

Midterm exam

Instructions: You have 75 minutes to complete this exam. Write your answers in the blue book provided to you. Credit, including partial credit, will depend principally on your explanations, so be sure to write thorough answers. Unsupported answers will receive 0 credit. Good luck!

1. A firm maximizes profit by producing a quantity such that marginal revenue equals to marginal cost.
 - a. **(5 points)** Explain why marginal revenue falls as output rises, for a monopolist.
 - b. **(5 points)** Marginal revenue is constant as output rises for a firm in a perfectly competitive market. Explain in words the economic intuition for this difference between the properties of the marginal revenue function for the competitive case and the monopoly case.

2. Chloe operates a donut shop. She estimates the price elasticity of demand for her product is $\epsilon = -1.4$. She is considering **increasing** her price by 10%. It costs Chloe $c(Q)$ to make Q donuts in a given day.
 - a. **(5 points)** Will Chloe's revenue increase or decrease (or is it uncertain)? Explain why.
 - b. **(5 points)** Will Chloe's profit increase or decrease (or is it uncertain)? Explain why.

3. Suppose Pazzo's and Mellow Mushroom are Bertrand competitors. Each has a marginal cost of \$7/pizza. The demand for pizzas is $Q = 2000 - 100P$.
 - a. **(5 points)** Explain why it is not a Nash equilibrium for both Pazzo's and Mellow Mushroom to charge a price of \$10.
 - b. **(10 points)** Suppose Pazzo's owner calls Mellow Mushroom's owner to suggest a more cooperative arrangement. If the two restaurants collude to set price in order to maximize total profits, what price will each restaurant charge?
 - c. **(5 points)** Suppose Mellow Mushroom charges the price you suggest in b. What is Pazzo's profit-maximizing price, given this?

4. **(10 points)** Briefly discuss the central tradeoff involved in determining for how long patents should be valid.

5. Two apple orchards in Door County, Wisconsin are Cournot duopolists. Each has to pay its workers \$12/bushel, but has no other marginal costs. The demand for apples is $P = 30 - \frac{1}{3}q_1 - \frac{1}{3}q_2$, where q_i is the number of bushels of apples orchard i sells on a given day.
 - a. **(10 points)** Show that in Nash equilibrium, each firm sells 18 bushels of apples each day and earns a daily profit of \$108.
 - b. **(5 points)** Now suppose that Orchard 1 has an opportunity to purchase the Applinator 5000, a robotic apple picker, for \$250/day. The Applinator 5000 will lower Orchard 1's labor cost to zero. Explain in words how this could possibly be worth it, given i) Orchard 1 spends only \$216 on labor without the Applinator 5000 and ii) Orchard 1 made a profit of only \$108 without the Applinator 5000?
 - c. **(Extra credit, 10 points)** Solve for the Nash equilibrium profits of both orchards if Orchard 1 does purchase the Applinator 5000.

6. The Springfield Isotopes, a minor league baseball team, have a stadium which seats 30,000 people. All seats are identical. The optimal ticket price is \$5, yet this results in an average attendance of only 20,000 people.

a. **(5 points)** Explain how it can be profitable to have 10,000 empty seats.

b. **(5 points)** Next week the Isotopes play the Capital City Goofballs, who have offered to buy an unlimited number of tickets at \$4 each, to be resold only in Capital City. How many tickets should be sold to Capital City to maximize the Isotopes' profit? 10,000? More than 10,000? Explain.

c. **(5 points)** Given your answer to b, what price should the Isotopes charge their own fans? \$4? \$5? More?

7. **(5 points)** You have already sold 200 doses of a new medicine you've developed. Here is your average total cost schedule:

Q	ATC
199	\$199
200	\$200
201	\$201

Your roommate offers to buy another dose from you for \$300. Should you accept her deal? Explain briefly.

8. **(5 points)** Initech uses two inputs to produce software: programmers (P) and managers (M). Initech's isoquants have the usual smooth, curvy shape. A programmer costs \$200 per day; a manager costs \$500/day. At the current level of output, the marginal product of a programmer is an additional 500 lines of code per day, while the marginal product of a manager is 1000 more lines of code per day. Is this firm producing at minimum cost? If so, explain why. If not, explain how the firm should change the ratio of inputs it uses to lower its cost.

9. **(10 points)** Each firm in a competitive market has a cost function of $c(q) = 16 + q^2$, and a marginal cost of $MC = 2q$. The market demand function is $Q = 24 - p$. Determine the number of firms active in the long run.

10. **(Extra credit: 5 points)** Write down any integer between 0 and 1000, inclusive. Your classmates will all do the same. I will do the following: tabulate all entries, find the highest number anyone has written down, and then award 5 points to the student who is closest to 90% of this highest number, without going over. If more than one student writes down the winning number, I will randomly choose one student to get the five extra points.

11. **(Bad grade insurance)** I am offering bad grade insurance. How this works: if you want to buy the insurance, you "pay" me a premium of 1 exam point. If, after grading is completed, your grade is below the course median, your policy will pay out 2 points. Thus, if you buy the insurance and finish below the median, you gain a point, while if you buy the insurance and finish above the median, you will lose a point. Mark in your blue book whether you wish to purchase the insurance or not.