Intermediate Microeconomics 301
Final Exam
Section 1
Wednesday May 3, 2006

Time: 2 hours.

Instructions. To obtain credit, you must give arguments to support your answer. The numbers in brackets at the start of each question are the numbers of points the questions are worth.

Exercise 1 [15]: Consumer theory

The utility that Paula receives by consuming good \( X \) and good \( Y \) is given by \( U(X, Y) = X^2Y \).

1. Draw her indifference curve associated with a utility level of 2, and the indifference curve associated with a utility of 4.

2. Suppose good \( X \) costs $4 a unit, good \( Y \) costs $2 a unit, and Paula has $50 to spend on both goods. Graph the budget line she faces.

3. What is the utility-maximizing choice of good \( X \) and good \( Y \)?

4. What is the marginal rate of substitution of good \( X \) for good \( Y \) when utility is maximized?

5. Suppose that Janet buys 2 units of good \( X \) and 4 units of good \( Y \) with her $50 budget. Would her marginal rate of substitution of good \( X \) for good \( Y \) be greater or less than \(-2\)? Explain.

Exercise 2 [25]: Producer theory

If each competitive firm in an industry has the short-run cost function \( C(q) = 200 + \frac{1}{2}q^2 \),

1. What is the individual supply of each firm? Represent the supply function in a graph.

2. If the market price is $20, what is the profit-maximizing output level for each firm? What is the total revenue? What are the profits?

Exercise 3 [20]: Supply and Demand

Joe and Rita are the only people in town that like peppermint stick ice cream. Joe’s demand is given by the equation \( P = 10 - 2Q \), and Rita’s demand is \( P = 10 - Q \).

1. What is the total town demand?

2. Suppose Frank moves to town. His demand is given by the equation \( P = 10 - 3Q \). Now what is the total demand?
Exercise 4 [15]: Nash Equilibrium
In the following game, players must move simultaneously.

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<tbody>
<tr>
<td>L</td>
<td>a, b</td>
<td>5, 0</td>
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<tr>
<td>M</td>
<td>1, 3</td>
<td>0, 0</td>
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What are the Nash equilibria of the game? How many are there?

a. when \( a > 1 \) and \( b > 0 \).
b. When \( a = 0.5 \) and \( b > 0 \).
c. When \( a > 1 \) and \( b = -1 \).

Exercise 5 [25]: Oligopoly

1. In a Cournot duopoly, each firm has a marginal cost of 40 (i.e., the total cost for each firm \( i \) is \( c_i(q_i) = 40q_i \)), and market demand is \( Q = 100 - 2p \) (recall that \( Q = q_1 + q_2 \)).

1. What are the best response functions of each firm?

2. What is the best output level for each firm?

3. How does the total output level compare to the cartel output level?