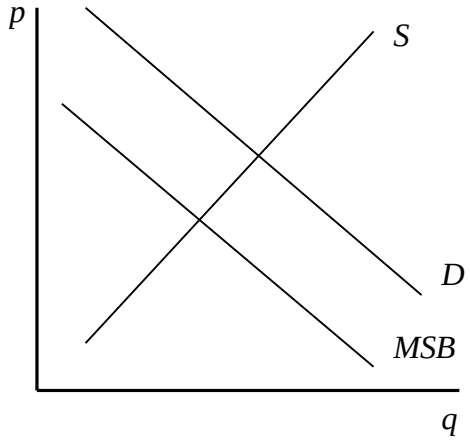
Name:
Student No.:

SPP/Econ 573
Benefit-Cost Analysis
Final Exam

April 26, 2000

Answer all questions on these sheets. In questions where it is appropriate, **show your work**, if you want partial credit for an incorrect answer. Point values of the questions are shown; there are a total of 61 points possible.

1. (11 points) The figure shows the supply and demand curves for a good (in a closed economy), together with another curve representing the marginal social benefit from consuming the good (MSB). Answer the following questions:



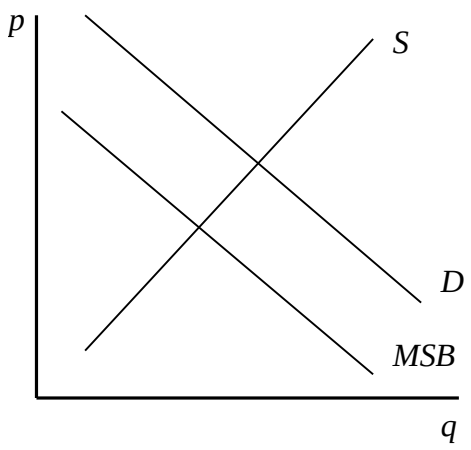
   a. (2 points) What is the nature of this externality? Is it positive, or negative, and is it associated with production or consumption?

   b. (2 points) If the government does not intervene in this market, what will be the equilibrium price and quantity? Find them in the figure and label them p_1 and q_1.

   c. (1 point) What level of output is socially optimal in this industry? Find it and label it $\hat{q}$.

[The figure from page 1 is reproduced here for your convenience. You should redraw the lines and labels that you added to it on page 1, for use in answering the questions below.]

d. (2 points) Which of the following policies could be used to achieve this optimum?

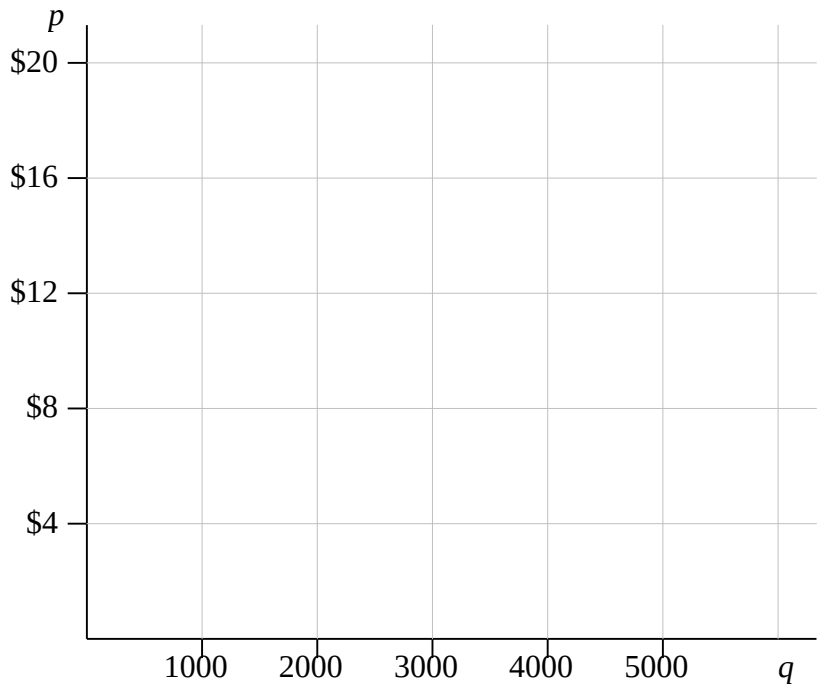


i. A direct restriction on output, permitting firms to produce no more than $\hat{q}$.
ii. A direct restriction on consumption, permitting demanders to buy no more than $\hat{q}$.
iii. A tax on sellers equal to the size of the externality.
iv. A tax on buyers equal to the size of the externality.

e. (4 points) For each of the policies listed in part (d), determine the effect on the welfare of producers of using that policy, starting from the free market solution of part (b). Add lines and labels to the figure above as necessary to identify the contributions of welfare, and use these in your answer.

2. (12 points) Production of fluffles has a constant marginal cost of $4.00 per fluffle, but any producer must also bear a fixed cost of $8000 independent of the number of fluffles produced. Demand for fluffles is given by the demand curve Q=4000- 250P.

   a. (2 points) Draw the marginal and average (total) cost curves of a single fluffle-producing firm. (Hint: note particularly the levels of average cost at outputs 1000, 2000, and 4000.)



   b. (2 points) Add to your diagram the market demand curve for a single firm, being careful about relevant intersections. Can a single firm can break even or make a profit in this market?

   c. (2 points) If there were two firms producing in this market, could they both make a profit?

d. (2 points) If there were only one firm, and if it were required to produce whether it made a profit or not, but it could produce and sell any positive quantity it liked, how much output would it produce and at what price would it sell it?

e. (2 points) What is the socially optimal quantity to be produced? Can a firm make a profit producing that?

f. (2 points) Write a short paragraph discussing how society might achieve the social optimum? (Don't waste too much time on this. There isn't necessarily one best answer, and you could probably write a lot here if you had time.)

3. (10 points) The city of Peoria is considering building a new park. It has polled the residents and estimated that the population of 750,000 is divided into three groups, members of which would individually be willing to pay the following amounts for the park:

Number of Residents	Amount each is willing to pay
A: 200,000	$0
B: 250,000	$12
C: 300,000	$100

Based on this information, answer the following questions:

a. (2 points) If the park can be built for $15 million, should it be?

b. (2 points) If the cost is $15 million, and if the only way to pay for the park is to divide its cost equally among the entire population, would a majority vote for it?

c. (2 points) What is the maximum amount that the city **should** be willing to pay for the park?

d. (2 points) What is the maximum amount that a **majority would** be willing to vote for, if the cost is to be divided equally?

e. (2 points) Write a short paragraph discussing how Peoria might handle the problem of whether to build the park. (Again, don't waste too much time on this. Just say something sensible.)

4. (16 points) Suppose that production of wheat generates a positive externality for society that is known to be worth $2 a bushel. Initially, the U.S. is producing 80 billion bushels of wheat a year for its (closed) domestic market, where the equilibrium price per bushel is $3.20. The U.S. government is considering buying 12 billion bushels a year from this market and shipping it to Russia, for an undisclosed price and perhaps other more political remuneration. The question is: what will it cost the U.S. as a country (not just as a government) to do this?

   a. (6 points) In the space below, use supply and demand curves to illustrate the initial equilibrium in the U.S. domestic wheat market and then the effect on it of this government purchase. Based on your diagram and any labels that you find it useful to introduce, identify the costs and benefits of this policy to

      i. domestic wheat producers (? PS),
      ii. domestic wheat consumers (? CS),
      iii. the monetary cost of the wheat to the government (? Gov), and
      iv. the rest of society via the externality (? Ext).

      (Note: You will most likely find it useful to label some areas in the diagram to use for some of this, but probably not for all of it. Feel free to identify these costs and benefits in whatever way is convenient.)

b. (4 points) Let the elasticity of supply in the U.S. wheat market be 0.8 and the elasticity of demand be (minus) 2.2. Solve for the change in price in the domestic wheat market as a result of this policy, and also the changes in quantities supplied and demanded.

c. (4 points) Using your results from part (b), calculate the four changes in welfare identified in part (a).

d. (2 points) How much, then, does this wheat for Russia cost the United States?

5. (8 points) Determine the following present discounted values using the interest rates indicated:

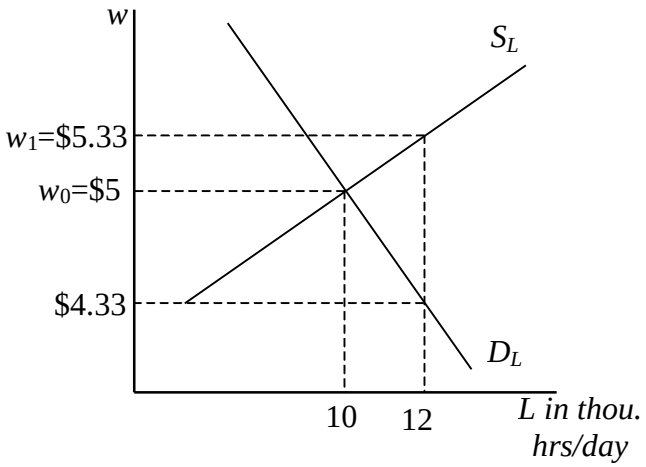
   a. (2 points) The present discounted value, at an interest rate of 5% per year, of $400 starting three years from now and continuing annually, with the last payment 10 years from today.

   b. (2 points) The present discounted value, at an interest rate of 12% per year, of a new car that is worth $25,000 today but on which you must make five annual payments of $10,000 a year starting one year from now.

   c. (2 points) The present discounted value, at an interest rate of 3% per year, of an oil well that yields $40,000 worth of oil today and continues to produce oil thereafter but with its output of oil declining at 10% a year forever.

   d. (2 points) Repeat part (c) but with output of the oil well equal to zero starting 11 years from now (that is, output is positive, but declining, for 11 years).

6. (4 points) In a previous exam, you quantified the effects of a subsidy to employment of unskilled labor in the village of Arbordale. What you found (or should have found) is shown in the graph and in the table below:



Effects of a $1/hr wage subsidy in Arbordale:

Initial wage	$5.00 /hour
Initial employment	10,000 hours/day
New wage	$5.33 /hour
New employment	12,000 hours/day
Cost of subsidy to government	$12,000 /day
Benefit to unskilled workers	$3,666.67 /day
Benefit to employers of unskilled workers	$7,333.33 /day

Now assume, in addition, the following:

- The unskilled workers in Arbordale are regarded as poor, and all others, including their employers and most taxpayers, as nonpoor.
- Another policy exists that can transfer income from the nonpoor to the poor in arbitrary amounts, but for every $1000 taken from the nonpoor, only $800 makes it to the poor. The rest is lost in inefficiency, administrative cost, and waste.

Evaluate the wage subsidy.

The following problem is completely optional. Don't waste time on it if you could more usefully be working on the rest of the exam. Not doing this optional problem will not count against you.

7. The town of San Wobble lies in a peculiar location where one side of the town (the West Side) is immune from tornadoes while the other side (yes, the East Side) is hit randomly by these storms every few years. Experience suggests that while houses on the West Side last forever, their residents living to ripe old age, the houses on the East Side have a probability of 1 in 2000 each year of being completely destroyed. Being hit by a storm is not always fatal to residents of these houses, but about one in ten hits by a storm causes a fatal injury. A typical house on the safe West Side sells for $140,000. An otherwise comparable house on the unsafe East Side sells for $126,000 and can be replaced quickly for $140,000. (These numbers do not include the land, which survives the storm.) The real interest rate is 3% a year.

   a. Assuming that residents of San Wobble are risk neutral with regard to loss of property, what is the value that they place on loss of life?

   b. If instead you knew from some other source that they value their lives at $5 million, how would the certainty equivalent of the loss of property value from a storm compare to his expected value? Are residents risk averse or risk loving?