

Sample Midterm Exam (Given in 2003)

Sloan School of Management
Massachusetts Institute of Technology

15.010/ 15.011
Economic Analysis for Business Decisions

MIDTERM EXAMINATION

Thursday, October 16, 2003

Directions: This is a closed-book exam. Please print your name clearly on each answer book.

Answer all questions as clearly and legibly as possible. The exam has a total of 1500 points; the number of points and a suggested amount of time is indicated for each question. You must turn in this exam along with your answer books before leaving the room.

In order to get full credit, you need to show your work. With TFU or essay questions, you need to define concisely the key concepts that you use in your answers.

Students in the 8:30 a.m. sections:

I will not discuss the contents of this exam with anyone in other sections before 5:30 p.m.

Students in the 10:20 a.m. sections:

I will not discuss the contents of this exam with anyone in other sections before 5:30 p.m.
I have not discussed the contents of this exam with anyone who took it earlier.

Students in the 4:00 p.m. section:

I have not discussed the contents of this exam with anyone who took it earlier.

Signed: _____

Print your name: _____

1. (250 points; 12 minutes) Decide whether each of the following statements is **True**, **False**, or **Uncertain**, and give a **brief but clear explanation** of your answer. (Most of the credit will be given for the explanation.)

1a) When an aluminum company made 100,000 cans, the last unit cost \$0.02. The next year it made 500,000 cans and the last unit cost \$0.04. This company does not benefit from economies of scale.

1b) A demand equation for gasoline is estimated to be:

$$\ln Q = -0.54 - 0.40 \ln P + 0.25 \ln \text{Income}$$

where Q is in millions of gallons per week and the price is per gallon. A refinery fire leads to a price increase from \$1.00 per gallon to \$1.50 per gallon. Since the above equation implies that gasoline demand is inelastic, the quantity demanded will drop by less than 1%.

2. (350 points; 18 minutes) A railroad which runs between two cities ‘produces’ two products: passenger and freight service. The marginal cost of carrying an extra ton of freight is \$0, and the marginal cost of carrying an extra passenger is \$0. There are joint, fixed costs of \$19,000 per day. There is no other competitor in this market.

The daily demand for passenger service is

$$P_p = 8 - 0.005Q_p$$

with Q_p the number of passengers and P_p the price of a two-way ticket.

The daily demand for freight service is

$$P_f = 10 - 0.001Q_f$$

with Q_f in tons and P_f the price per ton.

Currently, $P_p = \$5$ and $P_f = \$8$, so that $Q_p = 600$ and $Q_f = 2000$. The revenues from passenger service are \$3000 and from freight \$16,000.

The firm currently assigns overhead to products on the basis of their dollar share of revenues. Thus, the costs allocated to the passenger business are \$3,000, while those allocated to freight are \$16,000. The firm’s accountants argue that prices should be raised on both products, since the firm barely breaks even. What pricing would you recommend? Evaluate the accountants’ argument. Would your conclusions differ if the fixed costs were \$30,000 per day?

3. (450 points; 25 minutes) In the competitive market for medical scanning devices, there are 400 teaching hospitals in the US who would buy at most one device. Market demand in units is given by:

$$Q_d = 1250 - (1/4)P$$

up to the constraint that at most 400 units will be sold (i.e. $Q_d \leq 400$).

Market supply is given by:

$$Q_s = -3000 + P.$$

- (a) What is the equilibrium price and quantity of devices sold?
- (b) The government seeks to restrain healthcare spending by *taxing* teaching hospitals \$1000 per machine bought. What is the equilibrium quantity of devices sold, and what price do firms receive? Is there any deadweight loss, and, if so, how much?
- (c) If, instead of imposing a tax, the government provided a subsidy, would there be any deadweight loss? (*No calculation is necessary to answer this question.*)

4. (450 points; 25 minutes) In a small country, Gelbium, yearly demand for mail delivery is

$$Q = 110,000 - 10,000 p.$$

where p is expressed in Gelbium Marks (GM) and Q is expressed as the number of pieces of mail. The marginal cost of delivering a piece of mail is constant and equals 1 Gelbium Mark. There is no fixed cost.

- (a) Suppose the government runs the mail service. If the government wants to maximize the social surplus, how much should it charge for mail delivery?
- (b) Suppose the government privatizes mail delivery. It sells the monopoly right to deliver mail to a commercial firm. The firm is free to set its price. How much will the firm charge for delivering a piece of mail? What is the maximum (yearly) amount the government can charge for the monopoly rights? What is the effect of this privatization on total welfare?
- (c) Assume that the government, after having sold the monopoly rights, gives a subsidy of 2 Gelbium Marks per piece of mail that the firm delivers. What will be the impact of this subsidy on consumer surplus and on firm profits (relative to unsubsidized monopoly)? What will be the welfare effect?