

SAMPLE FINAL EXAMINATION

(Similar to exam given Tuesday, December 17, 2002, 9:00 a.m. to noon)

Answer all of the following nine questions (total of 540 points). On numerical questions, please place a box around your final answer. Please write your name and Sloan section on each book, and number your books. Leave the bottom of the front page blank, for the recording of grades. (Note: all prices are in dollars unless otherwise noted.)

1. True, False, Uncertain (63 points, 21 minutes). Decide whether each of the following three statements is true, false or uncertain. Most of the credit will be given for the explanation.

(1a) Your company makes chairs in Western Massachusetts, and you have just obtained a large new order. Chairs produced in your Pittsfield plant cost \$4.00 each on average, and those made in your North Adams plant cost \$ 5.00 each on average. Transportation costs to your warehouse are the same from each plant. Therefore, you should order production increased in Pittsfield to cover the new order.

(1b) Consider the following productivity matrix (expressed in dishes per minute). (It means that Richard, *if he only washes dishes*, can wash 8 dishes per minute.) The organization of tasks that maximizes the number of dishes that get washed *and* dried in one hour is that Richard washes dishes all the time and Gabriel dries dishes all the time.

	Wash dishes	Dry dishes
Richard	8	10
Gabriel	7	8

(1c) A local mattress store has the following ad: “**5% LOW PRICE GUARANTEE** – We promise to BEAT by 5% any advertised price that undercuts our price on comparable products.”

Low price guarantees can sustain high prices.

2. (45 points, 15 minutes) Consider the following game payoff matrix.

		B		
		Left	Middle	Right
A	Up	10, 1	3, -10	0, 3
	Middle	6, 10	4, 12	-4, 11
	Down	-5, 0	8, 5	1, 8

- (2a) Define (in one sentence) a dominant strategy. (Start with ‘A dominant strategy is a strategy that ...’). Does A have a dominant strategy? If so, what? Does B have a dominant strategy? If so, what?
- (2b) Define (in one sentence) a Nash equilibrium. (Start with ‘A Nash equilibrium is a set of strategies, one for each player, such that ...’) Give all Nash equilibria of this game.
- (2c) If A could commit to an action, what action would it commit to? Suppose B could let A go first in choosing actions (i.e. make itself the second-mover). Would B do so?

3. (45 points, 15 minutes) Old McAdams had a farm. ... And on this farm, he grows some corn. ... To grow corn, he needs a tractor. A new tractor costs \$120,000. There is a very liquid resale market for tractors; a tractor that is one year old sells for \$85,000 and a tractor that is two years old sells for \$45,000. For simplicity, assume that all tractors three or more years old cannot be used to grow corn and sell for \$0. These prices are expected to stay the same in the future. The variable cost of producing corn is the same regardless of whether you are using a tractor that is new, one year old or two years old.

- (3a) Old McAdams faces an interest rate of 10%. What is the user cost of capital associated with using a new tractor for one year? What is the user cost of capital associated with using a one-year-old tractor for one year? What is the user cost of capital associated with using a two-year-old tractor for one year?
- (3b) Old McAdams is formulating a plan for growing corn for the next three years. What is the optimal arrangement for the necessary tractor input over the three years? (For instance, should he buy a new tractor and use it for three years, or something else?)
- (3c) Suppose instead that the interest rate is 0 % (and that present value over the three years involves no discounting). Now suppose that Old McAdams can resell a one-year-old or two-year-old tractor as above, but must pay a broker fee of \$ 10,000 for each sale. Three-year-old tractors are junked, which does not require paying a broker fee. Now, what is the optimal arrangement for the necessary tractor input over the three years? Explain your answer. (Assume that at the end of the three year period, a tractor must either be sold or junked.)

4. (60 points, 20 minutes) There are more amusement parks in Orlando, Florida than anywhere in the country. 10,000 visitors arrive daily and buy tickets for rides on the roller coasters. Each ride requires one ticket. Each person's demand for rides is given by $P = 10 - 2Q$, and the average cost of providing rides on roller coasters is constant at \$2 each.

- (4a)** Given the large number of amusement parks, assume that the market for rides is perfectly competitive. What is the equilibrium ticket price; the quantity of tickets sold; consumer surplus; producer surplus?
- (4b)** Suppose that all parks are owned by one firm, Big D. Big D decides to charge an admission fee for each park, as well as a ticket price per ride. What is the optimal admission fee and ticket price? What are total profits to Big D? How does the total surplus compare to the solution in (4a)?
- (4c)** There are actually 2 groups of people who go to the parks, 2000 local Floridians and 8000 tourists who travel great distances to get there. The demand for each tourist is still $P = 10 - 2Q$, but each local's demand is $P = 10 - 4Q$. Locals can be identified because they have Florida ID cards. Now, what is the optimal admission fee and ticket price for locals? What is the optimal admission fee and ticket price for tourists? What are total profits now?
- (4d)** Given your answers to (4c), what would a tourist be willing to pay for a fake Florida ID card?

5. (45 points; 15 minutes) The rock band U2 is coming to Boston to perform at Gillette Stadium, and you are in charge of pricing and selling the tickets (assume all seats are the same and you only need to set a single price). Independent of the number of seats sold, you must pay the administration of Gillette Stadium a fixed amount of \$ 500,000 (to cover security and cleaning costs), which represents the only cost. There are 50,000 seats in Gillette Stadium.

- (5a)** One month prior to the concert, U2's newest album is released, with rave reviews about how the band is much better than they have ever been before. Demand for tickets is given as

$$Q_d = 120 - .8P$$

where Q_d is in thousands of tickets and P is the price per ticket in dollars. What price P should you charge? How many tickets will you sell and what are your profits? (Don't worry if there are empty seats, you can always give those seats away to worthy charities.)

- (5b)** Suppose you have the option of adding some temporary seats on the grass field for \$30 a seat (assume these seats have the same view as the other seats and tickets for them would sell for the same price). Would you add any seats? If so, what price would you charge, how many tickets would you sell and what would your profits be? Explain your answer.

6. (45 points, 15 minutes) Silverman Brothers hires new full-time associates each year. There are two types of candidates for these positions, Stars and Normals. Stars have productivity \$200,000 and Normals have productivity \$100,000. Each interview may be Great, Good, or Bad. Stars never have a Bad interview, Normals never have a Great interview, and those who have a Good interview are equally likely to be Stars or Normals. These probabilities are summarized below:

Interview outcome	Great	Good	Bad
Star	100%	50%	0%
Normal	0%	50%	100%

For instance, a candidate who has a good interview has expected productivity of \$ 150,000.

Suppose that Silverman Brothers is one of several investment banks that are similar in the eyes of job candidates. What would happen if Silverman offered \$150,000 to all candidates who have a Good interview? Would the productivity of those who accept the offer be greater than, equal to, or less than \$150,000? Briefly explain.

7. (72 points, 24 minutes) Acme Co. hires employees to sell magazine subscriptions that sell for \$20 each. Employees can exert effort, e , to increase sales. In particular, employees know that the quantity of subscriptions sold each week is:

$$Q = 10 + 2e$$

However, employees do not like to exert effort but do like wages, w . The utility of a typical worker is given by:

$$U = w - e^2/2$$

(7a) Employees are paid a fixed salary of \$200 per week ($w = 200$). If employees choose effort to maximize utility, how much effort do they put in? How many sales are produced per employee? What are Acme's profits per employee?

(7b) Instead, Acme decides to charge a franchise fee of \$200 per week and the employee will keep the magazine revenues. In particular, employees receive

$$w = -200 + 20Q$$

How much effort does the employee exert under this arrangement? How many sales are produced per employee?

(7c) If the employee's best option for alternative work provides a wage of \$200 at an effort of zero, what is the maximum franchise fee that Acme can charge and still attract the employee?

8. (72 points, 24 minutes) Accounet, Inc. produces specialized acoustic coupler gateways (ACG's) that are a key component in state-of-the-art digital audio equipment. They are a major producer, with production facilities in New Jersey, New York and Connecticut. They have divisions for distribution of ACG's in Europe, the United States and Japan. These are separate markets, so pricing in one does not affect pricing in another. Your job is to solve for the optimal production and distribution quantities for their various divisions. All quantity values are in millions of ACG's and all cost and price values are in dollars per ACG.

Marginal costs of production are described as follows:

Facility 1: (NJ)	$MC = 1$	for $q \leq 5$
	$MC = q - 4$	for $q > 5$
Facility 2: (NY)	$MC = 1$	for $q \leq 10$
	$MC = q - 9$	for $q > 10$
Facility 3: (CT)	$MC = 1$	for $q \leq 8$
	$MC = q - 7$	for $q > 8$

Demand and costs of distribution and marketing are described as

Distributor 1: (US)	Distribution (processing) cost 3 per unit
	Demand: $p = 20 - .5 * q$
Distributor 2: (EU)	Distribution (processing) cost 4 per unit
	Demand: $p = 16 - .5 * q$
Distributor 3: (JP)	Distribution (processing) cost 5 per unit
	Demand: $p = 12 - .5 * q$

Finally, Accounet can convert transient coupler gateways (TCG's) to ACG's and vice versa, at 0 cost, using their patented ACG-TCG conversion process. There is a competitive market for TCG's, where any amount can be bought or sold at 2.00 per unit.

- (8a)** What is the optimal transfer price that Accounet, Inc. should use for ACG's. What are the optimal production quantities at each of the three facilities? What are the optimal quantities to distribute in the US, Europe and Japan markets? Are any ACG-TCG conversions done?
- (8b)** Suppose now that the competitive market for TCG's has a price of 1.30 per unit. Suppose that it costs .70 per unit to convert TCG's to ACG's, and .20 per unit to convert ACG's to TCG's. What is the optimal transfer price now? What are the optimal production quantities at each of the three facilities? What are the optimal quantities to distribute in the US, Europe and Japan markets? Are any ACG-TCG conversions done?

- (8c)** It is discovered that ACG's are essential for use in technology for detecting terrorist activities. As a matter of national security, Accountet allows the US government to control all distribution. In particular, Accountet disbands its EU and JP distributors, and the (remaining) US distributor fills government orders only. (Assume the conversion costs are as in (8b)).

The US government orders 36 million ACG's. What is the optimal transfer price that Accountet should use between their divisions? What are the optimal production quantities at each of the three facilities? Are any ACG-TCG conversions done?

- 9.** (93 points, 31 minutes) The ice-cream industry is a two-tiered monopoly: there is one producer, Dagen Hasz, and one distributor, Stop&Go. Dagen sets its wholesale price P_d (in \$ per pound) at which Stop & Go can buy ice-cream. On its turn, Stop&Go sets the final market price P_m (in \$ per pound) at which consumers can buy ice-cream. Assume for simplicity that the marginal costs of producing ice-cream and of distributing ice-cream are both zero. The demand for ice-cream by consumers is

$$Q = 10 - P_m$$

where the price is expressed in \$ per pound, and the quantities are million pounds of ice-cream.

- (9a) (i)** If the wholesale price would be $P_d = \$2$ per pound, what would Stop&Go choose optimally as its market price P_m ?
- (ii).** More generally, for a given wholesale price P_d , what is Stop&Go's optimal market price P_m ? Write the equation that relates P_d and Q .
- (iii)** Given your answer in ii., what is the optimal wholesale price P_d for Dagen to choose? How much profit do Dagen and Stop&Go make in this case?
- (9b)** Assume now that Dagen and Stop&Go merge (costs and demands stay the same). What is the optimal market price P_m for the merged company to charge, and what are total profits? How does this compare to your answer to (9a iii) and give a brief explanation for any difference.
- (9c)** Assume now that, instead of merging, Dagen and Stop&Go make a revenue-sharing agreement. In particular, Stop&Go sets the final market price P_m , but pays half its revenues to Dagen. In exchange, Dagen provides Stop&Go with all the ice-cream it needs to satisfy market demand at no cost (except for the share of revenue). What is the optimal price P_m for Stop&Go to set now? What are the firms' joint profits?
- (9d)** The relationship between the results of (9b) and (9c) depends importantly on the fact that $MC = 0$ here. As a general matter, if marginal costs are substantial, what would you expect to happen with revenue sharing?