DIRECTIONS

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6. The points for each question are listed. There are 160 total points and you will have 90 minutes. This means that if you budget approximately one minute for every two points, you will have 10 minutes to check your work at the end.

7. Show your work to get partial credit. If you cannot solve a problem using equations you can get partial credit for answering with a graph.

8. Please note that on part I you do not have to answer all the questions
I. SHORT ANSWER (30 points, 10 per question -- 15 MINUTES).
Indicate whether the underlined statement is true, false or uncertain. Please give a single word answer, followed by a concise explanation. Your grade depends on your explanation.

ANSWER ANY 3 OF THE FOLLOWING.

A. The Justice department has gathered data on a product which is produced by only one firm to determine whether this firm has market power. The data indicates that the supply and demand for this product are very cross-price and own-price inelastic. The firm claims that it’s product is simply a small part of a larger market. The Justice Department should not believe this firm.

B. Airlines are in a competitive market and as many people want to fly at the current price as the airlines are willing to provide seats. An erratic Billionaire unexpectedly buys many new airplanes from Boeing and starts Goofus Airlines, expanding airline capacity by 15%. If demand is fixed in the short-run, this leads to a surplus of seats.

C. If marginal cost is rising then average cost is also rising.

D. A risk averse worker choosing between a job which pays $1000 per week versus a job which pays $750 per week with a 50% probability and $1400 per week with a 50% probability will prefer the safe job paying $1000.

E. The cost of running an El train is $300. Each train can carry 500 people and the market price is $1.50. At rush hour, when the trains are full, the average cost per rider is $0.60. During off-peak hours, however, ridership falls to 100 people and the average cost is $3.00. The city should discourage riders from riding at night because the costs are so much higher.

II. SHORT ANSWER (20 points, 10 per question--10 MINUTES).
Give a brief answer to each of the following questions

A. A recent letter to the editor at a newspaper said that most people leave a tip for the waiter or waitress at a restaurant but do not leave one for the bus boy. If everyone began leaving and additional tip for the bus boy, what would eventually happen in the markets for bus boys and waiter/waitresses?

B. Why is it so hard to find a bathroom while shopping on Michigan Avenue?
Question III: Quantitative Problem (40 points total -- 20 MINUTES)

Consider the market for Cheese Doodles (Q is in bags). The demand for Doodles is

$$Q_D = 30 - P$$

And the supply of Doodles is

$$Q_S = 3P - 10.$$  

A. (5 points) What is the equilibrium P and Q?

B. (10 points) The government decides it needs money for Cheese awareness classes in major business schools and to pay for them it imposes a tax of $4 per bag on Cheese Doodles. What is the new equilibrium Q? What is the price the buyer pays and the price the supplier receives?

C. (10 points) What is the DWL & revenue from this tax.

D. (15 points) The government decides that cheese is still not liked by enough people so it wants to expand the Cheese awareness classes to high school and college. To do so it raises the tax $8 more per bag (to $12 total). What is the additional DWL and revenue from increasing taxes by this amount (i.e., beyond what resulted from the $4 tax)?

Question IV: Qualitative Problem (30 points total -- 15 MINUTES)

The fishermen off the New England coast have, in the last two months, been faced with depressed whitefish prices because “super” trawler ships which have triple the capacity of existing fishing boats have been flooding the market with substitute types of fish. In response, suppose the U.S. government decides to prop up whitefish prices by setting a price floor--no whitefish can sell for less than $4 per pound--and this floor exceeds the current equilibrium price.

A. (5 points) What happens in the market for whitefish (P and Q) as a result of this law?

B. (10 points) Show the change in the welfare of fishermen (producer surplus) after this law takes effect.

C. (5 points) Would society have been any better off to give the fishermen the amount of money in B) and not have a price floor? Why or why not?

D. (10 points) Under what supply and demand conditions would the price floor actually make the fishermen worse off than they were before the law?
Question V: Quantitative Problem (40 points total--20 MINUTES)

You operate a start-up telecommunications company and your opportunity cost is 10%. You are evaluating your investment choices and you face the following dilemma.

You are deciding whether to build a plant to produce new internet phones. The plant will cost either

a) $2m if you build it in 1997 (year zero) or

b) $3.3m if you build it in 1998.

Various things are happening as you make your decision, however.

1) At the end of 1997 (after spending the $2m if you build today but before spending the $3.3m if you build next year), you find out if the government will outlaw your phone system. This has a 50% chance of happening and will mean that you earn nothing.

2) At the end of 1998 (after spending the $3.3m if you wait until 1998), you will find out if your phone is the best in the market, in which case you earn $4.84m in 1999 or is not the best, in which case you earn $2.42m in 1999. The chance of being the best is 3/4 and of being not the best is 1/4.

A. (5 points) What is the NPV of building the plant today?

B. (10 points) Would it be better to wait until next year and then decide whether or not to invest in 1998?

C. (10 points) What is the most you would be willing to pay for information about the outcome of the government ruling if you could get it in 1997 before deciding about spending the $2m?

D. (15 points) Say the information offered in part C) actually costs .25m. How much is the option worth to you of waiting until 1999 and finding out whether or not you have the best phone assuming that building the plant in 1999 would cost $3.63m?
I True/False/Uncertain -- Worth 30 points

A. TRUE. If the supply and demand are very cross- and own-price inelastic this means that if the firm raises prices, there is little decrease in the quantity demanded and little increase in the quantity supplied by other firms. This firm likely has market power.

B. FALSE. If demand is fixed (vertical demand curve), an increase in supply will lead to lower prices. Prices will fall so that the quantity supplied and the quantity demanded are equal and there will be no shortage. It will move from point 1 to point 2.

C. FALSE/UNCERTAIN. If marginal cost is rising but still less than average variable cost, average cost will not be rising. If you have an average of 90 and your next 3 test scores go from 80 to 82 to 85, your marginal is rising but your average is still coming down.

D. UNCERTAIN. The expected value of the one job is \( \frac{1}{2} \times 750 + \frac{1}{2} \times 1400 = 1075 \) while the safe job pays 1000. What determines whether the worker will take the risky job is how risk averse they are.

E. FALSE. The costs listed are average costs. What matters for the firm is marginal cost. The marginal of additional riders at night is zero because the trains are empty therefore with a price of $1.50 and a MC of nothing, they should encourage ridership.

II SHORT ANSWER -- Worth 20 Points

A. If everyone began leaving a tip for the busboy, this is an increase in the wage. Since there are no barriers to entry, eventually, many more people will begin signing up to be busboys and as the supply expands, the wage will fall until finally the equilibrium wage
plus tip has returned back to its normal, ‘zero profit’ level. If being a waiter is a substitute occupation for busboys, restaurants will have to pay waiters more to prevent them from becoming busboys in the short-run but, again, wages will eventually come back to normal levels.

B. Public bathrooms increase the utility of society but not the individual store which pays for their upkeep--an externality. As for any other positive externality, the competitive market under-provides bathrooms from a societal point of view. To get around this problem, stores must either be the sole beneficiary of their bathrooms such as charging a fee for using the bathroom to cover marginal cost or putting up a sign which says bathrooms are for our customers only.

III Quantitative Problem -- worth 40 Points

A. Set \( Q_S = Q_D \) or \( 30 - P = 3P - 10 \)
   Then \( P = 10 \) and \( Q = 20 \)

B. With a tax of 4, we know that \( P_B = P_S + 4 \) and setting supply = demand means

   \[
   \begin{align*}
   30 - P_B &= 3P_S - 10 \\
   30 - (P_S + 4) &= 3P_S - 10 \\
   P_S &= 9 \text{ and } P_B = 13 \\
   \text{At these prices, } Q &= 17
   \end{align*}
   \]

C. The revenue is rectangle DEHI = \( tQ = 4\times17 = 68 \)
   The DWL is a triangle AB = \( 1/2*(Q_2 - Q_1)*(P_B - P_S) = .5*(20-17)*(13-9)=6 \)

D. With the new tax of 12, \( P_B = P_S + 12 \) and setting supply = demand means

   \[
   \begin{align*}
   30 - P_B &= 3P_S - 10 \\
   30 - (P_S + 12) &= 3P_S - 10 \\
   P_S &= 7 \text{ and } P_B = 19 \\
   \text{At these prices, } Q &= 11
   \end{align*}
   \]

   The revenue is rectangle GHIJ = \( tQ = 12\times11 = 132 \)
   The DWL is the triangle ABCDEF = \( 1/2*(Q_2 - Q_1)*(P_B - P_S) = .5*(9)*(12) = 54 \)

   Therefore the incremental revenue is \( = (132-68)=64 \)
   and the incremental DWL is \( CDEF = (54-6) = 48 \)
IV. Qualitative Problem -- worth 30 Points

If they put in a price floor the market looks like this:

A. At the price floor of \( p_2 = \$4 \) per pound, the quantity supplied is \( Q_3 \) and the quantity demanded is only \( Q_2 \). The difference (\( Q_3 - Q_2 \)) is a surplus. The price rises to \$4 (P2) and the quantity sold is \( Q_2 \).

B. Producer surplus before the law was the triangle CDF. After the law, the producer surplus is area BCD. The change in fishermen’s welfare is therefore \( B - F \).

C. Society receives a combined ABCDEF before the regulation and a combined ABCD after the regulation. Since the fisherman only gain \( B - F \), if somehow society could simply give them \( B - F \) without changing the price and creating the DWL E and F, it would be better off.

D. The fishermen would be worse off if \( B - F < 0 \) which will happen under circumstances where the supply is relatively inelastic and the demand is relatively elastic.

V. Quantitative Problem -- worth 40 Points

The basic setup is
A.  The NPV of investing in year zero is
   \[= -2 + .5 \times 0 + .5 \times (0.75 \times \frac{4.84}{1.1^2} + 0.25 \times \frac{2.42}{1.1^2})\]
   \[= -2 + 0.5 \times (3 + 0.5) = -2 + 1.75 = -0.25\]

B.  NPV of waiting one year and then investing only if good news is
   \[= 0.5 \times 0 + 0.5 \times (-0.33/1.1 + 0.75 \times \frac{4.84}{1.1^2} + 0.25 \times \frac{2.42}{1.1^2})\]
   \[= 0.5 \times (-0.3 + 0.5) = 0.25\]
   The difference between this and next best option (an NPV of 0) is the value of waiting = 0.25. Therefore it would be better to wait one year.

C.  If you could have the information about the first level of uncertainty in year 1, and choose not to invest if it’s bad news then the NPV is
   \[= 0.5 \times 0 + 0.5 \times (-2 + 0.75 \times \frac{4.84}{1.1^2} + 0.25 \times \frac{2.42}{1.1^2})\]
   \[= 0.5 \times (-2 + 3 + 0.5) = 0.75\]
   The difference between this NPV and best alternative (waiting 1 year) is 0.5
   Therefore the most you would be willing to pay for info is 0.5

D.  If the info in part C. costs 0.25, then the total NPV of buying the info and then investing if the information is good news is the NPV in C minus the 0.25 cost of information which has a total NPV = 0.5

The value of waiting all the way to 1999 and then investing only if you get good news about the government regulation and good news about whether you have the best product is

\[NPV = 0.5 \times 0 + 0.5 \times 0.25 \times (-3.63/1.1^2) + 0.75 \times (4.84/1.1^2)\]
\[= 0.5 \times 0.75 \times [0.3 + 4] = 0.375\]
As this is lower than the total NPV of option C with costly information (it had an
NPV of .5), you would pay nothing for this option.
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I. **SHORT ANSWER (40 points, 10 per question -- 20 MINUTES).**
Indicate whether the underlined statement is true, false or uncertain followed by a concise explanation. Your grade depends entirely on your explanation.

**ANSWER ANY 3 OF THE FOLLOWING.**

A. **Consumer surplus falls when price rises.**

B. **Suppose there is a fixed supply of cattle in the short run. Scientific warnings about mad cow disease cuts the demand for beef in half. This creates a surplus of beef.**

C. **Until deregulation, airfare regulations in the United States kept prices significantly above the competitive level (marginal cost). It is still possible that prior to deregulation, airlines made no economic profit.**

D. **In a competitive market with inelastic demand, a firm which raises its price will increase its total revenue.**

E. **A bookstore operator decides that it will cost $300,000 to buy a building and $200,000 in merchandise costs to open a store in Lincoln Park. He estimates the store will yield $600,000 in benefit. After spending $300,000 on the building and merchandise, Borders opens a large store in the same area. The operator’s estimate of the store’s benefit falls to $250,000 (from the original $600k). The owner should abandon his plans for opening the bookstore.**

II. **SHORT ANSWER (20 points, 10 per question--10 MINUTES).**
Give a brief answer to each of the following questions

A. **A business school student is trying to decide between taking a summer job which pays $20,000 and starting a mail-order business which has a 2/3 chance of losing $15,000 but a 1/3 chance of earning $99,000. Under what conditions would a business school student would take the summer job over the mail order business and why?**
B. The Clinton administration has come under criticism for not fighting hard enough against drugs. As evidence, Ted Koppel on *Nightline* pointed out that the street price of cocaine is down by more than 25% since Clinton took office--making it easier for kids to buy it. Are we losing the war on drugs?

**III. QUANTITATIVE PROBLEM (30 points total -- 15 MINUTES)**

Consider the market for milk where supply and demand (in gallons) for milk is (P is in dollars per gallon):

\[ Q_s = 60P - 40 \]
\[ Q_d = 200 - 20P \]

A. (5 points) What is the equilibrium P and Q?

The government decides that milk is good food. To encourage milk consumption, the government gives a subsidy to consumers of $4 per gallon purchased.

B. (10 points) What is the price the buyer pays and the price the supplier receives after the government subsidy and the quantity of milk consumed?

C. (5 points) What is the consumer surplus after the subsidy?

D. (10 points) What is the Dead Weight Loss of this subsidy?

**IV. QUANTITATIVE PROBLEM (25 points total -- 12.5 MINUTES)**

Boeing is deciding whether to build a new airplane, the 797. Developing the plane will cost $1.75 billion today. The firm's opportunity cost is 10% and they have to make the decision today. Their arch-enemy, Airbus, is also thinking about a new plane, the A600.

A. (5 points) With a 50% chance, the 797 will be superior to the A600 and so it will generate $500 million of profit per year forever, starting next year. With a 50% chance, though, it will be inferior and will generate only $100 million per year, forever. What is the NPV of the plane?
B. (10 points) Boeing enters into a negotiation with the noted rocket scientist, Trokfxx Xzfkorx, Ph.D. They believe that if they can hire Dr. Xzfkorx, it will increase the probability of having a superior plane to $\frac{3}{4}$. What is the most they would be willing to pay Dr. X?

C. (10 points) If Boeing’s opportunity cost rises to 20%, what is the most they would pay Dr. X to work on the 797?
V. **QUANTITATIVE PROBLEM (15 points total -- 7.5 minutes)**

A firm has the following costs at various levels of output:

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A. (10 points) IN YOUR BLUE BOOK, complete the table.

B. (5 points) What would output and total profit be for this firm if the competitive market price were 50.

VI. **QUALITATIVE PROBLEM (30 points total--15 MINUTES)**

Banff is the oldest and most popular national park in Canada and the government rents land in it for limited commercial development. Recently UNESCO warned the Canadian government that the park would lose its listing as a World Heritage Site if proposed residential development within the park did not cease. Canada’s Heritage Minister, Sheila Copps, responded last week by setting a quota on new developments so that no more than 10,000 people will be allowed to move into Banff.

A. (5 points) On a graph, indicate what will happen to the quantity of residents and the rental price of Banff land after the regulation and what happens to consumer surplus.

B. (5 points) If Ms. Copps is acting rationally on behalf of Canada by putting in this regulation, how much must the World Heritage Site listing for Banff be worth to Canadians?

C. (10 points) Would it have been better for Canada to leave the number of new residents unrestricted but instead tax the new residents until the quantity fell to 10,000 (i.e., the same quantity as with the quantity regulation)? Why or why not?
D. (10 points) How would it change the answers to B) and C) if the 10,000 potential new residents of Banff were all American retirees (not Canadians)?

ANSWERS

**BUSINESS 300 : MICROECONOMICS**

Graduate School of Business  
University of Chicago

Prof. Austan Goolsbee  
Mid-Term Answers  
Fall 1996

I True/False/Uncertain -- Worth 30 points

a. FALSE/UNCERTAIN. It depends on why price rises. If price rises because demand goes up, price rises but consumer surplus rises, too.

b. FALSE. If supply is fixed (vertical supply curve), a decrease in demand will lead to lower prices. Prices will fall so that the quantity supplied and the quantity demanded are equal and there will be no shortage. It will move from point 1 to point 2.

C. TRUE. If the firms had large fixed costs, they could make no profit even if they charge \( P > MC \).

D. FALSE. In a competitive market, firms are price takers so the industry demand curve doesn’t matter. Raising prices will cause the firm to lose all its business.

E. TRUE/UNCERTAIN. The bookstore owner is clearly going to lose money with the Borders moving in. This should lead him to shut down. The fact that he has spent $300,000 does NOT make it a sunk cost. It is only a sunk cost if he cannot sell the building or the merchandise to someone else. He should only continue to operate if he cannot find a buyer for the building.
II SHORT ANSWER -- Worth 20 Points

A. The expected value of the Mail-order company is \( 2/3(-15) + 1/3(99) \) or $23k. The safe job pays $20k. The student would have to be a) risk-averse since risk-neutral or risk-loving would take the higher expected value job and b) the risk premium must be greater than $3000. Just risk averse is not enough. [You could draw this in a risk-aversion picture as we did in class but it was not necessary].

B. This is the classic identification problem. The fact that prices are lower may mean that supply has not been reduced but may also mean that demand has fallen. Without a measure of quantity, there is no way to know if we are losing the war on drugs.

III Quantitative Problem -- 30 Points

A. Set \( Q_S = Q_D \): \( 60P - 40 = 200 - 20P \) and \( P = \frac{240}{80} = 3 \)

plugging back in, \( Q = 60(3) - 40 = 140 \).

B. With a subsidy of $4/gallon, \( P_B = P_S - 4 \)

Now set \( Q_S = Q_D \)

\( 60P_S - 40 = 200 - 20P_B \)

\( 60P_S - 40 = 200 - 20(P_S - 4) \)

\( P_S = \frac{320}{80} = 4 \)

\( P_B = P_S - 4 = 0 \)

\( Q = 60*4 - 40 = 200 \)

C. Consumer surplus is the area below the demand curve and above the buyers’ price. The zero price for demand is 10 so the consumer surplus is the area of 1+2+3+4 which is \( \frac{1}{2}*(200)*(10-0) = 1000 \)

D. The Dead-Weight Loss is the area that the government has to pay which does not increase the consumer or producer surplus. This is area 6+7. The sum of the two
triangles is \( \frac{1}{2} \cdot (4-3) \cdot (200-140) + \frac{1}{2} \cdot (3-0) \cdot (200-140) = \frac{1}{2} \cdot 4 \cdot 60 = 120 \)

IV Quantitative Problem--25 points

A. The NPV = \(-1.75 + \frac{1}{2} \cdot \frac{.5}{.1} + \frac{1}{2} \cdot \frac{.1}{.1}\) = \(-1.75 + 3 = 1.25\)

B. The NPV with Dr. X is \(-1.75 + 3/4 \cdot \frac{.5}{.1} + 1/4 \cdot \frac{.1}{.1}\) = \(-1.75 + 4 = 2.25\)

so it would be worth it to pay up to the difference--2.25 - 1.25 = 1

C. If Boeing's opportunity cost were 20%, then the NPV without Dr. X would be

- \(-1.75 + \frac{1}{2} \cdot \frac{.5}{.2} + \frac{1}{2} \cdot \frac{.1}{.2}\) = -.25 and the NPV with Dr. X would be

- \(-1.75 + 3/4 \cdot \frac{.5}{.2} + 1/4 \cdot \frac{.1}{.2}\) = .25.

Since Boeing always has the option to not invest, the amount they would pay is not the difference between .25 and -.25 but rather the difference between .25 and 0--the most they would pay is .25.
V. Quantitative Problem--15 points

A) 

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B) If the price is 50, the firm will produce where P=MC--making 5 units of output. The Total revenue = 5*50 = 250 and the TC at q=5 is also 250 so profit = 0.

VI. Qualitative Problem--30 points

A. In the graph above, putting in a supply quota shifts the supply curve from S1 to S2 as no more than 10,000 people can move in. Quantity falls from Q1 to 10,000 and price rises from P1 to P2. Consumer surplus falls from A+B+E to A.

B. If she is acting rationally on behalf of Canada, the benefits of the listing must exceed E+F. E+F is the DWL generated by this regulation--the amount that society (Canada) loses by putting in place the regulation so the benefit must be greater than the cost.

C. If Canada put in a tax of an amount per unit equal to the length of the line from point 2 to point 3, this would reduce the quantity to 10,000 just as the quota did. Consumer surplus would still be A and DWL would still be E+F. The only difference would be that B+C would not be producer surplus. It would instead be government revenue. So long as the producers are Canadian, using a tax vs. a regulation has no impact on the total
benefit for Canada.

D. If the consumers were all Americans, then in B), Canada loses F in DWL but gains B in revenue or PS from the Americans so the listing must be worth F - B (can be negative meaning the regulation benefits Canada even without the listing). For C), there is no change in the answer. Either way--tax or regulation--Canada still receives B+C+D.