SUID:

Peter J. Wilcoxen
PPA 723, Managerial Economics

Department of Public Administration
The Maxwell School, Syracuse University

Exam 3
Spring 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)

Suppose the federal government is considering a new tax policy to control climate change. Everyone agrees that enacting the policy would prevent damages having a present value of $1 trillion (that is, $1000 billion). However, no one is certain how much the policy will cost. It is generally agreed that there is a 30% chance that the present value of the costs will be relatively low, $400 billion, and a 70% chance the PV of the costs will be high, $1.4 trillion. Please note that since everything is already expressed in PV terms, you do NOT need to do any PV calculations in this problem.

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

Question 1, continued.

Now suppose that a large state is considering adopting the policy on its own, before the federal government decides whether or not to act. The state's analysts have concluded that the expected net present value would be -$10 billion and have recommended against the policy. However, if the state went ahead, its costs will provide valuable – but imperfect – information about what would happen at the federal level. When federal costs would be low, there is a 60% chance that state costs will be low; when federal costs would be high, there is an 80% chance that state costs will be high.

(b) Please compute the *expected value of the state policy as a test of the federal policy*. You may assume that the state would adopt the policy if the federal government were to give it $10 billion in compensation. Should the federal government pay the state to go ahead? Explain. To keep things simple, you may assume that that payoffs to the federal policy remain as they were in part (a) – you don't need to scale them down to reflect the fact that the state went first.

Question 2 (20 points)

An organization wants to produce 16 units of output at the lowest possible cost. It had the following production function: $Q = K^{1/3} L^{2/3}$. The price of capital is $20 and the price of labor is $40.

(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 10 and 20 inclusive.

EQUATION									

Question 3 (20 points)

A non-profit organization assists low income households with their income taxes. The organization's monthly costs are given by TC = \$375 + \$20*Q and the demand for its services is given by P = \$100 - \$1*Q. 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. 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 68 and 78, inclusive.

EQUATION									

Question 4 (40 points)

A medical research company has developed a new drug that might be very useful in treating a rare but serious illness. However, the drug cannot be used until after it has gone through an expensive clinical trial. If the trial succeeds, the firm would be able to patent the drug and would be a monopolist during the patent period. Demand for the drug would be given by P = 1020 – 4*Q. The drug could be manufactured for a marginal cost of $20 a unit via a constant returns to scale production function.

(a) If the drug were approved, what price would a profit-maximizing firm charge for it during the patent period? What Q would it produce each year? What profits will it earn? As a hint, the quantity will be between 120 and 130.

EQUATION									

Question 4, continued.

Now let's add in the time dimension. The patent would allow the firm to be a monopolist for 20 years (years 1 to 20; the firm doesn't sell the drug in year 0). After year 20, the patent expires and the market becomes competitive. The interest rate is 5%.

(b) Assuming the clinical trial succeeds, what is the present value of the stream of profits that would be generated by the drug?

Question 4, continued.

(c) Again assuming the trial succeeds, what will the price of the drug be after the patent expires and competitors enter the market? Now calculate the present value of all consumer surplus generated by the drug.

Question 4, continued.

Finally, now consider the clinical trial itself. Suppose that the trial costs $300,000 and there is only a 30% chance the drug would be approved. 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 of the trial and explain why a risk neutral firm would not undertake it. Then evaluate the following two policies to see if either one would change the firm's decision: (1) a $50,000 subsidy for the clinical trial, or (2) extending the life of the patent to 40 years.