SUID:

Peter J. Wilcoxen
PPA 723, Managerial Economics

Department of Public Administration
The Maxwell School, Syracuse University

Final Exam
Fall 2006

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. *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 may 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:

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

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 (40 points)

A non-profit foundation focuses on helping people with a serious disease. It has raised $50 million and has asked for your help in deciding how to use it. One option would be to give the money out as grants to cover the medical expenses of people afflicted by the disease. You may assume that doing so would generate an immediate $50 million worth of benefits. Alternatively, it could use the money to fund a research project searching for a cure. The research project has only a 10% chance of success, but if it does it would produce benefits worth $400 million. If the project fails, the entire $50 million would be gone.

Throughout this problem you may assume that everything happens right away; you do not need to do present value calculations.

(a) Please draw an appropriate decision tree and evaluate the two options. Assuming the foundation is risk-neutral, what should it do? Why?

Question 1, continued.

Now suppose that it is possible to do a pilot study before undertaking the full-scale research project. The pilot study would cost $5 million and would indicate whether the full project is "likely" or "unlikely" to succeed. However, the test is not infallible: there is a 30% chance that it would incorrectly report "unlikely" when the research would actually succeed; and there is a 50% chance that it would incorrectly report "likely" (to succeed) when the research would actually fail.

(b) Please draw an appropriate decision tree and determine the *expected value of the test*. What should the foundation do? Why? (You should assume the foundation could pay for the test out of other funds – that is, it could cover both the cost of the test and the cost of the research if it decided to go ahead with both.)

Question 2 (20 points)

An organization wants to produce 20 units of output at the lowest possible cost. It had the following production function: $Q = K^{0.4} L^{0.6}$. The price of capital is \$15 and the price of labor is \$25.

(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 15 and 25 inclusive.

EQUATION									

Question 3 (20 points)

A non-profit organization operates a nature preserve. To help cover the costs of maintaining the preserve, it operates a guided-tour service. The monthly demand for tours is given by the equation P = 450 – 10*Q, and its monthly costs are given by TC = $1,340 + 10*Q.

(a) The organization wishes to earn as much profit as possible from the tour service. What should it charge and how many tours should it provide? How much profit will it earn? As a hint, the value of Q is between 15 and 25, inclusive.

EQUATION

Question 4 (40 points)

A private company is considering whether or not to undertake a 5-year, $100 million research project to develop an inexpensive device that homeowners could use to monitor their energy consumption (the whole $100 million would be paid in year 0). The project has a 30% chance of success. If it succeeds, annual demand for the device would be given by $P = 30 – Q$, where Q is measured in millions (e.g., Q=1 is 1 million devices). The device could be patented for 20 years, making the firm a monopolist for years 6-25 (the research takes place during years 0-5). The device could be manufactured via a constant returns to scale production process having a marginal cost of $20 per unit. Furthermore, it can be shown via a table like that in Question 3 that the profit-maximizing Q during the patent period would be 5 (to the nearest million). Please note that you DO NOT need to prove that Q=5 is correct. The interest rate is 5%.

(a) What is the expected net present value of the project? Would a risk-neutral firm undertake it? Explain.

Question 4, continued.

(b) If the project succeeds, what will be the annual consumer surplus produced by the device during the patent period? What will be CS be after the patent period, assuming that price-taking firms enter the market and the price of the product drops to $20? Using these numbers, please calculate the expected present value of CS from the project.

Question 4, continued.

(c) Now suppose the government considers subsidizing the research project. It offers to pay 40% of the project's cost ($40 million). Determine whether or not that would change the firm's decision. Assuming that the government is risk-neutral, and that it raises revenue via a tax with a CV of $1.50 per $1 of revenue, is the subsidy a good idea from the government's point of view? Be sure to show your work and explain what you find in words.