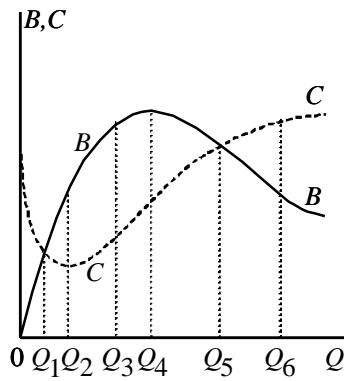


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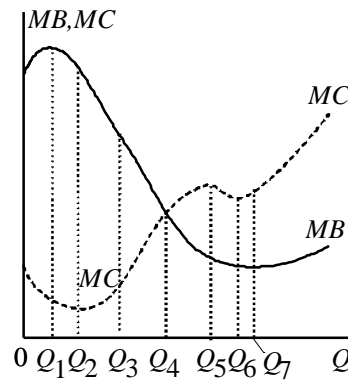
## Midterm Exam #1 October 1, 1997

**Instructions:** Answer all questions directly on these sheets. Points for the parts of each question are indicated, and there are 94 points total. Budget your time.

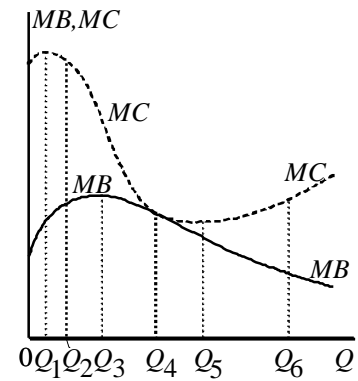
1. [12 Points (2 each)] The figures below show either total benefits ( $B$ ) and total costs ( $C$ ), or marginal benefits ( $MB$ ) and marginal costs ( $MC$ ), as functions of the level (quantity,  $Q$ ) of some activity. In the blanks provided and using the labels in the diagrams, indicate the level of each activity that maximizes net benefits from it. You should assume that there are no fixed costs in any of these cases. If the optimum appears to be different from any that are labeled, use the one that is closest to the optimum.



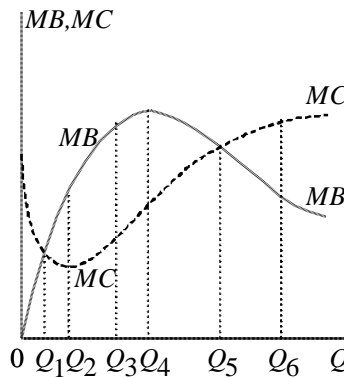
a) \_\_\_\_\_



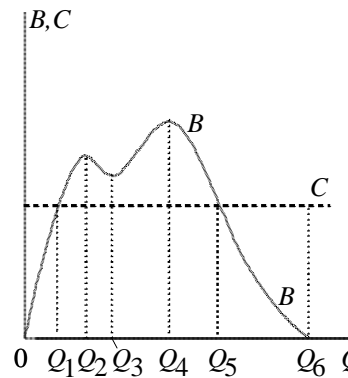
b) \_\_\_\_\_



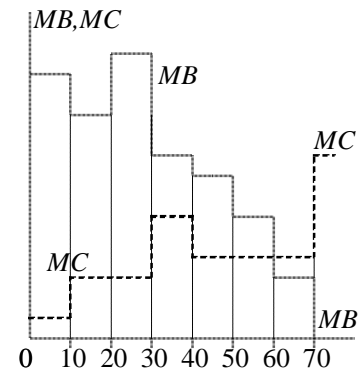
c) \_\_\_\_\_



d) \_\_\_\_\_

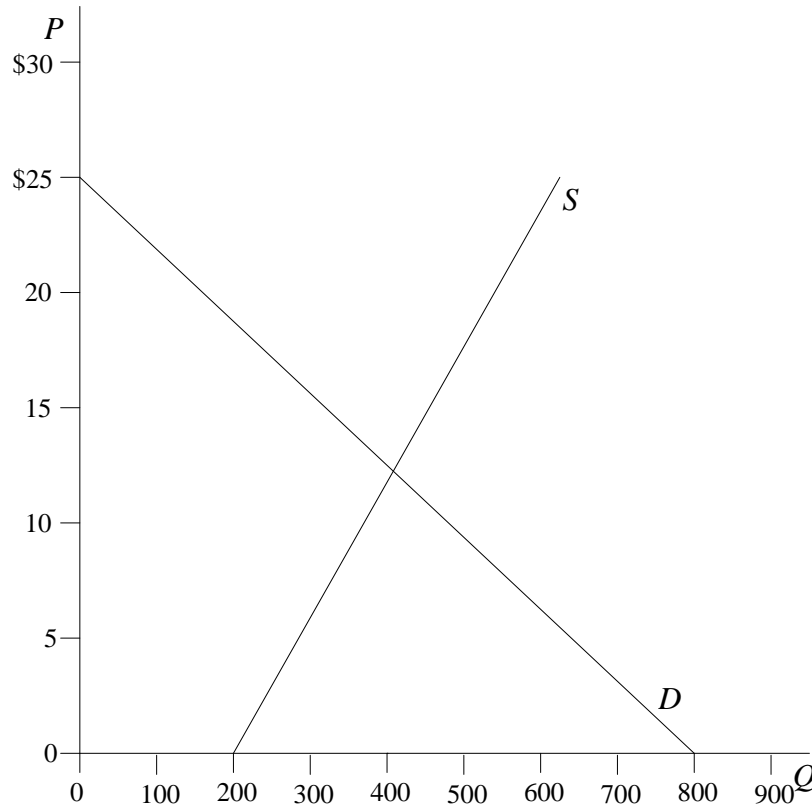


e) \_\_\_\_\_



f) \_\_\_\_\_

2. [22 points] In the diagram below are drawn a supply curve,  $S$ , and a demand curve,  $D$ , for a market.



- (4 points) Find the market equilibrium price and quantity in the diagram and label them  $P_0$  and  $Q_0$ .
- (4 points) Suppose that output in the market were at the level  $Q_1=600$ . Find the marginal (private) cost of additional output when  $Q_1=600$ , and label it  $MC_1$ . Find the marginal (private) benefit of additional output when  $Q_1=600$ , and label it  $MB_1$ .
- (2 points) Suppose that consumption in this industry causes pleasure to other people who are nearby to those consuming (perfume, perhaps), the external benefit of which to society is \$5 per unit of output. Draw a curve in the diagram representing the marginal benefit to society as a whole of various levels of consumption in the industry, and label it  $MBS$ .
- (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 consumption 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 increased benefit from the externality: \_\_\_\_\_

The net benefit to society: \_\_\_\_\_

3. [24 points] Supply and demand for potato chips in Fort Wayne, Indiana, are given by the following two equations:

$$P = 2 + 0.005Q$$

$$Q = 335 - 100P$$

where  $P$  is price in \$ per 24 oz. bag and  $Q$  is quantity in thousands of 24 oz. bags per week. Be careful, as you answer the following, that you specify completely your units of measurement.

- a) (2 points) Verify, in the space below, that competitive equilibrium price and quantity are \$2.45 per bag and 90,000 bags per week. (You will need to use the equations above, either to solve them for these equilibrium values or to confirm that the market clears at these values. Show enough of your work for us to see what you have done.)
- b) (4 points) Calculate the total consumer and producer surplus in this market in that competitive equilibrium (you may assume that firms have no fixed costs).

Total Consumer surplus: \_\_\_\_\_

Total Producer surplus: \_\_\_\_\_

- c) (4 points) Suppose now that a production tax, of \$0.15 per 24 oz. bag, is levied on producers of potato chips. Verify, in the space below, that the new equilibrium quantity is 80,000 bags per week and the new equilibrium price paid by demanders is \$2.55 per bag. (See part (a) for what you need to do to verify an equilibrium.)
- d) (6 points) In the new equilibrium, including the production tax from part (c), what are the new levels of total consumer and producer surplus, and how much revenue is the government collecting?

New Total Consumer Surplus: \_\_\_\_\_

New Total Producer Surplus: \_\_\_\_\_

Government Tax Revenue: \_\_\_\_\_

- e) (8 points) What are the welfare effects of the tax? Be careful to distinguish gains and losses.

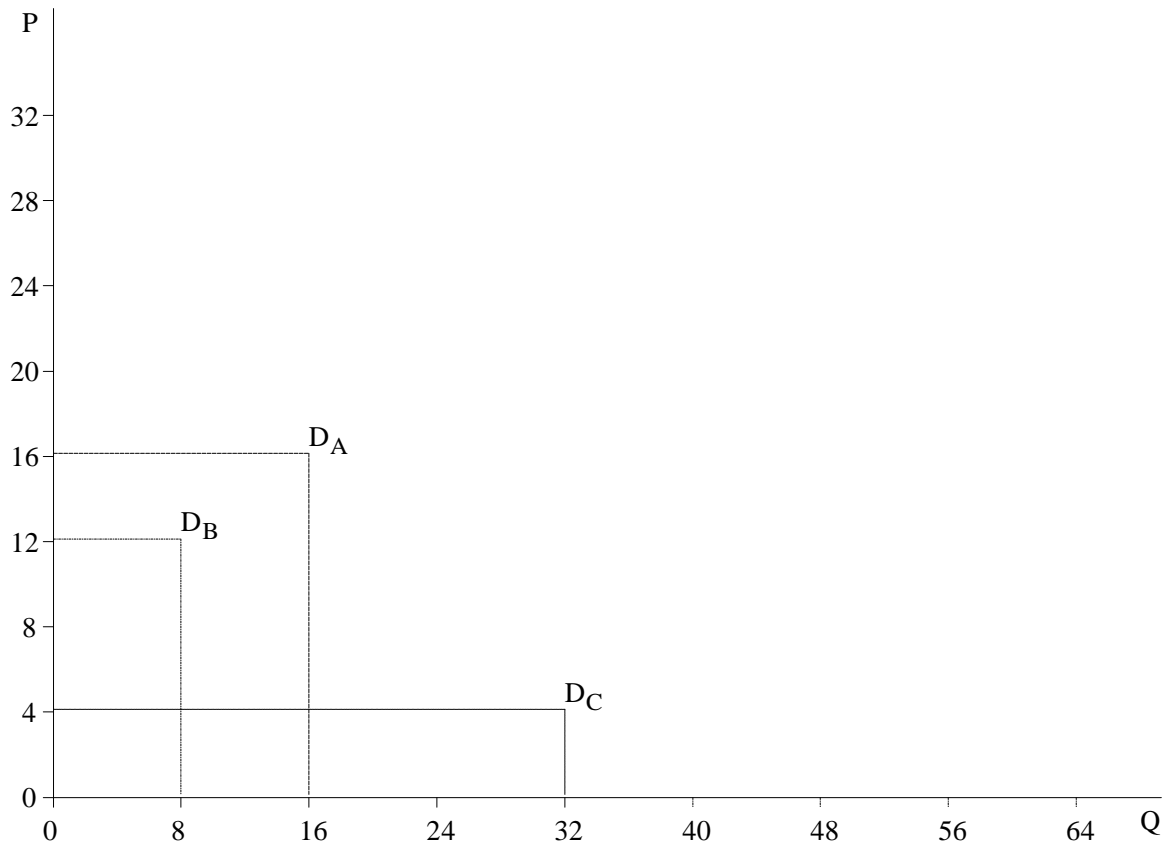
Change in Consumer Surplus: \_\_\_\_\_

Change in Producer Surplus: \_\_\_\_\_

Change in Government Revenue: \_\_\_\_\_

Net Social Benefit from Tax: \_\_\_\_\_

4. [24 points] In the figure below are drawn the demand curves for three households,  $D_A$ ,  $D_B$ , and  $D_C$ , for a non-excludable public good. Each household is willing to pay the constant marginal amount indicated for the public good for any quantity up to a maximum, as shown, but both the willingness to pay per unit and the maximum are different across households.



- a) (4 points) In the figure above, draw the social marginal benefit curve for this public good, taking account of the demands by all three households. Be sure to make clear the locations of the intercepts of this curve as well as any kinks. Label it MBS.

b) (6 points) If there were no government or other possibility of collective action, what quantities of the public good would you expect to see produced 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) 18

ii) 14

iii) 8

c) (4 points) If this were a private good instead of a public good (for this part of the question only), how much would be produced at constant marginal costs equal to the following?

i) 8

ii) 2



- d) (10 points) Suppose that the marginal cost of the public good were constant and equal to 18. Suppose also that the total cost is to be divided equally among the three households.
- i) What quantity of the public good would be socially optimal? Indicate how you get your answer.
  - ii) If the social optimum of part (d-i) were selected, what is the total amount each household would have to pay for it?
  - iii) Which of the three households, if any, would be worse off than if the public good were not provided at all?
  - iv) If the number of households were to double, adding one household of each type with the same demand curves  $D_A$ ,  $D_B$ , and  $D_C$ , how would the socially optimal quantity change?
  - v) How many of these six households would now be worse off? (This is still assuming that the optimal quantity is provided and that its cost is divided equally among all households.)

5. [12 points] Each of the figures below show average and marginal cost curves for monopolist firms, together with the demand curves that they face. Note that in figure (c) the average and marginal cost curves coincide, both being constant up to a capacity constraint and rising vertically at capacity. There is also a capacity constraint in figure (d), though here the marginal and average costs are not the same below capacity, but both become vertical at capacity.

In each of the figures, find the following levels of output and label them as indicated:

$Q_M$ : The monopolist's profit maximizing output.

$Q^*$ : The socially efficient output.

$\bar{Q}$ : The largest output the firm could produce without running at a loss.

