buffalo wandered the plains of the west before humans hunted them. Their population (the stock of the resource) was stable. As Indians began to hunt the buffalo, they affected the population but clearly did not obliterate them. The population attained a new steady state. Fish stocks follow a similar process as does groundwater. These types of resources are of particular concern because quite often the stocks are not privately owned. Sometimes the resource is exploited by unfettered (unrestricted) common access. Other times, government regulates production, but only occasionally by means of fee-simple ownership\(^2\) to the resource.

A. Describe the relationship between the natural reproduction process and the harvest rate that is consistent with experience in the case of Indians and the buffalo.

B. Under what circumstances can common access drive the resource to extinction (as in the case of the passenger pigeon)\(^3\)?

C. What problems are created by a regulatory regime where government allocates production rights to the resource to many firms? Why do these kinds of regulatory regimes often embody technological restrictions? (For instance, only sailboats can be used to harvest oysters in the Maryland part of the Chesapeake Bay.)

D. What problems occur when government grants the production rights to the resource in one firm, but for a limited period of time? Are these problems more severe than those created by allowing multiple producers? If not, why do we not see more of this kind of regulation?

\(^2\) Fee-simple ownership means ownership that is complete and unencumbered by restrictions or covenants on use or sale. The owner can do anything he wants to with the property including selling it in whole or in part to another economic agent.

\(^3\) Passenger pigeons were migratory game birds that populated the United States in large numbers at the beginning of the twentieth century. They were slightly smaller that the common pigeons, which plague Sirrine Hall, and were quite tasty. Over hunting reduced their numbers to the point that the population began to fall (for reasons not entirely clear to scientists) and the last pigeon died in captivity at the St. Louis Zoo in 1954.
IV. Assume that you are the regional manager of three movie theaters in this area. You observe that the candy Red-Hots are uniquely sold during children's movies. You investigate further. A marketing expert associated with the Clemson Small Business Development Center tells you that children on average have discretionary control over 1 percent of their family's total earnings per child. Of the three theaters, two are located in cities with median family income of $20,000 per year, while the third is in a relatively rich area where income is $25,000. Once you find this out, you design the following experiment. In the first theater, you set the price of Red-Hots at $.50 while in the second and third theaters the price is set at $.75. As a result of this experiment, you discover a price elasticity of demand that equals -1.5 and an income elasticity of 1. Your next idea is to use these estimates to help price a large box of Red-Hots. The normal box is 2 oz. You are going to sell a 3 oz. box.

A. Derive the price effect associated with an ordinary linear demand curve using the estimate of the price elasticity given above. This is the demand curve that describes the behavior of an individual who consumes one 2 oz. box of candy. In other words, let the movement along this demand curve from a 2 oz. box to a 3 oz. box be represented as a change from one unit to 1.5 units.

B. Derive the income effect associated with a linear demand curve from the income elasticity estimate given above. You know that children that eat Red-Hots go to the movies about once a week.

C. Solve for the slope of the utility constant demand curve.

D. Using the slope of the utility constant demand curve, compute the maximum price that you can charge for the 3 oz. box of Red-Hots relative to a 2 oz. box priced at $.75.

E. Assume that the Red-Hots cost the theater nothing. (Assume that movie producers are giving them away to theater managers to promote their films.) Which size and what price maximize revenue?
V. You have developed a new camera that permits you to take photographs which may be stored on a floppy diskette. The diskettes may be inserted into the floppy drive of a personal computer and displayed on the screen. The camera has the technical characteristic that only one image can be stored on a diskette and that image cannot be copied to another medium.

The both the camera and the diskettes are patented. The camera is simple and can be produced at constant cost $C$. The diskettes also have a constant cost, call it $D$. Assume demand over the life of the camera by each individual for this new form of photo is given by $P = \$ - q$, where $q$ is the number of photos and $P$ is the price the consumer would be willing to pay for each photo.

A. Given you have a monopoly in both the camera and the diskettes, what price do you charge for the camera? What price for the diskettes.

B. What would happen if you lost your monopoly in the supply of the diskettes?

You develop software so that the photo images can be copied to the hard disk of a PC. This makes the photos more valuable to consumers. Indeed, demand for the photos stored in multiple form is given by $P = k - q$, where $k$ is greater than one. Each picture still requires one diskette, and the diskettes cannot be reused.

C. How much can you charge for the software that allows the images to be copied from the diskette to a PC?
A. Decide whether each of the following statements is true, false, or uncertain, and justify your answer.

(5) 1. In a world with no transaction costs, imposing a fee per unit of pollution emitted by a polluter will have no impact on the allocation of resources.

(5) 2. A competitive industry’s demand curve for labor is the horizontal sum of the marginal-revenue-product-of-labor curves of each firm in the industry.

(5) 3. Monopoly in one sector of an economy is inefficient both because it raises prices and lowers output in the monopolized sector and because it induces too much production in the competitive sectors of the economy.

(5) 4. The establishment of enterprise zones within a city, that is, areas in which firms are subject to lower tax rates, is likely to reduce the economic welfare of the residents of that zone.

(5) 5. If the futures price of corn did not equal the expected value of the price of corn at delivery, then there would be arbitrage opportunities available.

(5) 6. If a production function is homothetic, then it is also homogeneous.

B. Give clear, concise, answers to each of the following questions.

(5) 1. Until recently, the German steel industry was organized into a government-sponsored cartel, which was completely protected from foreign competition by prohibitive tariffs. Assume that the German steel firms sell some, but no all, of their steel on the (perfectly competitive) world market. If the German firms’ costs rise and they continue to sell some steel abroad, what will happen to the price of steel in Germany? Why?
(5) 2. Price elasticities of demand for gasoline are estimated from the following three data sets:

(a) time-series observations of consumption and local prices that fluctuate weekly between $1.00 and $1.20 due to a price war

(b) cross-section observations of consumption in which the price varies from $1.00 to $1.20 due to regional differences in gasoline taxes

(c) observations of consumption rates before and after a price increase from $1.00 to $1.20 due to foreign supply interruptions

What is the likely rank order of the absolute values of the estimated elasticities in the three samples?

(5) 3. Fred Mertz consumes Coors beer. His income is $60/day. If the price of Coors is $3 per six-pack he consumes five six-packs per day. The Coors company discovers what a lover of its beer he is and decides to make him the following offer: If he becomes the Coors “poster boy” they will give him $10/day. Unfortunately, he would have to move to Golden, Colorado, where the price of Coors is $5 per six-pack. What will happen to Fred’s Coors consumption if the accepts the offer? If he is still rational after all his beer consumption, will he accept the offer?

C. (15) Assume a consumer’s utility function is \( U = X^{0.5} Y^{0.5} \) and his income is $2.00. Units of X can be purchased for $0.25 each, but the price of Y is uncertain. There are two vendors—one charges $0.75 and the other $1.25—but the consumer does not know which one charges which price. The consumer can go to either vendor costlessly, except that he can only go to one of them. There are no quality differences in Y at either vendor.

1. Is this consumer risk averse?

2. What is it worth to this consumer to find out in advance what each vendor’s prices are?

3. The consumer would prefer to choose randomly between the two vendors than to pay the expected value of the price of Y ($1.00) with certainty. Show that this is true.

4. Is this result consistent with your answer to A? Explain fully.
D. (10) The following animal experiment has been conducted: A rat is placed in a cage that has the facility to dispense two flavors of soft drinks (A and B) to the rat based on its willingness to press one or the other lever above each drink dispenser. The rat is given an endowment of lever presses (that is, a maximum number of them after which the dispenser does not work) and confronted with prices of each drink in terms of the number of lever presses required to obtain a unit of the drink. The rat is allowed a period of trial and error to discover its endowment of lever presses and the prices it faces before its consumption choices are recorded. The data from this experiment are:

<table>
<thead>
<tr>
<th>Endowment (presses)</th>
<th>Prices (presses/fl.ounce)</th>
<th>Consumption Choices (fluid ounces)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>60</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>40</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>60</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Does this rat’s behavior satisfy the restrictions implied by demand theory? Explain.

E. (15) In almost every case, sexual harassment charges in the workplace are made by women against men. Currently, women who win sexual harassment cases in courts can receive back pay and legal costs. However, U.S. laws prohibit women from being awarded punitive damages (i.e., additional compensation paid to the victim to punish the offender). Assume that the law is changed so that punitive damages can be awarded. Predict the impact of such a change on:

1. the number of true incidents of sexual harassment
2. the number of sexual harassment cases
3. the number of women relative to the number of men employed, both per firm and in the aggregate
4. the wage rate of women relative to the wage rate of men

Also consider the optimal assignment of liability for punitive damages between the firm and the harasser.
1. (30) Bill Clinton has proposed a major investment in infrastructure. Analyze the impact of this proposal on private investment, total investment, short-run income, long-run income, short-run prices, and long-run prices. Consider three alternative financing mechanisms in your answer: (i) increased taxes, (ii) borrowing, no increase in money supply, and (iii) borrowing with accommodating monetary policy.

2. (20) Suppose that accidents to workers of a given skill are more likely in industry R than in S (For simplicity, you may assume that all accidents are non-fatal, and that no accidents occur in S).
   a. If workers are not compensated for any of their time lost or other costs to them of accidents (they bear the liability), what determines the wage rate in R compared to S if workers are fully informed and risk neutral?
   b. If strict liability were imposed on employers (that is, they were required to compensate workers for losses due to any on-the-job accidents, regardless of fault), what would be the level of wages in R relative to S if workers are risk neutral?
   c. If workers differ from each other in their attitudes toward risk, but are fully informed, is worker-liability or firm-liability the more efficient rule? Be sure to explain what you mean by efficiency.
   d. If workers have identical attitudes toward risk, but have different perceptions of the riskiness of industry R, which of the two liability rules is more efficient? Why?

3. (30) Consider the so-called Stone-Geary utility function:

   \[ U = (x_1 - y_1)^\alpha (x_2 - y_2)^\beta, \quad \alpha, \beta > 0. \]

   a. Derive the demand function for \( x_1 \).
   b. Show that the Engel curve for \( x_1 \) is linear.
   c. Show that the income elasticity of demand for \( x_1 \) is constant and equal to unity if and only if \( y_1 = 0 \).
   d. Give an intuitive interpretation of \( y_1 \).
4. (30) Suppose that a household has the utility function

\[ U = -\frac{1}{2}[(c_0 - \bar{c})^2 + \beta(c_t - \bar{c})^2] \]

where \( \beta \) is a discount factor for utility in the two periods, \( 0 < \beta < 1 \), \( c_t \) is consumption in period \( t \), and \( \bar{c} \) is constant. Suppose that the household’s budget constraint in the two periods is

\[ c_0 + a_t = (1+r)a_0 \]
\[ c_t = (1+r)a_t. \]

with \( a_t \) being assets acquired in period \( t-1 \) and carried over to a period \( t \) and \( r \) is the constant interest rate earned on assets. The initial level of assets, \( a_0 \), is given by past history.

a. Show the Lagrangean and first-order conditions for this constrained maximization problem.

b. Does this function satisfy conditions such that a maximum exists? For what parameter values?

c. Solve for the consumption functions: \( c_t \) a function of \( a_t \); and \( c_0 \) a function of \( a_0 \) (and not \( a_t \)).

d. Explain how similar analysis would be used to determine the optimal gestation period of a renewable resource.

5. (30) Dad has a son named Sonny. Sonny has a daddy named Dad. Dad’s utility function contains both his own consumption (D) and Sonny’s consumption (S). Assume that Dad may “freely” (i.e., one-for-one) transfer goods to his son, should he choose to do so.

I. As our story begins, Sonny is an infant (and so he has no earning power of his own).

a. If D and S are both goods for Dad, will he always choose to feed and clothe (i.e., transfer resources to) his son? Explain.

b. Suppose Dad’s preferences are such that he decides to feed and clothe Sonny. Now suppose that a stranger walks up and offers Dad a gift of either (i) jar of Sonny’s favorite baby food, or (ii) a can of Dad’s favorite beverage. Which gift will Dad choose? Explain.
II. Time passes. Sonny is now old enough to earn some spending money on his own, mowing neighbors’ lawns (using Dad’s lawnmower, of course).

a. Will Dad charge Sonny rent for the use of his lawnmower?

b. Suppose the conditions of Part I-b (above) are met. What will be the impact of Sonny’s earning power on the amount of money Dad spends on Sonny? Explain.

c. Would Dad’s behavior toward Sonny be different if the source of Sonny’s outside income was an inheritance from Aunt Matilda rather than lawnmowing? Explain.

d. Would your answer to part (c) be different if Dad cared about Sonny’s utility rather than Sonny’s consumption? Explain.

III. Government intervenes. It decides that parents in general are not doing enough to support their children in the style to which they are entitled, so it levies a tax on parents and gives the proceeds to children.


b. How will your answer to part (A) change as the size of the tax on Dad (and thus the transfer to Sonny) rises? Explain.

IV. Reality intrudes. People under the age of 18 are minors. As long as they reside at home, their parents get to decide what their consumption levels will be, even if the kids don’t like it. Generally, however, the law provides that some minimum level of consumption must be provided by the parent as long as the child resides at home.

a. Will Sonny ever run away from home? Explain.

b. Will Dad ever kick Sonny out of the house? Explain.

V. After you finish graduate school (if not sooner), Dad will one day stop sending you checks. Does this mean he no longer loves you?
6. (30) Agricultural policy-makers have devised schemes for reducing output with the goal of improving the welfare of farmers. One way to reduce output is by imposing a restriction on a single input as in the case of acreage restrictions which establish maximum acreages that farmers are permitted to plant to certain crops like corn or wheat; another is to impose a maximum quota on output as in the case of tobacco or peanuts.

   a. Show the farmer’s optimization strategy under each case.

   b. What are the welfare implications of the two schemes? Which do you prefer? Why?
PART I – Micro TFU: Decide whether each of the following statements is true, false, or uncertain, and justify your answer. Your grade will depend entirely on your justification. Choose any SIX out of ten.

1. Given the linearly homogeneous production function \( f(a,b) \), if the average product of \( a \) is increasing, and both factors are employed, the marginal product of \( b \) must be negative.

2. No firm would ever operate at a quantity where marginal cost is less than average cost.

3. It is impossible for a demand curve to have a constant elasticity throughout its entire price range.

4. If we know that (a) Florida orange growers are risk averse, (b) Florida supplies all the U.S. orange market (and there is no international trade in oranges), (c) the size of the crop grown by each and every grower varies significantly because of the weather, and (d) Florida orange growers sell futures before the size of the crop has been determined, then we can safely deduce that the demand for oranges is relatively inelastic.

5. If the marginal product of labor increases with the amount of capital that it works with, then we can expect industries with high capital-labor ratio to pay higher wages than those with a lower ratio.

6. If the ordinary demand curve for potatoes is linear, and if the marginal propensity to consume potatoes is constant, then the compensated demand curve for potatoes is linear.

7. If the marginal propensity to consume is constant, the income elasticity of demand is exactly unity.

8. Golf instructors of equal abilities must earn a higher hourly rate in a locale where the golf season is six months long than in a locale where golf can be taught year-around.

9. Diminishing marginal utility for all goods is a necessary and sufficient condition for diversification in consumption.

10. In order to raise wages in an industry, a labor union must reduce employment in that
industry.
PART II – Extended-answer problems: Choose ONE of two questions.

1. Suppose the demand curve for housing is \( p = 1 - x \) and the available supply is \( x^o \). The price is controlled below its equilibrium level. Assume that the available supply is rationed out randomly among those who demand it at the going price. Show that, if price control were abolished,

   (a) consumers as a group would be worse off.

   (b) there would be a potential Pareto improvement.

2. The following are some crude statistics on U.S. growth:

<table>
<thead>
<tr>
<th>Period</th>
<th>Output</th>
<th>Land &amp; Capital</th>
<th>Labor</th>
<th>Labor’s Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>1800 to</td>
<td>4.00</td>
<td>4.00</td>
<td>3.30</td>
<td>.55</td>
</tr>
<tr>
<td>1905</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1905 to</td>
<td>3.20</td>
<td>2.20</td>
<td>0.71</td>
<td>.55</td>
</tr>
<tr>
<td>1967</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   (a) How much of the growth in output per worker was due to increases in the amount of capital and land per unit of labor in each period?

   (b) To what would you attribute the differences between periods in the growth of output per worker:

   (c) To what would you attribute the constancy of labor’s share of national income between the two periods?
PART III -- More extended questions: Choose ONE of two questions.

1. Suppose a person has a utility function

\[ U = y + 2T^{1/2}, \]

where \( T \) is units of leisure and \( y \) is real consumption.

(a) Derive this person’s labor supply function.

(b) What is the minimum wage at which she is willing to work at all?

(c) How will her supply of work time respond to a small cut in a flat percentage income tax?

(d) Suppose she wins a large bet on the Virginia-Clemson football game. What will be the effect on her supply of work time?

2. An isolated country bank has a demand curve for loans equal to

\[ r_L = 16 - 0.625L, \]

and faces a supply curve of deposits equal to

\[ r_D = 2 + 0.5D, \]

where \( r_L \) and \( r_D \) are the interest rates paid on loans and deposits respectively, and \( L \) and \( D \) are loans and deposits, respectively, in millions of dollars. Both \( r_L \) and \( r_D \) are in units of hundreds of basis points, so that, e.g., the maximum interest rate that would be paid on loans is 17%. Also, 20% of deposits must be deposited with the Federal Reserve at zero interest. All the net proceeds of deposits (after Reserve requirements) are available for lending.

(a) What will be the interest rates paid on loans and deposits?

(b) What will be the amount of loans and the amount of deposits?

Now suppose that a new financial instrument, a Treasury Bill, is available and pays a rate of interest of 12%. The bank cannot affect the Bill rate.

(c) What are now the answers to questions (a) and (b)?

(d) What quantity of Bills will the bank buy?

(e) Explain in words why the bank might buy Bills even if the interest rate on loans were higher. (There may be more than one reason. Give as many as you can justify economically.)
MICROECONOMIC THEORY

1. A fellow economist has presented you with the following estimates:

<table>
<thead>
<tr>
<th></th>
<th>Natural Gas</th>
<th>Electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own price</td>
<td>-1.95</td>
<td>-0.67</td>
</tr>
<tr>
<td>Income</td>
<td>1.65</td>
<td>0.01</td>
</tr>
<tr>
<td>Cross-Price</td>
<td>-0.23</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Setting aside considerations of the statistical significance of the estimated parameters, evaluate their consistency with economic theory. In particular:

a. Are the estimates consistent with the Slutsky equation?

b. Is it reasonable that natural gas is apparently a complement for electricity while electricity is apparently a substitute for natural gas?

c. If natural gas and electricity were the only goods in the world, would the cross-price elasticities for each demand function be consistent with the own-price elasticities?

d. Since electricity and natural gas are not the only goods in the world, is there any indication about how much natural gas consumption is affected by prices other than the price of electricity? Is there any indication of the extent to which electricity consumption is affected by prices other than the price of natural gas?

e. Is there any indication about how much the consumption of goods other than natural gas and electricity is affected by changes in the price of electricity? Does the price of natural gas or electricity more strongly affect the consumption of everything else? (Assume that electricity accounts for about 2% of consumer spending and natural gas accounts for about 0.5%).
2. Decide whether each of the following statements is true, false, or uncertain, and justify your answer. Your score will depend entirely on your justification.

a. If each of the firms in a competitive industry operates under conditions of constant returns to scale in production, the long-run supply curve for the industry is perfectly elastic.

b. A perfectly competitive firm is less likely to discriminate against women or minorities in its hiring and promotion practices than is a monopolist.

c. Imagine that there is a very large university located in a town with a comparatively small permanent (i.e., non-student) population. If the non-faculty employees of this university formed a union and successfully bargained for higher wages, the long-run result would be higher tuition charges and lower salaries for professors.

d. Whales are a renewable natural resource, whereas coal is not (i.e., for all practical purposes, the total amount of coal on the planet is fixed). Therefore environmental activists should spend less time trying to “save the whales” and more time trying to “save the coal.”

3. Answer each of the next two sub-questions concisely but thoroughly.

a. Suppose you have a telephone credit card. When you make a call using that card, the price of the call is higher than if you had dialed directly from your home. There is no operator involved in either case; the telephone company’s computer tracks your call. Why are the rates different between direct-dialed calls and credit-card calls?

b. As you know, last August when Iraq invaded Kuwait, a large contingent of American troops was shipped to the Persian Gulf. Analysts quickly computed the cost of the so-called Operation Desert Shield by summing the wages paid to the soldiers with the costs of shipping the people and equipment. Estimates of the cost were said to be as high as $5 million per day. Evaluate this line of reasoning in the context of economic theory.

4. It is proposed that the government require all businesses to provide fringe benefits for their employees. One proposal is that the government require all employers to provide $1,000 worth of health insurance annually to each employee. A second proposal is that the fringe benefit should be a $20 bottle of whiskey given to each employee every Friday after work for 50 weeks each year. The two proposals have drawn complaints that include: (1) that the extra burden will drive some businesses out of existence and reduce employment in others, (2) that businesses will pass the burden on to consumers and thus increase inflation, and (3) that the added fringe benefit will lower wages. Give your analysis of the probable results of each of the two proposals. Be thorough.
There are seven questions in this exam. Answer all of them. Allocate your time wisely. If you get stumped on a question, go to the next one.

1. Suppose the U.S. imports all its oil and that the demand curve for oil in the U.S. is

\[ P = 100 - .5Q \]

where \( P \) denotes price and \( Q \) denotes quantity. Further, the oil producing countries’ aggregate marginal cost curve for producing oil is

\[ MC = Q. \]

(a) What are the competitive price and quantity of oil? At these values, what are the price elasticities of demand and supply for oil?

(b) A cartel is formed among the exporters. Bases on the U.S. demand function for oil and their marginal cost function for producing oil, the cartel chooses the wealth maximizing output of oil, and signs a contract in perpetuity to continue supplying this quantity of oil to the U.S., forever. What is that output and the resulting price of oil?

(c) What is the amount that the U.S. loses because of the cartel and what is the amount that the cartel owners gain? Show graphically and calculate numerically.

(d) Assume the cartel is in place and supplying the monopoly quantity. Now an economics professor at Clemson makes the seemingly outrageous suggestion that the U.S. levy a $25.00 per barrel tax on oil imports. Show the effects of the tax. (Do so both graphically and quantitatively.)

(e) Based on your analysis in (d), does the loss the U.S. suffers because of the cartel increase or decrease as a result of the tax? Would you change the amount of the tax?

2. Within this century, product liability has changed from "caveat emptor," let the buyer beware, to "caveat venditor," let the seller beware. Analyze the allocative and distributional consequences of such a dramatic shift. Make sure any assumptions you make for this analysis are explicit.
3. There is a law on the books in the City of Clemson which states that no more than three unrelated persons may occupy a rental unit (e.g. an apartment). This law has long been unenforced, so that many rental units are currently occupied by four (or more) unrelated persons (e.g., students). The City currently intends to begin enforcing this law beginning September 1, 1991.

(a) Analyze all of the allocative and distributional implications of the enforcement of this law. Be sure to reveal the economic analysis by which you derive the effects (rather than merely stating the effects), showing the relevant demand and supply curves. Your answer will depend in part on both the correctness and completeness of the implications which you are able to derive.

(b) Would owners of existing rental units always oppose the enforcement of this law? Would they ever oppose it? Explain.

4. Suppose you live in a world called New Hampshire. You consume two goods, housing (H) and all other goods (A). Assume that you supply labor completely inelastically, so that your budget constraint is \( rH + A = M \), where \( r \) is the unit price of housing, \( M \) is your earned income, and the price of all other goods is normalized to unity.

Transaction costs in New Hampshire are zero, and housing is a perfectly divisible good. Assume that your tastes for housing and all other goods are constant now and forever more, implying that you have purchased the house in which you reside with only the thought of consuming the flow of housing services in mind; thus houses are not purchased to serve as a store of value, etc.

While out for a walk one day, you discover a bottle in which a genie resides. He offers to grant you one wish, but says you must choose between three options:

(1) He will go back into the bottle and leave you alone to live as you were living before you found the bottle; or

(2) He will cause an earthquake that will destroy half of the houses in New Hampshire; your house will be one of the houses that is left completely undamaged; or

(3) He will create a gold discovery in Alaska that will induce half of the residents of New Hampshire to move away; however, you will not be allowed to leave to participate in the gold rush.

Which wish do you want the genie to grant? Explain your answer carefully and completely.
5. During the early part of this century a prominent English lord spent a month each winter vacationing on a small island in the Mediterranean. He paid for his expenses on the island with checks drawn on his London bank. So great was the impression of his Lordship on the local inhabitants that instead of cashing the checks, they held onto them and began using them as a medium of exchange (money).

(a) Who bears the cost of his Lordship’s vacation? Explain; be precise and make your assumptions explicit.

(b) Analyze the effects of his Lordship’s visits on the level of GNP and the rate of interest on the island.

(c) What would you expect to happen to prices on the island when his Lordship arrived each year? Explain.

(d) Would you expect the timing of these price changes to differ when the inhabitants of the island came to expect his visits? Explain.

(e) Would you expect the impact of his Lordship to be different if he gave the checks to the inhabitants as gifts, rather than using them to purchase goods and services? Explain.

6. Suppose that a household has the utility function

\[ U = \frac{1}{2} \left[ (c_0 - \bar{c})^2 + \beta (c_t - \bar{c})^2 \right] \]

where \( \beta \) is a discount factor for utility in the two periods, \( 0 < \beta < 1 \), \( c_t \) is consumption in period \( t \), and, and \( \bar{c} \) is a constant. Suppose that the household’s budget constraint in the two periods is

\[ c_0 + a_t = (1 + r) a_0 \]

\[ c_t = (1 + r) a_t \]

with \( a_t \) being assets acquired in period \( t-1 \) and carried over to period \( t \) and \( r \) is the constant interest rate earned on assets. The initial level of assets, \( a_0 \), is given by past history.

a. Show the Lagrangian and first-order conditions for maximizing (1) subject to (2).

b. Does this function satisfy conditions such that a maximum exists? For what parameter values?

c. Solve for the consumption functions: \( c_t \) a function of \( a_t \) and \( c_0 \) a function of \( a_0 \) (and not of \( a_t \)).
ECONOMIC THEORY PRELIM
FALL 1990

There are two sections to this exam. The first section, micro theory, contains five questions. You must answer the first two and then any two of the remaining three. There are two questions in the macro section. You must answer both. Good luck!

MICRO

1. Evaluate the following statements true, false, or uncertain and explain.

(a) Food and clothing are the only two goods. Joe spends 25 percent of his income on food. The income elasticity of demand for food is 1.0 and the price elasticity is -1.0. Therefore the cross-elasticity of demand for food is zero.

(b) Because their jobs are so repulsive, garbage collectors earn less than college professors.

(c) If one tank can inflict as much damage on an enemy as 100 soldiers, a rational military strategist should use one tank for every 100 soldiers?

(d) An increase in the employer portion of the Social Security tax will have more effect on employment of labor the greater is the elasticity of substitution of capital for labor.

(e) An increase in the employer portion of the Social Security tax will cause the use of capital to rise.

(f) Surgeon A saves 80% of his patients; surgeon B saves only 40%. Therefore Surgeon A’s fee will be twice Surgeon B’s.
2. Consider a competitive industry with free entry. The industry is composed of identical firms with U-shaped long-run average total cost curves. Initially we are in long-run equilibrium. Assume factor prices are constant.

A large annual fixed license fee is suddenly imposed on all firms.

(a) How does the long-run equilibrium number of firms change? How does the long-run equilibrium price of the product change?

(b) How does the level of output of each producer change in the short run? Long run?

3. Suppose a good is very income elastic. Is it likely to be price elastic or inelastic or is it impossible to determine? Suppose a good is very price elastic. Is it likely to be income elastic or not, or again, is it impossible to determine?

4. It has been estimated that the U.S. is spending about $100 million per day on the military buildup in Saudi Arabia. This includes salaries for soldiers as well as maintenance on planes, tanks, and arms. It also includes expenditures for food and the like. Some people argue that this is too much money to spend because the price of gas could never increase enough to warrant that much expenditure. Evaluate this argument in the economic terms of opportunity cost.

5. Intel produces the microprocessors for personal computers. The top end of the market is currently satisfied by a processor called 386. Intel markets two different chips – the regular 386 and the 386SX. The SX is just a slower version and is priced a good deal less.

(a) Assuming that production costs are identical for both chips, explain why INTEL sells the 386SX more cheaply.

(b) If production cost falls by 10%, explain what would happen to the relative prices of the regular 386 and 386SX chips.
ANSWER ALL QUESTIONS

1. Suppose an individual has incomes of $100 in period one and $150 in period two. His utility function is:

   \[ U = \log C(1) + \log C(2) \]

   where \( U \) = utility
   \( C(1) \) = consumption in period 1
   \( C(2) \) = consumption in period 2

   What will he consume in the two periods if the interest rate is 20 percent? How much will he borrow in period one and repay in period two? What is the present value of his income? What is the present value of his consumption? What rate of interest would cause him to borrow and lend nothing?

2. Why are equilibrium wages for the same work higher in New York City than in Clemson? How does this apparent violation of the Law of One Price persist?

3. When an industry’s output expands, most of the increase in output comes from firms that were already in the industry before the expansion occurred. What can we deduce about the shapes and heights of long-run marginal cost curves for firms already in the industry and for prospective and actual new entrants?

4. Suppose you have just obtained the results of the 1990 Census of Population and have estimated the parameters of the following model of consumption using income and consumption data for 50,000 households in the United States during March 1990:

   \[ C(i) = a + b \ Y(i) \]

   where \( C(i) \) represents consumption expenditures by household i, \( Y(i) \) represents the income of household i, and a and b are estimated parameters. How would you expect your estimates of a and b obtained from these data to differ, if at all, from those you would obtain from a sample of observations of aggregate consumption and income for each year from 1948 to 1990? Explain your answer.
5. Assume that today the West German money stock is one billion W-marks and that the East German money stock is one billion E-marks. Assume also that it is known that in six months the two currencies will be freely convertible at a fixed rate of exchange to be announced in three months. Finally, suppose that in six months all trade barriers between the two countries are certain to be eliminated (perhaps because the two countries will be fully united by then).

a. Derive an expression for the W-mark price of the E-mark that is consistent with price-level stability in both East and West Germany.

b. Describe in detail the real and nominal consequences likely to occur after the official exchange rate is announced, but before the two economies are unified, if the official rate is different from the one you derived in part (a).

6. Risk neutral investors face two sets of choices. They must decide whether to participate in a project. They must also decide whether to become informed about the project. That is, an investor is asked to fund a venture. He can simply say “Sure, how much do you want?”, or he can examine the prospectus, etc., and then decline or accept the proposal. Let the proposal carry a fixed price P. Assume that the investor knows the distribution of project outcomes, which can be described by any well behaved probability density of your choice (like normal, for instance).

a. Without being concerned about information, what is the decision making criterion for participating in the project?

b. How does participation vary with the variance (or standard deviation) of the distribution of outcomes?

Now introduce information. Assume that the investor can acquire information about the project. For a fee C the investor can determine the exact value of the outcome of the project.

c. What determines whether the investor buys information?

d. Will the investor ever participate without buying information?

e. Given that the investor buys information, what determines whether the investor on average participates in the project? That is, what is the likelihood that the investor will participate given that he has purchased information?

f. How does the investor’s purchase of information vary with the variance of the distribution of project outcomes?
1. If the Federal Reserve were to purchase a large quantity of U.S. Treasury securities on the open market, what would be the initial effects on short-term interest rates, long-term interest rates, and the stock of money? What would be the long-term effects on interest rates, real output, and the aggregate price level? State your assumptions and justify your answers fully.

2. True, false, or uncertain and explain:
   a. The Phillips Curve will be steeper in high-inflation economies than in low-inflation economies.
   b. According to the natural-rate/rational-expectations theory of output and inflation, deviations of output from its natural rate will always be serially uncorrelated.

3. Suppose there are two ways of crossing the River City River: a bridge and a ferry. Suppose further that ferry rides are competitively priced, the ferry boats are produced by a competitive industry and the ferry operator hires workers in a competitive labor market. Finally, assume that for every 25 cent increase in the toll charged to cross the bridge, an extra ferry boat will be added to the ferry operation.
   a. Give an operational definition of traffic congestion as it relates to this bridge. Under what circumstances, if any, would the ferry be congested?
   b. What conditions are satisfied by the optimal bridge toll?
   c. If there is never any traffic congestion on the bridge, how would you estimate the social cost of charging a $1 toll to cross the bridge.

4. Many people (including some Congressmen) have argued that the recent spate of “takeovers” (in which one firm buys another firm) is harmful to the long-run growth of the United States. Their reasoning is that the growth in real income would be increased if these firms undertook productive investments in new assets rather than simply buying existing assets. Evaluate this reasoning.
5. The state of North Carolina raised its gasoline tax from $0.15 to $0.20 per gallon, effective August 1, 1989, making it the second-highest state gas tax in the country.


   b. Raleigh, N.C. is located near the geographical center of the state; Charlotte, N.C. is located near the South Carolina border. What impact would you expect the tax to have on the prices of gasoline in Raleigh, compared to the prices in Charlotte? Explain.

   c. Compare the impact of the higher tax on the consumption of regular unleaded gasoline with its effect on the consumption of premium unleaded gasoline. Explain.

   d. Predict the effect on the sales of gasoline in N.C. during August 1989, and compare to August 1988.

   e. Make the same type of prediction regarding December 1989 sales and December 1988 sales, and then compare your August-to-August prediction with your December-to-December prediction.

6. A monopolist sells its output in two separable markets, with revenue functions \( R_1(q_1) \) and \( R_2(q_2) \), respectively. Total cost is a function of total output, i.e., \( q = q_1 + q_2 \) so \( C = C(q) \).

   a. Derive the rule for profit maximization. Under what circumstances will the seller charge the same price in both markets?

   b. Suppose that the government imposes a per-unit tax. What effect will this have on the quantity sold in each market?

   c. What is the revenue maximizing rule for the taxing authority?
You have four (4) hours. Answer all questions.

1. Consider the problem of consumer behavior involving work and leisure. Let the utility function be expressed as $U = U(M,L)$, where $M$ is income, $L$ is leisure. The relationship between $M$ and $L$ is $M = E + (24 - L)W$, where $E$ is an initial endowment and $W$ is the wage rate.

   a. Demonstrate that the wage rate is the price of leisure. Evaluate the Slutsky condition; what constraint on consumer behavior is implied?

   b. Some business school graduates go on for an MBA, some do not. Assume that they are all of equal ability and tastes for work, and that the tuition cost of the MBA is paid for by each student. What predictions can we make about the behavior of those who do not go on for an MBA compared to those who do?

2. Many hundreds of regressions have been run of earnings on years of schooling, age and a grab bag of household characteristics like parents’ schooling, parents’ income, etc. A dummy variable for females in these regressions invariably indicates that women receive substantially lower earnings than men. This “wage gap” is widely attributed to the effects of discrimination against women.

   a. Several attempts have been made in the literature to explain this gap in terms of explanations that involve no discrimination. Summarize some of these alternative explanations or develop some of your own.

   b. It is not obvious that prejudice by male workers against female workers will produce a wage gap. Explain why a standard competitive model of discrimination fails to account for the wage gap.

   c. What assumptions are necessary for competitive markets to result in underpayment of women? Explain.
3. a. As income rises, the amount of a good, X, that an individual is willing to give up for another good, Y, falls holding the amount of Y consumed constant. In what case(s) is this statement true?

b. The utility held constant demand curve is everywhere more elastic than the income held constant demand curve. In what case(s) is this statement true?

c. Define and discuss the differences between the following concepts of cost.
   (1) Fixed cost
   (2) Sunk cost
   (3) Variable cost
   (4) Opportunity cost
   (5) Costs of non-salvageable investment.

4. Suppose the U.S. has a supply curve of widgets (in the relevant range):

\[ S = 10P - 50 \]

where S is quantity supplied and P is the price of widgets. Suppose next that the world supply of widgets to the U.S. is completely elastic at a price of $10. Finally the demand curve for widgets is

\[ P = 35 - W/4 \]

where W is the quantity of widgets purchased. (Again this holds only in the relevant range.) What will be the quantity of widgets purchased in the U.S., what will be the price, and what will be the amount exported or imported.

NOTE: FOR THIS QUESTION THE WIDGET INDUSTRY IS SMALL IN THE U.S. ECONOMY.

Now suppose there is a large improvement in foreign productivity due to Japanese education, Korean hard work, etc. As a consequence the supply curve to the U.S. now falls to $7.50, again completely elastic. Calculate the new price in the U.S., the quantity purchased, the amount produced in the U.S., and the quantity exported or imported. Calculate the loss to the U.S. economy due to this decline in competitiveness.

Finally explain in a qualitative way how your answers would change if the widget industry were a large part of the U.S. economy.

5. True, false or uncertain:
Under the natural rate hypothesis, if the variance of the price level is relatively large, producers will respond to an increase in the price level with a relatively large increase in output.

6. True, false or uncertain:
Permanent real shocks result in a greater change in both real and nominal variables in the aggregate economy than temporary real shocks if individuals are forward looking maximizers.
with rational expectations.
Comprehensive Examination  
Economic Theory  
October 21, 1988

YOU HAVE FOUR (4) HOURS TO ANSWER FOUR (4) QUESTIONS

PART I: Answer BOTH of the following questions.

1. The theory of consumer behavior admits a paradoxical result concerning substitutes and complements: Good A can be a substitute for good B while at the same time good B is a complement to good A. What are some of the conditions under which this is possible? For instance, is it likely that tennis shoes are a complement to tennis balls, but tennis balls are a substitute for tennis shoes?

2. Suppose a price searcher wants to price discriminate. He has two groups of customers, A and B. A has a demand curve given by \( P = 100 - 2X \), where \( P \) is price and \( X \) is output. B has a demand given by \( P = 80 - X \). The firm has zero marginal costs.
   a. What will the prices be if the firm can separate the market?
   b. What will the prices be if the firm cannot prevent resale of the product?
   c. What will the prices be if the only thing that prevents resale is a $10 per unit transaction cost?

PART II: Answer TWO of the following questions

3. True, false, or uncertain? Explain your responses briefly. (Note: No historical knowledge of what actually happened to interest rates etc., is necessary; you are being asked to make predictions based on economic theory.)
   a. When the atomic bomb exploded over Hiroshima in August, 1945, interest rates in Japan rose.
   b. When the atomic bomb exploded over Hiroshima, short term interest rates in the U.S. fell relative to long term interest rates in the U.S.
   c. If a new development in bio-genetics makes South Carolina trees (and only South Carolina trees) grow faster at each point in their lifetimes, South Carolina trees will be harvested sooner.
   d. If a student passes his Ph.D. prelims, his response will be to increase his net borrowing.
   e. When gold was discovered in California in 1849, interest rates in California fell relative
4. True, false, or uncertain?

   a. If the rate of inflation is 15% per period and the rate of money growth is 10% per period, then one-third of the inflation rate during the period is attributable to nonmonetary factors such as real output shocks.

   b. If the volume of commercial bank lending is an increasing function of the rate of interest, then the nominal money stock will be positively correlated with nominal GNP even in the absence of any influence of open-market operations on aggregate demand.

   c. If expectations are formed “rationally” in the sense of Muth, then deviations of real GNP from its trend must be serially uncorrelated.

   d. The Purchasing Power Parity Theory of exchange rate determination implies that the relative value of any two currencies is determined solely by the ratio of the money supplied of the two countries in question.

   e. In order for the Quantity Theory of Money to hold exactly, an economy’s “LM curve” must be vertical.

5. The October 10, 1988 issue of Fortune reports that Senator Ernest F. Hollins (D-S.C.) travels around the country carrying two identical shirts, one made in Taiwan, the other in the U.S. Both shirts sell at retail for $18.

   In trying to drum up support for additional restrictions on apparel imports from Taiwan, the Senator argues that, since U.S. firms are able to produce the same quality at the same retail price, added import restrictions would not drive up apparel prices in the U.S.

   a. Evaluate the Senator’s economic reasoning and his conclusion.

   The Senator also argues that added import restrictions on apparel and textiles would “save American jobs.”

   b. Again, evaluate the Senator’s economic reasoning and his conclusion. In doing so, you may wish to distinguish between

      (1) employment in the textile/apparel industry
      (2) employment in other industries, and
      (3) employment in the economy as a whole.

      (Assume for simplicity that the governments of other nations would not “retaliate” with their own new import restrictions.)
The same *Fortune* article also reports that the delivered *wholesale* price of the Taiwanese-made shirts is lower than the delivered *wholesale* price of U.S.-made shirts, even though both have the same *retail* price.

c. How can you explain the existence of two different wholesale prices for shirts of the same quality that sell at the same retail price?

(1) Assume initially that current import restrictions are in fact binding.

(2) At least one member of this committee has asserted that, even if current import restrictions were *not* binding, the same general pattern (i.e. lower wholesale prices of Taiwanese-made shirts that sell at the same retail price as U.S. shirts) would be observed. Is he right? Explain.
You must answer questions 1 and 2.

1. Suppose that there are three goods, X, Y, and Z. If X and Y are substitutes and Y and Z are substitutes, does it necessarily follow that X and Z are substitutes? Suppose on the other hand that X and Y are complements and Y and Z are complements. Does it necessarily follow that X and Z are complements?

2. Answer the following with TRUE, FALSE, or UNCERTAIN and give a brief explanation.

   (a) The optimum quantity of money is that which leads to a declining price level at a rate equal to the real rate of interest.

   (b) When the rate of inflation declines the economy is stimulated because consumers have increased purchasing power.

   (c) According to the Ricardian equivalence theorem an increase in Social Security benefits will induce people to save more by an exactly equal amount.

   (d) The rational expectations explanation of business fluctuations takes into account uncertainty as well as risk.
Answer either question 3 or question 4.

3. Most distinguished scientists agree that the world’s most pressing social problem is overpopulation. Economists on the other hand tend to think of social problems arising in the context of externalities.

To consider a simple formulation of this problem imagine a one product economy where the item is produced according to a linear and homogeneous production function in the two factors, land and labor. You and your spouse have an average amount of land and an average number of children, namely two. Your children will inherit your land as well as enter the labor force. There is a free market in both land and labor.

What will happen to the income of your children if

(a) other people now decide to have more than two children?

(b) other people continue to have two children?

(c) other people now decide to have less than two children?

Explain and illustrate diagrammatically. What external effects arise?

4. In the ancient land of Nod (east of Eden) there were two industries. Fish were caught in a large internal lake according to the production funtion: \[ F = 1.5L_F - \frac{L_F^2}{800} \]. Sandals were produced according to the production function \[ S = L_S \] where \( F, S, L_F, \) and \( L_S \) are fish, sandals, labor in fish, and labor in sandals, respectively. Nod is “small” so that prices are exogenous.

There were no property rights to the lake so that labor could move freely at no charge between the two industries.

(a) Initially fish and sandals are measured in units such that their prices are both unity. What is the allocation of labor between fish and sandals? What is the national income using sandals as the unit of account or money.

(b) If the demands for fish and sandals in Nod follow from the common utility function: \[ U = S^6 F^2 \], which product is exported and which is imported? Show your derivation.

(c) The answer to (b) will reveal that fish are exported and sandals are imported. (You can do the following even if you did not arrive at this.) The demand for fish rises so that the world price is now $1.25 per fish. (Nod is small in world markets so that all prices are fixed outside of Nod.) What is the new allocation of labor? How has the real national income changed? Why?
Answer either question 5 or question 6.

5. (a) Harry Belafonte (the singer) has a record on which he sings Christmas songs. The lyrics of one are (in part)
   “There was room at the inn for the merchants that day
   But Joseph and Mary had no place to stay.”
   Why do you suppose this was true?

   (b) In a similar vein, consider restaurant meals. In better restaurants it is generally accepted (1) that at lunch one can get more (quantity or quality) for the same money than at dinner, and (2) that while it is clearly known that demand is higher on a Saturday than, say on a Thursday, the prices for dinner are the same. Why do you suppose this is true?

6. When gasoline prices rose sharply during the late 1970s, many full-service gas stations converted to self-service (i.e., they stopped pumping gas for the customers and stopped checking their oil or washing their windshields). Since then, gasoline prices have declined and some stations have returned to being full service. Can you explain this move to self-service in response to higher gas prices and return to full-service as gas prices fell?
Answer either question 7 or 8.

7. Microeconomics tells us that higher rates of interest will initially induce an individual to save more, but that eventually an individual will save less in response to higher interest rates. Yet macroeconomics tells us that the aggregate supply curve can safely be treated as upward sloping whatever the interest rate might be.

(a) On what grounds does microeconomics tell us this? Explain.

(b) Is it possible for individual saving schedules to be backward bending at the same time that the aggregate saving schedule is positively sloped throughout? Explain why or why not.

8. The aggregate supply curve is usually drawn as being upward sloping. Does this positive slope imply that people work harder and capital is used more intensively when the price of all goods and services rises? Explain.
Comprehensive Examination in Economic Theory
October 5, 1987

Instructions: You must answer questions 1 through 2. In addition, you must answer either question 3 or question 4, either question 5 or question 6, and either question 7 or question 8. Thus, there are 5 questions to be answered. You have four hours to complete the examination. Allocate your time so that you can adequately respond to each question.

Required Questions:

1. Does money matter? Discuss and defend your position.
2. Suppose your firm has the opportunity to purchase either of two drug stores. One is the only drug store in a small town and the building inspector there has guaranteed that no additional drug stores will be permitted. The second is a drug store in a large city where there are hundreds of competitors. Is the purchase of the monopoly store the better decision?

Answer Either Question 3 or Question 4:

3. When some people go out to eat, they spend a lot of time. They ponder the menu, they converse a lot, in general, they spend a long time in the restaurant. By contrast, others are in a hurry. They seldom order drinks or appetizers, and they do not talk a lot. Can you explain this phenomenon?
4. Throughout Europe banks and stores convert currencies from one to another. Most of these establishments post the prices of various currencies in terms of the local currency outside the establishment. Rates change frequently. For example, in June, 1987, in Venice, Italy, one store devoted exclusively to currency conversion offered to sell 1280 Lire for 1 $US during the day (10am-5pm) when other change stores and banks were open and in competition. However, when the other change stores and banks closed during the evening this particular change store increased the price of lire to 1240 per 1 $US. A similar phenomenon existed in Interlaken, Switzerland. There a commercial bank offered to sell 1.48 Swiss Francs for 1 $US during regular business hours, but when other banks closed, this bank (Credit Suisse) kept one window open for currency exchange purposes only, and it increased the price of francs, only offering 1.42 for 1 US dollar. In both cases, a similar phenomenon exists for other currencies; during the evening hours a purchaser of the local currency gets less money than a purchaser during the daytime. Why do these currency exchange establishments change the price of converting into the local currency during the evening hours?

Answer Either Question 5 or Question 6:

5. Suppose there is a monopolist who practices market segmentation price discrimination in two markets where both markets have linear demand. If a factor price increase causes marginal cost to increase will output price rise more in the elastic or the inelastic market?
6. If a firm has two plants, one of which has diminishing marginal cost of production, it will always pay to concentrate production of a given volume of output in that one plant. True or false? Discuss.
Answer Either Question 7 or Question 8:

7. Discuss “A fundamental problem in the formulation of the rational expectations hypothesis is the absence of any compelling specification of the relevant economic theory” and the objective probability distribution of outcomes.

8. a. Explain the different effects on interest rates of an increase in money supply growth. What do you think is the most likely scenario for interest rate movements when money growth increases?
   b. Which would you rather be holding if there is a rise in interest rates: long-term or short-term bonds? Explain.
You must answer questions 1 through 3. In addition, you must answer either question 4 or question 5, either question 6 or question 7, and either question 8 or question 9. Thus there are 6 questions to be answered. You have four hours to complete the examination. Allocate your time so that you can adequately respond to each question.

Required Questions:

1. Let a consumer’s income equal $1000. The price of food is $10 per unit and the price of other goods is $1 per unit. Initially, consumption is 40 units of food and 600 units of other goods.

   (a) Compare the initial consumption bundle with the one where the consumer is given a 30 unit food subsidy.

   (b) If the consumer is taxed $300 and given a 30 unit food subsidy, what consumption bundle will he choose?

   (c) What are the implications if the consumer is given a 50 unit food subsidy? If the consumer is given a 50 unit food subsidy and is taxed $500?

2. An economy satisfies all the conditions for Pareto optimality except for one producer who is a monopolist in the market for her output and a monopsonist in the market for the single input that she uses to produce her output. Her production function is \( Q = .5X \), the demand function for her output is \( P = 100 -4Q \), and the supply function for her input is \( R = 2 + 2X \).

   (a) Find the values that maximize the producer’s profit.

   (b) Find the values that satisfy Pareto optimality conditions.

   (c) Is case b really Pareto optimal if she is not permitted to exercise her market power?

   (d) Under what theoretical criteria could you move toward a welfare maximum given that your starting point is the monopoly-monopsony case?
3. The recession of October 1981 to December 1982 was the most severe recession the U.S. had experienced since the 1930’s. As evidence of this, unemployment reached 10.7 percent in December 1982.

Consider the following characteristics of the economic environment during this period:

i. The full-employment budget showed sizeable deficits during this period.

ii. Money supply growth rates were not generally considered contractionary, with M1 averaging a 5% rate and M2 averaging 9%.

iii. Consumption expenditures slightly increased, government expenditures were unchanged, investment expenditures and net exports fell significantly.

iv. Inflation fell from 10% in 1981 to 4% in 1982. Despite this, nominal interest rates did not fall significantly and the real rate of interest was generally greater than 10%.

Given this information, answer the following questions:

(a) What were the principal causes of this recession?

(b) Why do you think interest rates were high? Relate your reasoning to an IS-LM analysis of the economy.

(c) What policy recommendations would you make at the end of 1982?

Answer Either Question 4 or Question:

4. Discuss how the monetary authority, the general public, and the banking system interact to create money.

5. Explain three ways in which the U.S. government obtains real revenue through inflation of money and prices. (Assume a progressive income tax.)
Answer Either Question 6 or Question 7:

6. Greenville, like many other cities, provides incentives to encourage business firms to locate their operations within the city. It is argued that as firms move in, average wages will go up and unemployment will go down as new jobs are created. Is the argument correct? Answer for both the short run and the long run. In the long run, who will benefit from a firm’s decision to move to Greenville?

7. The new tax law will cause the following changes:

   (a) Marginal tax rates will decline. (For example, an individual with a taxable income of $10,000 will pay 15% in taxes under the new tax law. The individual would have paid 25% in taxes under the old tax law.)

   (b) Taxable income will increase for many taxpayers because of the decrease in the items deductible from income. (For example, the costs incurred by owners of rental property must be spread over more years, thereby increasing the taxable income of landlords.)

   Would you expect the new tax law to cause rent (on houses, apartments, etc.) to increase or decrease? Explain.

Answer Either Question 8 or Question 9:

8. “The elasticity of demand for a factor of production will increase as that factor’s share of total production increases.” True, False, or Uncertain. Explain.

9. “If the elasticity of substitution between capital and labor exceeds 1, then a rise in wages will cause the share of income going to labor to rise.” True, False, or Uncertain. Explain.
You must answer questions 1 through 3. In addition, you must answer either question 4 or question 5, either question 6 or question 7, and two of the three questions 8 through 10. Thus, there are 7 questions to be answered. You have four hours to complete the examination. Allocate your time so that you can adequately respond to each question.

Required Questions:

1. A production function which assumes a given amount of capital (say 100 acres of land and assorted equipment) and which shows the effects on output (say bushels of corn) which result from increasing the amount of labor can be divided into 3 “stages” (or “phases”). Describe the stages of production and explain where a rational producer would operate in terms of both physical production and cost.

2. Briefly outline the models and contrast the views of Keynesians, Friedman style monetarists, and Rational Expectations theorists.

3. Suppose a government decides to raise $100 million through a per-unit tax system. There are only two goods in the economy, x and y. The demand functions for x and y are, respectively, $P_x = 100 - .0001x$ and $P_y = 80 - .0002y$. The supply functions of x and y are $P_x = .0003x$ and $P_y = .0002y$.

   How should the government tax these industries so as to minimize welfare losses? (Be sure to discuss the concept.)

   In what way is this solution “second-best” in nature?
Answer either question 4 or question 5:

4. According to an equation of Irving Fisher, \( r_m = r + p \) where \( r_m \) is the monetary rate of interest, \( r \) the real rate of interest, and \( p \) the anticipated proportionate rate of price inflation. (There should also be an \( rp \) term, which is normally of negligible magnitude.)

   A. An equation of somewhat similar appearance, supposed to apply to any asset, is due to Keynes:

   \[
a + q - c + f = i
   \]

   where \( a \) is the expected rate of price appreciation of the asset, \( q \) its marginal yield, \( c \) its marginal “carrying cost” (exclusive of interest cost), \( f \) its “liquidity premium” –all these being defined in proportionate terms, of course. And \( i \) is the current “effective rate of interest.”

   Treating Fisher’s equation as a special case of Keynes’, indicate how the terms correspond to those used by Keynes. (Hint: which is the asset being held?)

   B. In times of continuing hyperinflation, it has been observed that at first the rate of price inflation lags behind the rate of money expansion, but eventually the former catches up and even comes to exceed the latter. This is usually interpreted in terms of expectations about future inflation. Explain. What behavior of \( r_m \) would you expect in the course of a hyperinflation?

5. It is commonly stated that deficits can be financed in three ways: taxation, money creation, and borrowing.

   A. It might be maintained that money creation is only a slightly disguised form of taxation.

      1. Explain this position, and comment.

      2. Indicate where the burden of this form of “tax” falls. You may want to distinguish between the cases in which the consequences of the money creation are, and are not, correctly anticipated.

   B. It might also be maintained that borrowing to finance a deficit is also not ultimately distinguishable from taxation.

      1. Explain this position, and comment.

      2. Indicate where the burden of this form of “tax” falls. Again, you may want to distinguish between situations in which the consequences of the borrowing are, and are not, correctly anticipated.
Answer either question 6 or question 7:

6. Assume that the state of North Carolina imposes a tax on the sale of electricity. Duke Power sells electricity in North and South Carolina. Will Duke Power sell more or less power in South Carolina as a result of the tax on its North Carolina sales (assuming that the public service commission in South Carolina does nothing to affect Duke’s behavior)? How will Duke Power’s response in North Carolina be affected by a rule that stops Duke from selling either more or less in South Carolina?

7. Suppose city government enacts the following tax package to protect existing downtown merchants. All new retail establishments must pay an annual license fee of $F/year. The proceeds will be used to pay for garbage collection for retail merchants. Retail merchants currently pay for their own garbage removal through a user fee system. What will happen to the price and quantity of retail goods in the long and short run when this plan is enacted? Will there be more, less, or the same number of retailers after the plan is enacted?

Answer two of the following three questions:

8. Real income has increased throughout the western world during the twentieth century. At the same time, the average number of children per family has declined. Are children therefore an inferior good? Why or why not?

9. The volunteer army has been criticized on the grounds that it is excessively costly and, because of the proportion of minorities represented, unfair. Comment.

10. At any given price, the demand curve of a rich person is apt to be less elastic than that of a poor person for the same good. True or false. Explain.

1 Not necessarily because bundled service price discriminates against shoppers who only buy a few things. If this price discrimination is covering fixed costs, it may be efficient in a Ramsey sense.

2 Rate of return on buying or selling?

3 If resources are efficiently priced, parents pay for this increased scarcity.

4 Edgeworth box.

5 $bP_1 + cP_2 = eP_1 + gP_2 = 0$; $e = c$; cross-price effects for good three are zero; income elasticity for good three greater than 1 and $= -$ price elasticity. Tax the good with smaller intercept because marginal change in DWL with respect to price equals the intercept.

6 Benefits are less gun crime. Costs are less gun fun. Empirically, measure expenditures on gun fun and compare to costs of gun crime.