SUID: | |

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Exam 3
Fall 2012

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 and you'll have 180 minutes to complete it. Be sure to budget your time accordingly.

4. Some questions provide a blank table 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. The tables may have more rows or columns than you need.

5. 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*.

6. Some helpful PV formulas:

$$PV = \frac{B_t}{(1+r)^t} \qquad PV = \frac{B}{r}$$

Question 1 (15 points)

A government agency is considering what to do about an abandoned site previously used to dispose of hazardous waste. If it does nothing, the site will cause $10,000 of damages in water pollution and lost tax revenue per year forever. Two proposals are being considered. Under plan A, the agency would spend $50,000 in each of the next three years (years 1, 2 and 3) to clean up the site. Damages would be eliminated beginning in year 4. Under plan B, the agency would leave the waste in place but install a $50,000 barrier to stop it from creating the water pollution problem. The barrier could be installed right away (in year 0) and damages would decrease to $5,000 per year beginning in year 1. The agency uses an interest of 5% in present value calculations.

Please calculate the net present values of the two plans and indicate what the agency should do.

Question 2 (15 points)

A city government would like to improve conditions in a low income neighborhood. The planning department has proposed to renovate a park and improve several streets. The project would cost $10 million in year 0. However, the city is not sure what benefits the project will create because it's not sure whether the residents will like the results. There is a 40% chance they will like the renovations and the benefits will be $1 million per year forever starting in year 1. If they don't like the renovations, however, the benefits will be 0. The city uses a 5% interest rate in its present value calculations

(a) Please calculate the expected value of proceeding with the project. Should the city go ahead?

Question 2, continued

Now suppose the city could hire a consulting firm for $1 million (paid in year 0) to carry out a public outreach process that would involve the residents in the design of the project. The process would increase the chance the residents would like the outcome to 70%. However, it would take several years, delaying construction until year 3 and benefits (if they occur) would not begin until year 4. You may assume the construction cost would still be $10 million (but now paid in year 3) and the benefits (if the residents like the project) would still be $1 million per year.

(b) Please determine the expected net present value of hiring the consulting firm. Would it be a good idea?

Question 3 (15 points)

Suppose the government is considering adopting an energy tax to reduce carbon dioxide emissions and lower future damages from climate change. The tax would take effect in year 1 and remain in force forever. However, it is unsure about the nature of household preferences. If households have type-CD preferences, they would reduce energy consumption significantly and the policy would produce $100 billion of benefits every year forever beginning in year 11. However, if households have type-PC preferences, they would reduce energy consumption much less and benefits would be $50 billion every year forever starting in year 11. You may assume that the compensating variation for the policy would be $60 billion per year in either case.

The government believes that the probability is 80% that households have type-CD preferences. However, it could determine the preferences for certain by spending $10 billion on a study. You may assume the study could be done in year 0 and that the results would be available immediately. Please compute the expected present value of the study using an interest rate of 5% and explain how the government should proceed.

Question 4 (15 points)

The head of a household is concerned about consumption in two periods: 0 and 1. In period 0, she will be working and raising a family, and her income will be $150,000; in period 1, she will be retired and her income will be $50,000. She prefers to have twice as much consumption while raising her family in period 0 than she will have in period 1. She can borrow or save at an interest rate of 10 percent.

Please calculate her intertemporal equilibrium, determine how much she consumes in each period, calculate how much she borrows or saves in period 0, and illustrate your results with an appropriate graph.

Question 5 (15 points)

A non-profit organization provides medical services to low income households. It has total costs given by TC = 200 + 10*Q where Q is the number of people it serves. The demand for its services is given by the equation P = 140 – 5*Q, and there are no other organizations providing a similar service. The organization wishes to serve as many people as possible without running a deficit.

What price should the organization charge and how many people will it be able to serve? How much profit will it earn? As a hint, the value of Q is between 20 and 30, inclusive.

Variable								
Equation								

Question 6 (15 points)

A biotech company is considering developing a new process for manufacturing an enzyme that could be used to produce fuel from agricultural waste. The process could be patented and the company would become a monopolist in the production of the enzyme. It believes demand for the enzyme would be given by the equation P=262 – 10*Q where Q is the quantity of the enzyme, and it would be able to produce the enzyme for a total cost given by TC = 2*Q.

Once the process has been developed, what price would the firm charge and what quantity of enzyme would it produce in each year during the time it is a monopolist? What profits will it earn each year? As a hint, the quantity will be between 10 and 20.

Variable								
Equation								

Question 7 (15 points)

Now suppose the development process in Question 6 costs $10,000 (paid in year 0) and has a 60% chance of success. If it works, the profits found in Question 6 begin to arrive in year 1. The firm would be a monopolist for 20 years (years 1-20) after which other firms would enter, the price would fall to $2 and the firm's profits would drop to 0. If the project does not succeed, the firm would earn no profits in any year.

Please calculate the expected net present value of the project assuming that the firm uses an interest rate of 10% in present value calculations. Should the firm undertake it?

Question 8 (15 points)

Finally, suppose the government is concerned about the potential consumer surplus that could be created by the enzyme in Questions 6 and 7.

(a) Suppose the firm goes ahead with the project and it succeeds. What consumer surplus will the enzyme create during each year of the monopoly period? What CS will it produce each year after the monopoly period? What will be the overall expected present value of the CS? You may assume the government uses a 10% interest rate in its present value calculations.

Question 8, continued.

(b) Suppose the government considers giving the firm a $2,000 grant to pay part of its $10,000 development cost. However, to raise the $2,000 it would have to impose a tax on households and the compensating variation of the tax policy would be $3,000. Would the payment be efficient? Would it change the firm's decision about developing the enzyme? Please note that the firm would still be allowed to be a monopolist and would *not* have to repay the $2,000 grant.