HAND IN
Answers recorded on exam paper

Faculty of Arts and Sciences
Queen's University
Economics 212
Microeconomic Theory
Final Exam
April 15, 2019
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Instructions

- The exam is THREE hours in length.
- CALCULATORS ALLOWED: Casio 991 calculator.
- The exam consists of two sections: Section A has five short answer questions and is worth 25 marks and Section B has five problems and is worth 75 marks.
- Please write your answers in the space provided in this booklet. You may do rough work on the back of the pages or continue an answer there if you run out of space. Please indicate that your answer continues on the back of the page.
- For full marks you must correctly derive your answers and show all work.
- Proctors are unable to respond to queries about the interpretation of exam questions. Do your best to answer the exam questions as written.
- Please write your student number and section of the course in the space below.
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STUDENT NUMBER:

SECTION:

Section A: Five questions, each worth 5 marks, for a total of 25 marks.

1. Assume the firm uses a Cobb-Douglas technology. "In the long-run, an increase in the wage rate will increase the cost of producing a given level of output because the firm uses less capital and more labour." Explain and illustrate whether this statement is true, false or uncertain.

2. The short-run total cost of a perfectly competitive firm is given by $STC(q)=1200+10q+4q^2$, where q is the firm's output. Derive the short-run supply function of the firm. Assume there are 1000 identical firms in the industry. Derive the market supply function.

3. The demand for a good is given by $Q^D = 2000 - 5P$ and the supply of the good is given by $Q^S = 15P - 200$. Determine how a 20% tax on the good is shared between producers and consumers.

4. A firm produces output, Q, using capital, K, and labour, L, according to the production function $Q = 4L + 8K$. The firm faces a wage rate of \$20 per unit and a rental rate on capital of \$60 per unit and wishes to produce 1400 units of output. Determine the cost-minimizing bundle of inputs and the cost of producing 1400 units of output.

5. Consider a monopolist with a cost function given by C=1000+30Q and facing an inverse demand given by P=7500-10Q. Determine the profit maximizing values of price and market output.

Section B: Five problems, each worth 15 marks, for a total of 75 marks. Each part of each question is worth five marks.

1. A perfectly competitive firm has a production function given by $Q=LK^2$, where Q is output, L is labour and K is capital. Input prices are given by w (wage) and r (rental rate on capital).
    a) Derive the conditional input demand functions of the firm.

b) Derive the long-run total cost function for the firm.

c) In the short run the amount of capital is fixed at 4 units. Derive the short run demand for labour, the short run total cost function and the short run inverse supply function (ignore shutdown conditions). Roughly sketch this supply function.

2. The long-run cost function of a firm in a perfectly competitive market (made up of many identical firms) is given by $C(q)=400q-4q^2+.2q^3$, where q is firm output. Market demand is given by $Q^D=15{,}000-5P$, where Q is market output and P is price.
    a) Solve for the long-run equilibrium values of price, output per firm, the number of firms and market output.

    b) A manufacturing industry consists of many identical firms. Each firm has a U-shaped average cost curve where the minimum of average cost occurs at an output of 5 million units and where the value of minimum average cost is \$8/unit. Market demand for the good is given by $Q^D=8000-10P$, where demand is measured in millions of units and P is market price. Determine the long run equilibrium price, output per firm, market output, and the number of firms in the long-run equilibrium.

c) In the short-run, the supply curve of a perfectly competitive industry is the horizontal summation of the individual firm supply curves. Why is the long-run supply curve of the industry not merely the horizontal summation of the individual firm supply curves?

3. Consider a duopoly that faces a market demand given by P=20,000-10Q, where P is product price and Q is market output. The two firms in the market have cost structures as follows: firm 1 has costs given by C_1= 4000q_1, while firm two has costs given by C_2=400q_2, where subscripts indicate the respective firms. The output in the market is equal to the sum of the firm outputs.
   a) Solve for the Cournot equilibrium values of price, market output and firm outputs.

b) Suppose firm 2 chooses its output level first and firm 1 follows. Solve for the Stackelberg equilibrium values of price, market output and firm outputs.

c) Assume inverse market demand is given by P=70-2Q, where Q is market output. Each firm in the market has a constant marginal cost equal to $10 per unit (fixed costs are zero). Compare the market price and output level in a perfectly competitive market structure with the market price and output levels that would occur in a Cournot duopoly. Show the two outcomes on an appropriately drawn inverse demand curve.

4. The market for tons of gravel is characterized by a demand function of the form $Q^D=30,000-200P$ and a supply function of the form $Q^S= 300P - 20,000$, where P is the price per ton.
   a) Determine the equilibrium values of the price per ton and the number of tons transacted. Calculate the elasticities of supply and demand at the equilibrium.

   b) The government levies a tax on gravel at the rate of $50 per ton. Explain how the tax is shared between producers and consumers and how the quantity of gravel is affected by the tax. Explain how the elasticities calculated in part a) relate to the shared tax burden.

c) Return to the situation in part a) and explain how a production quota in the amount of 9000 tons will affect the market price and quantity of gravel. Explain how consumers and producers are differentially affected by the tax versus the quota.

5. Consider the payoff matrix below, which shows two players each with three strategies.

		Player 2		
		A2	B2	C2
Player 1	A1	24, 15	17, 21	20, 20
	B1	19, 21	18, 20	21, 22
	C1	22, 14	21, 19	17, 18

a) Find all Nash equilibria in pure strategies for this simultaneous choice, one-play game. Explain your reasoning.

b) Draw the game in extended form and solve assuming sequential choice, with player 2 choosing first.

c) Professor X announces that he will auction off $20 in a competition between two students. Each student has two loonies (one dollar coins) to use in the bidding and may offer a bid of $2, $1, or $0. The bids are written on a piece of paper and privately submitted at the same time to Professor X. The highest bid wins the $20. In the event of a tie, the students split the $20 evenly. The catch is that each student must pay the amount of his or her bid to Professor X regardless of who wins the auction. Create a 3x3 payoff matrix that describes the game. The payoffs should represent any winnings minus the bid amount (a payoff can be negative if a student makes a positive bid but loses the auction to a higher bid). Solve the game for all Nash equilibria.