SUID:

Peter J. Wilcoxen
PPA 723, Managerial Economics

Department of Public Administration
The Maxwell School, Syracuse University

Final Exam
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DO NOT OPEN THIS EXAM UNTIL YOU ARE TOLD TO DO SO.

Instructions

1. Write your SUID in the box in upper right corner of this exam. Do NOT write your name.

2. SHOW ALL YOUR WORK. Answers without supporting work will receive little or no credit.

3. There are 120 points possible on this exam and Question 5 is worth twice as much as the other four. *Be sure to budget your time accordingly.*

4. Several questions provide blank tables you can use to organize your calculations. Be sure to label the columns clearly and *show the equation for the column in the bottom row of the table.*

5. The tables many have more rows and columns than you actually need.

6. Do all your work on the exam. If you need extra space, write on the backs of the pages. However, if you do write an answer on the back of a page, *be sure you've noted that near the question.*

7. A hint about handling fractional exponents: if $X^{0.4} = Y$ then $X = Y^{1/0.4}$.

8. Some helpful PV formulas:

$$(1)\ \frac{B}{(1+i)^t} \qquad\qquad (2)\ \frac{B}{i}$$

9. Some helpful factors in case your calculator can't handle exponents:

t	1	5	10	15	20	25	30	35	40
(1.05)^t	1.0500	1.2763	1.6289	2.0789	2.6533	3.3864	4.3219	5.5160	7.0400

Question 1 (20 points)

An organization wants to produce 20 units of output at the lowest possible cost. It had the following production function: $Q = K^{(1/2)} L^{(1/2)}$. The price of capital is $50 and the price of labor is $32.

How much capital and labor should it use? What will be its average cost per unit of output at this set of inputs? You may assume that the organization can buy fractional amounts of labor. As a hint to reduce the number of calculations you'll need to do, the amount of capital is between 14 and 20 inclusive.

EQUATION									

Question 2 (20 points)

A non-profit organization provides legal advice for low income people. Its costs that can be summarized by the equation: $TC = 100 + 4*Q^2$ (note that Q is squared) where Q is the number of people it assists. The demand for its service is given by $P = 390 – 5*Q$ and it has no competitors (no other organizations serve its population of potential clients).

The organization wishes to help the maximum number of clients it can without running a deficit. What should it charge and how many clients will it serve? As a hint, the value of Q is between 40 and 50, inclusive.

EQUATION									

Question 3 (20 points)

A competitive profit-maximizing firm has a production function given by $Q = 3*K + L^{1/2}$ (note that only L is raised to the ½ power). The price of capital is $15 and the price of labor is $22. The firm currently has 4 units of capital, which it cannot change right away. The market price of its output is $220.

(a) Find the firm's profit-maximizing choice of L and Q. As a hint, the value of Q is between 15 and 20, inclusive.

EQUATION									

Question 3, continued

(b) How much profit does the firm earn? If the industry is composed of many firms with identical production functions and capital stocks, would the market produce the efficient amount of output in the short run? Explain how you know. Describe (but do not calculate) what will happen in the market in the long run.

Question 4 (20 points)

A pharmaceutical company has developed and patented a new drug that might be useful for treating a particular type of cancer. Before it could sell the drug, however, it would have to conduct an expensive series of tests to make sure the drug is safe and effective. In deciding whether to proceed with testing it has the following information:

- If testing is successful, the annual demand for the drug will be given by P = 1255 – 2*Q
- Testing will cost $600,000, which must be paid immediately;
- There is a 20% chance that testing will be successful;
- If testing is successful, the firm can sell the drug, otherwise, it gets nothing;
- If the firm sells the drug, the patent will allow it to be a monopolist for 20 years (years 1 to 20);
- The patent expires after year 20 and the market (if testing has been done) will then become competitive;
- The cost of manufacturing the drug is $25 per dose;
- The interest rate is 5%.

(a) If testing is successful, what price should the firm charge and how much of the drug should it produce each year? What profits will it earn? (You may assume that the firm's goal is to maximize profits.) As a hint, the quantity will be between 305 and 315.

EQUATION									

Question 4, continued

(b) Show that a risk-neutral firm will choose *not* to test or produce the drug. Explain your result. *Note: BE SURE TO SHOW ALL YOUR WORK! Since the answer is given you will be graded ONLY on your analytical approach.*

Question 5 (40 points)

Now let's examine the drug from Question 5 from a different perspective. Suppose the original firm has given all rights to the drug to an anti-cancer NGO. The NGO has $600,000 on hand and is now considering whether or not to conduct the test. If the test is successful (same cost and probability of success as before), the NGO will allow *any* firm to manufacture the drug without paying any sort of license fee and the market will move to the competitive outcome in year 1. If the NGO decides not to buy the test, it will give the $600,000 out as cash grants to current cancer patients. Either way, it is going to pay out $600,000; the question is which policy produces the greatest benefits.

(a) If the test succeeds, what quantity would be produced in the market? You may assume that all firms have constant returns to scale and can produce the drug for an average and marginal cost of $25. *Explain in words how you know your answer is correct.*

(b) What consumer and producer surplus would be generated by the market each year?

Question 5, continued

(c) Now step back and consider the NGO's decision. Should it pay for the test? Explain. *As part of your explanation, be sure to indicate how much larger the benefits are from the NGO's best action compared to the other possible policy (that is, calculate the difference).* You may assume that the NGO is risk neutral. You should also assume that paying out the $600,000 as cash grants will generate exactly $600,000 of benefits.

Question 5, continued

(d) Questions 4 and 5 together illustrate the key policy issues associated with pharmaceuticals. Discuss your results for the two questions with emphasis on efficiency. Here are some key points to consider:

- In the absence of the NGO, is the private firm's decision not to conduct the test efficient? *Explain.*
- If the private firm had gone ahead with the test anyway, and the test had been successful, would it have produced the efficient amount of output during its 20 year patent period? *Explain.*
- How would changing the length of the patent period affect the decision: would a *longer* period make the firm more or less likely to conduct the test? What about a *shorter* patent period? *Why?*
- What general lessons can you draw about efficiency in the pharmaceutical industry?