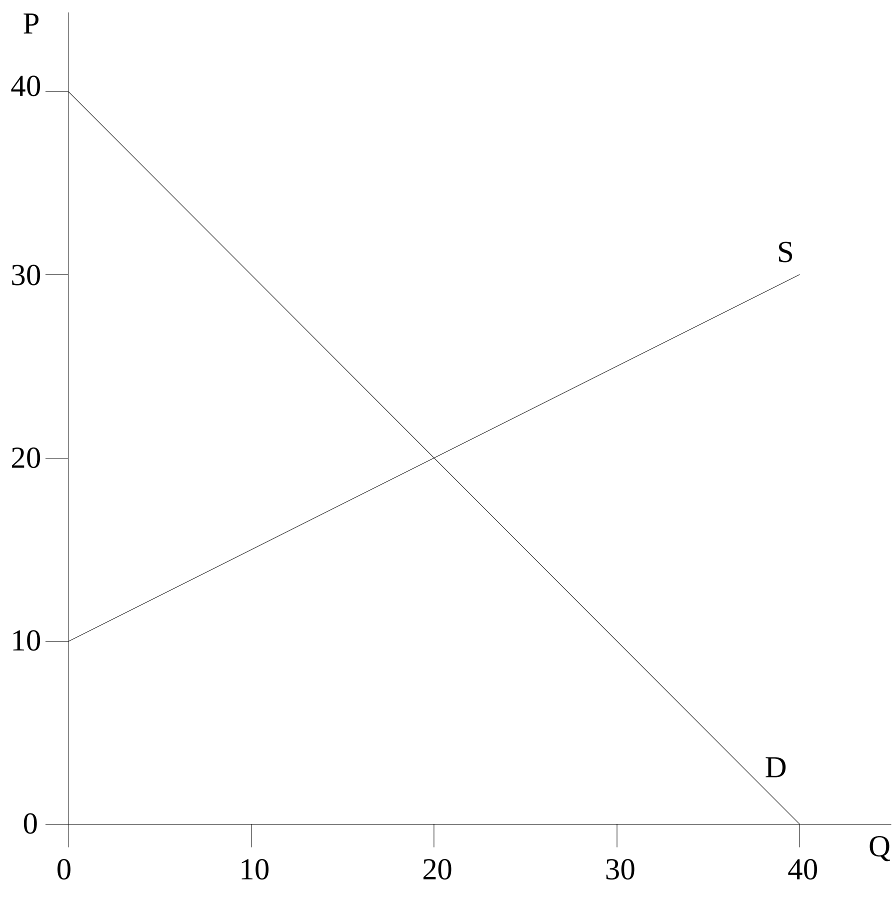
Name: ________________________

Midterm Exam #1
January 30, 1997

Instructions: Answer all questions directly on these sheets. Points for each part of each question are indicated, and there are 100 points total. Budget your time.

1. (34 points) In the diagram below are drawn a supply curve, S, and a demand curve, D, for a market.



a) (4 points) Find the market equilibrium price and quantity in the diagram and label them P_0 and Q_0.

b) (4 points) Suppose that output in the market were at the level Q_1=5. Find the marginal (private) cost of additional output when Q_1=5, and label it MC_1. Find the marginal (private) benefit of additional output when Q_1=5, and label it MB_1.

c) (2 points) Suppose that production in this industry causes pollution, the external cost of which to society is $10 per unit of output Draw a curve in the diagram representing the marginal cost to society as a whole of various levels of output in the industry, and label it MCS.

d) (2 points) Identify the socially optimal level of output in the diagram in the presence of the externality introduced in part (c), and label it Q_E*. (Finding it in the diagram is enough. You don't need to read the number.)

e) (4 points) Describe, in the space below, a policy that would move output in this industry to this socially optimal level. Why would this work?

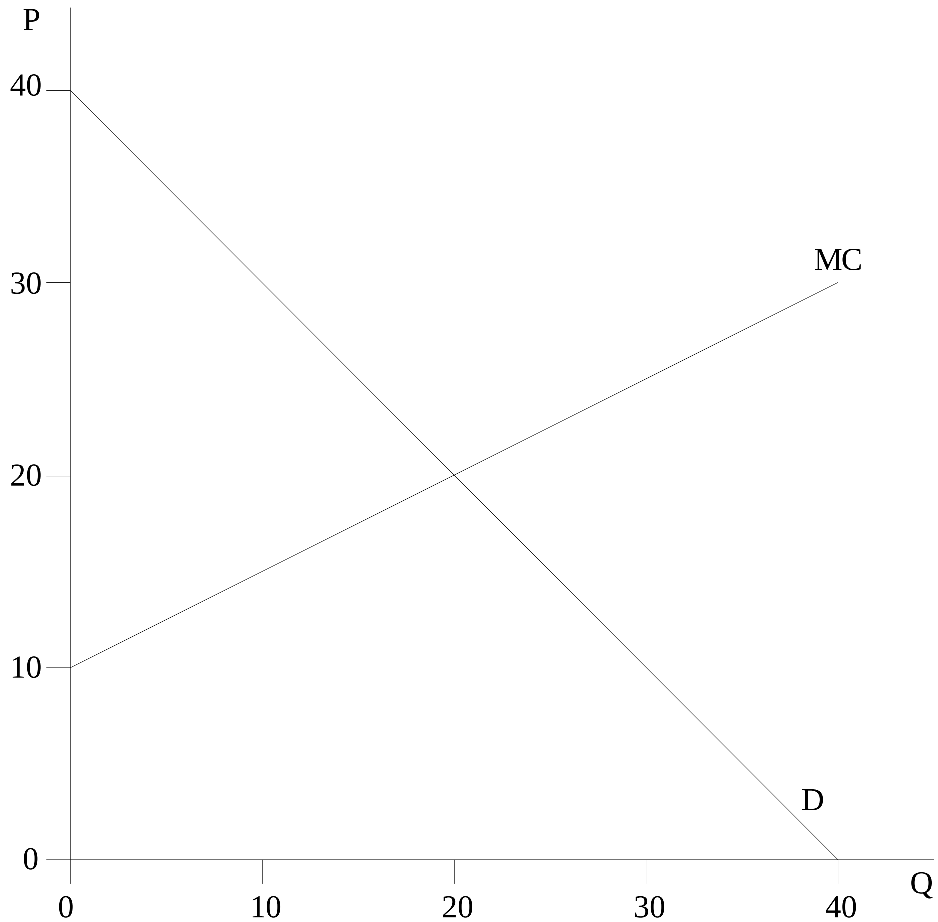
f) (6 points) Find in the diagram an area or areas that measure both of the following effects of the optimal policy from part (e). Add labels to the diagram, so that you can describe them with those labels in the blanks below.

The reduced external cost: ______________________

The net benefit to society: ______________________

g) (2 points) Most of the figure from above is repeated below. Now, however, you should interpret the upward sloping line as the marginal cost curve of a monopolist, as shown. In the absence of any externality, find the socially optimal output in this figure also, and label it Q*.

h) (4 points) Find the level of output that this profit-maximizing monopolist would select and the price it would charge to consumers. Label them Q_M and P_M respectively.

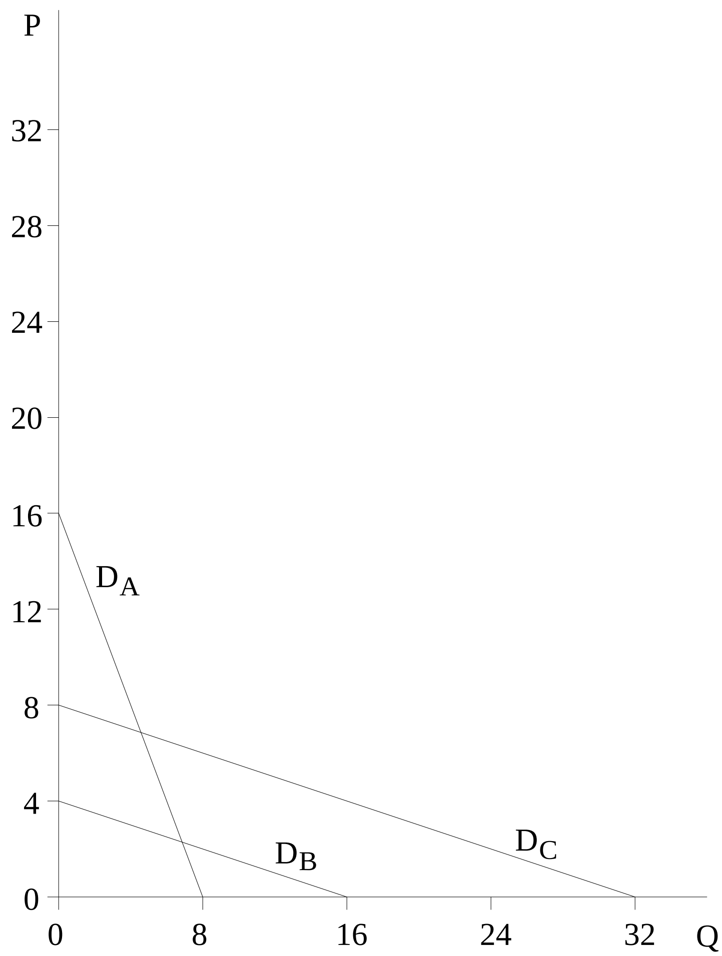


i) (2 points) Assuming that the monopolist has no fixed costs, identify its maximized level of profits in the diagram and indicate below how you have labeled it.

Profits = ______________________

j) (4 points) So far in this question, you have looked first at a polluter that was not a monopolist, and second at a monopolist that was not a polluter. Without doing any further formal analysis, do you think it is possible for a firm that is both of these things – i.e., a polluting monopolist – to operate efficiently from a social point of view? That is, is it possible that the optimal policy for dealing with a polluting monopolist might be to leave it alone? In the space below, explain briefly in words why or why not.

2. (36 points) In the figure below are drawn the demand curves of three individuals, D_A, D_B, and D_C, for a non-excludable public good. Each consumer knows both its own demand curve and those of the other two.



a) (6 points) Write the equations of the inverse demand curves for each of these consumers:

A: P =

B: P =

C: P =

b) (6 points) If there were no government or other possibility of collective action, what approximate quantities of the public good would you expect to see in this economy if the marginal cost of the public good were constant and equal to each of the following (briefly explain your answers)?

i) 20

ii) 12

iii) 6

c) (8 points) Construct the social marginal benefit curve in the above diagram, taking care to indicate clearly its shape and location, and label it MBS. Write the equation of the MBS curve for each of the following ranges of quantities:

0-8:

8-16:

16-24:

24-32

d) Suppose that the marginal cost of the public good were constant and equal to 12, and also that the total cost is to be divided equally among the three consumers.

i) (2 points) What approximate quantity of the public good would be socially optimal? (You may find the answer graphically, if you wish, and it is sufficient to come within 1 unit of the correct answer.) Indicate how you get your answer.

ii) (2 points) If the social optimum of part (d-i) were selected, what is the total amount each consumer would have to pay for it?

iii) (2 points) Which if any of the three consumers would be worse off than if the public good were not provided at all?

iv) (6 points) What quantity would each consumer individually regard as optimal if the cost were shared equally?

A: B: C:

v) (4 points) If an election were held to decide between having none of the public good at all and having the social optimum of part (d-i), which would win? Why?

3. (30 points) Cigarettes are supplied to Ann Arbor perfectly elastically (i.e., at a fixed price to suppliers) of $2 per pack. Ann Arbor's demand for cigarettes is given by the linear inverse demand function, $P=10-0.5Q$ where Q is quantity consumed in thousands of packs per day. A study by the University of Michigan School of Public Health has determined that, because of second-hand smoke, each pack of cigarettes smoked in Ann Arbor adds $.50 to the total cost of health care in the city for nonsmokers as a group. Smokers themselves are assumed to be fully aware of any health costs to themselves due to their own smoking, and that they pay for their own health care. Smokers are not hurt by second-hand smoke.

   a) (4 points) Calculate the equilibrium price and quantity of cigarettes sold in Ann Arbor if the market remains free.

   b) (3 points) What is the total cost of health care due to second-hand smoke in that situation?

   c) (6 points) In the space below, draw curves representing the supply of cigarettes, the demand for cigarettes, and the social marginal cost of cigarette consumption in Ann Arbor, assuming that the cost of health care for nonsmokers is the only social cost not borne by smokers and the sellers of cigarettes themselves. Be sure to label them clearly.

   d) (4 points) Identify in your figure the free-market equilibrium quantity consumed, Q_0, and the socially optimal quantity, Q^*.

e) The Ann Arbor City Council is considering levying an *ad valorem* (percent of value) tax on cigarette sales in the city. Assuming that smokers cannot bring cigarettes in from outside, what percentage tax rates would achieve the following objectives:

i) (3 points) Reduce cigarette consumption to zero;

ii) (3 points) Reduce Q to its social optimum, Q*;

iii) (3 points) Raise enough revenue to pay the health care cost of nonsmokers that is caused by second-hand smoke.

f) (4 points) The marketing department of the U of M business school has designed an advertising campaign that they believe would shift the (inverse) demand function for cigarettes to $P=10-0.8Q$. By how much would this ad campaign reduce Ann Arbor cigarette consumption, assuming that there is no tax on cigarettes?