

Sloan School of Management
Massachusetts Institute of Technology

15.010/ 15.011
Economic Analysis for Business Decisions

SAMPLE FINAL EXAMINATION

(Similar to exam given Tuesday, December 16, 2003, 9:00 a.m. to noon)

Directions: This is a closed-book exam. Please print your name and Sloan section clearly on each answer book and number your books.

Answer all questions as clearly and legibly as possible. You have 180 minutes and the exam has a total of 1800 points; each question indicates the number of points and a suggested amount of time.

For numerical problems, please draw a box around your answer.

You must turn in this exam along with your answer books before leaving the room.

Signed: _____

Print your name: _____

Answer all of the following eight questions (total of 1800 points) (Note: all prices are in dollars unless otherwise noted.)

1. True, False, Uncertain (180 points, 18 minutes). Decide whether each of the following three statements is true, false or uncertain. Most of the credit will be given for the explanation.

- (a) At a production level where a firm has economies of scale, its marginal cost must be below its average cost.
- (b) Assume you can buy a car for \$3,000 and you will be able to use it for 3 years. Afterwards it will have zero re-sale value. Alternatively you can rent a car for \$1000 per year. You should be indifferent between these two options.
- (c) Chili-dog lovers come from far and wide to Mike's Famous Chili-Dog Fair and have identical demand for chili-dogs. (A chili-dog is a type of food.) Attendees purchase a ticket from Mike to enter the Fair but, once inside, they may purchase chili-dogs from any of a number of independent chili-dog stands. Chili-dog stands have zero fixed costs and marginal cost of \$2.00 per chili-dog. Currently the stands compete aggressively so that price equals marginal cost. The stand-owners approach Mike with the following proposition:

“This bitter price competition among the chili-dog stands is really hurting profits. If you *required* us to charge a higher price, we could share the extra profits with you. We would all be better off.”

Mike should accept the deal.

2. (250 points, 25 minutes) On the island of Waihai, apple farmers grow 200,000 apples per year. The cost of harvesting the apples is 10 cents per apple. There are no other costs. Demand for apples on Waihai is $Q=240-p$, with p the price per apple in cents and Q the demand in thousands of apples. Apples can also be bought or sold on the world market at a price of 50 cents per apple.

- (a) What is the price for apples on Waihai. How much gets imported or exported?
- (b) How much does total surplus change if apples bought or sold on the world market incur an extra transportation cost of 10 cents per apple?

3. (200 points, 20 minutes) DSL Inc. can provide internet service at 10 Megabits per second (Mbps), but it can slow down the service to 2 Mbps at no additional cost. Consumers like faster service with values (in dollars) given by:

	10 Mbps	2 Mbps
Value to a business	100	30
Value to a family	40	20

Suppose there are 100 potential business consumers and 100 potential family consumers. DSL's marginal cost is zero.

- (a) Say that DSL can distinguish families from businesses. What speed and price should it offer businesses? What speed and price should it offer families?
- (b) The National Communications Commission (NCC) forces DSL to charge one price for 10 Mbps and forbids any slowdown in service. What price will DSL charge for 10 Mbps? Calculate the lost revenue due to the regulation. What is the change in consumer surplus compared to part (a)?
- (c) Now say that DSL **cannot** distinguish families from businesses and considers offering both 10 Mbps and 2 Mbps services. What price would DSL charge for each service? Should DSL offer the two services? Compare consumer surplus relative to part (b).

4. (200 points, 20 minutes) Xemico is a small island in the Pacific with demand for milk equal to $Q=12-P$, where P is expressed in million Petesas and Q in tons. The island has two milk producers. The marginal cost of producing milk is zero. The firms compete by choosing quantity (i.e. they are Cournot competitors).

- (a) How much milk will each producer produce? What will be the price?
- (b) By how much would total surplus change if this market were competitive?

5. (270 points, 27 minutes) Harry met Sally and they decided to participate in MIT's 50K competition. They agree that if Harry puts h hours of work in the project and Sally puts s hours of work in the project, the outcome of the project will be worth: $R = h + s - h * s$. They also agree that they will split the outcome equally, receiving $R/2$. The cost of h units of effort for Harry is $C(h) = h^2/2$, and the cost of s units of effort for Sally is $C(s) = s^2/2$.

- (a) Assume that both Harry and Sally cannot observe each other's work hours and that they simultaneously decide their efforts. Find the two reaction curves, the Nash equilibrium of the game, and payoffs in equilibrium.
- (b) Suppose that Sally decides her number of hours first and Harry decides after knowing the number of hours chosen by Sally. Find the equilibrium of the game and payoffs in equilibrium.

6. (250 points; 25 minutes) Your company produces lawn mowers. Each lawn mower needs one engine. You produce your own engines. The market for lawn mowers is competitive and the market price is \$1,100. Given the engine, there are additional costs of \$900 to assemble the lawn mower.

- (a) Your firm has one fabrication plant for engines. Its marginal cost is $MC = 10Q$. There are no fixed costs. All quantities are expressed in thousands of engines or lawn mowers. What is the optimal production levels Q for your engine fabrication plant? What is the optimal transfer price for an engine?
- (b) Your firm has two fabrication plants for engines; their marginal cost structures are given as
- $$MC_1 = 10 Q_1$$
- $$MC_2 = 10 + 10 Q_2$$

There are no fixed costs. All quantities are expressed in thousands of engines or lawn mowers. What are the optimal production levels Q_1 and Q_2 for your two engine fabrication plants? What is the optimal transfer price for an engine?

- (c) Take the situation of part b) but suppose that there is also a competitive outside market for engines, where engines can be purchased or sold for \$ 250. What are the optimal production levels Q_1 and Q_2 for your two engine fabrication plants, how many lawn mowers Q should you produce, and how many engines should be bought or sold in the outside market? What is the optimal transfer price?

7. (300 points, 30 minutes) [The following is based on actual events, though details are fictionalized for simplicity.] In the early 1990s activist groups supported by Ralph Nader filed a recall petition against 10 million General Motors trucks, claiming that their fuel tanks could explode in a crash. In 1993, General Motors proposed to settle the resulting lawsuits by giving coupons to all 10 million affected owners. Each coupon allows one to receive \$1000 off any new GM truck purchased in 1994. (The coupons expire at the end of 1994.) These coupons are fully transferable: if someone with a coupon gives / sells it to someone else, that person can also use it to get \$1000 off a new GM truck. If the proposal goes ahead, all parties expect a competitive market to arise in which these coupons will be actively traded.

GM has zero fixed costs and marginal cost of \$10,000 per truck. Demand for GM trucks in 1994 is given by

$$D(p) = 8,000,000 - 200p$$

- (a) Suppose that the judge does not allow the settlement. In this case, what price will GM charge for its trucks? What is GM's profit and what is consumer surplus?
- (b) Suppose now that the judge allows the settlement and that GM charges a price of \$26,000 for trucks. Construct the resulting demand and supply curves in the market for coupons. What is the price at which coupons will trade? Given this price for the coupons, how many trucks will GM sell? What is GM's profit and what is consumer surplus? How much did GM's profit and consumer surplus change, relative to your answer in (a)?

8. (150 points, 15 minutes)[Short Answer; No specific calculations are necessary]
Zipcar rents out cars by the hour. Originally, users paid both a per-hour and a per-mile charge. Some of its customers, however, complained that the system was too complex and clamored for a pure per-hour charge. The CFO makes the following calculation. Over the past year, Zipcars were rented for a total of 10,000 hours and driven for a total of 100,000 miles. Since the original per-mile charge was 5 cents and on average each driver drives 10 miles for each hour that he/she rents a car, the CFO concludes that eliminating the per-mile charge and raising the per-hour charge by 50 cents would be a breakeven operation (i.e. would not change the profits). Evaluate the CFO's conclusion?