SUID:

Peter J. Wilcoxen
PPA 723, Managerial Economics

Department of Public Administration
The Maxwell School, Syracuse University

Exam 3
Fall 2007

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

Instructions

1. Write your SUID in the 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 on the exam. 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. Where applicable, show the equation for the column in the bottom row of the table.

5. The tables may have more rows or columns than you 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 $X^{1/4} = Y$ then $X = Y^4$.

8. Some helpful PV formulas:

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

Question 1 (40 points)

A city is considering a $100 million upgrade to its water supply system. The upgrade would reduce maintenance costs associated with the current system and would provide capacity for potential future population growth. The reduced maintenance costs would produce a present value benefit of $20 million. The additional capacity would produce an additional present value benefit of $140 million on top of the maintenance benefits, but only if the city actually grows. At the moment, the chance of the city growing is believed to be 40%.

(a) Please draw an appropriate decision tree and calculate the expected value of the upgrade. Assuming the government is risk neutral, should it proceed with the upgrade? Why?

Question 1, continued.

A consultant could be hired for $1 million to conduct a detailed analysis of the city's prospects for future growth. However, the consultant's ability to predict the city's future is known to be imperfect. When the city will actually grow, the consultant will always detect that and report it. Unfortunately, consultants tend to report what their clients want to hear. There is a 40% chance the consultant will be overly optimistic and report that the city will grow when in fact the population will remain the same.

(b) Please compute the *expected value of hiring the consultant*. Should the city hire the consultant? Explain.

Question 2 (20 points)

An organization wants to produce 100 units of output at the lowest possible cost. It has the following production function: $Q = K^{0.75} L^{0.25}$. The price of capital is $200 and the price of labor is $100.

(a) How much capital and labor should it use? What will be its average cost per unit of output at this set of inputs (in dollars and cents)? 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 105 and 115 inclusive.

EQUATION									

Question 3 (20 points)

A philanthropist wishes to help low income homeowners renegotiate their mortgages. The cost of providing the service is given by TC = \$100*Q, where Q is the number of clients. Demand for the service among homeowners is known to be given by P = \$205 - \$1*Q. In addition, the philanthropist is willing to provide a grant of \$15,000 to help support the operation. You may assume that no other firms or organizations serve this market.

(a) The organization wishes to serve as many clients as possible without running a deficit (after taking the grant into account). What should it charge and how many clients should it expect to serve? How much profit will it earn? As a hint, the value of Q is between 180 and 190, inclusive.

EQUATION									

Question 4 (40 points)

A biotech company is considering a research program that might lead to a breakthrough in the production of ethanol from cellulose (essentially allowing vehicle fuels to be produced from wood chips and other plant wastes). If the research program is successful, the firm will be able to patent the process and license it to other firms. Demand for licenses in each year would be given by P = \$35 – \$2*Q where P is measured in millions of dollars (e.g., P=35 means \$35 million). Assuming (for now) that the research project is successful, producing the licenses could be done at zero cost (TC=MC=0).

(a) What price would a profit-maximizing firm charge for licenses during the patent period? What Q would it issue each year? What profits will it earn? As a hint, the quantity will be between 5 and 15.

EQUATION									

Question 4, continued.

Now add the time dimension. The patent would allow the firm to be a monopolist for 20 years (years 1 to 20; the firm doesn't license the process in year 0). After year 20, the patent expires and anyone will be able to use the process for free. The interest rate is 5%.

(b) Assuming the research program succeeds, what is the present value of the stream of profits that would be generated by process?

Question 4, continued.

(c) Please calculate the present value of all consumer surplus generated by the project (both during and after the patent period).

Question 4, continued.

Finally, now consider the research project itself. It will cost $500 million and there is only a 15% chance the process will work. The cost would be paid in period 0 and you may assume that the results would be known immediately.

(d) Please calculate the expected value to the company of developing the process and the expected consumer surplus it would produce. Explain whether or not a risk-neutral firm would undertake it. Is this efficient? Discuss. If the firm would not undertake the project, please calculate the amount larger the profit would have to be in each year of the patent period for the project to be worthwhile to the firm.