

# Final Exam

Economics 212 - Microeconomic Theory

Faculty of Arts and Sciences Queen's University

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Summer 2019

## Instructions:

- Please clearly write your answers in the answer booklets provided.
- Make sure to record your student number on the front of all booklets used.
- The exam is **three hours** in length.
- Calculators allowed: **Casio 991**
- There are 9 questions that add up to a **total of 100 points**.
- 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, **state any assumptions that you make**.

## Questions:

1. (10pts total) Jill has a quasi-linear utility function of the form  $U(x, y) = \sqrt{x} + 5y$ . Let  $I$  denote her total income and  $P_x$  and  $P_y$  denote the prices of good  $x$  and good  $y$ .
  - (a) (5pts) Derive Jill's demand curve for  $x$  as a function of the prices,  $P_x$  and  $P_y$ . Verify that the demand for  $x$  is independent of the level of income at an interior optimum.
  - (b) (5pts) Derive her demand curve for  $y$ . What happens to the demand for  $y$  as  $P_x$  increases? Is  $y$  a normal good?
2. (10pts total) Consider a simplified world in which Jarone and Ralph are the only people that consume oatmeal cookies. Assume their respective inverse demand curves for oatmeal cookies are  $P = 12 - 4Q_J$  and  $P = 30 - 5Q_R$ .
  - (a) (5pts) Derive the market demand curve for  $Q^m$  as a function of  $P$ , where  $Q^m$  is the total demand from all consumers.
  - (b) (2pts) For what values of  $Q^m$  will only one person consumer oatmeal cookies? Will it be Jarone or Ralph?
  - (c) (3pts) Draw a graph of the market demand curve with  $Q^m$  on the horizontal axis, and  $P$  on the vertical axis. Label both of the intercepts and the kink point in the demand curve.

3. (15pts total) Suppose the market supply curve is given by  $Q_s = 40 + 30P_s$  and the market demand curve is given by  $Q_d = 400 - 15P_d$ .
- (a) (3pts) Solve for the equilibrium market price and quantity.
  - (b) (4pts) What is the consumer surplus in the market equilibrium?
  - (c) (4pts) Now suppose the government imposes a price ceiling of \$10. What amount is traded in the market (*assume the government does not purchase excess supply*)? Now what is the consumer surplus?
  - (d) (4pts) Draw a clearly labeled graph with the market supply and demand functions, and the price ceiling. Label the areas for the consumer surplus, the producer surplus and the dead weight loss with the price ceiling.
4. (5pts total) Jeremy Lin has preferences over consumption ( $c$ ) and leisure ( $l$ ) given by:

$$u(c, l) = c^{2/3} l^{1/3}$$

Derive his marginal utility of consumption and his marginal utility of leisure.

5. (15pts total) Suppose you have 120 hours per week to divide between work ( $L$ ) and leisure ( $R$ ). Your preferences over consumption and leisure are  $u(C, R) = \min\{C, R\}$ , and your wage is \$25 per hour. The price of  $C$  is \$1.
- (a) (5 marks) Draw and properly label a graph of your budget constraint with  $R$  on the horizontal axis and  $C$  on the vertical axis.
  - (b) (5 marks) Solve for your optimal bundle of  $C$  and  $R$ .
  - (c) (5 marks) Now suppose the government introduces universal basic income and gives everyone \$500 no matter how much you work. Solve for your new optimal bundle of  $C$  and  $R$  under the new policy.
6. (10pts) Andrea operates a landscaping company and uses labour ( $L$ ) and capital ( $K$ ) to build fences ( $Q$ ). Her production function is:

$$Q = L^{\frac{2}{3}} K^{\frac{1}{4}}$$

Solve for both of her input demands, and her cost all as functions of  $Q$ ,  $w$  (the cost of labour), and  $r$  (the cost of capital).

7. (10pts total) Consider two lotteries A and B.

- Lottery A: 50% chance of winning \$400 and a 50% chance of winning \$1200
- Lottery B: 80% chance of winning \$500 and a 20% chance of winning \$2000

- (a) (4 marks) Calculate the expected value of lottery A and B.
- (b) (6 marks) Suppose Jenny has preferences  $u(I) = \sqrt{I}$ . Which lottery will she prefer?

8. (15pts total) Consider a duopoly that faces a market demand given by  $P = A - 2Q$ , where  $P$  is product price,  $Q$  is market output, and  $A$  is a parameter in the demand function. Firm 1's costs are given by  $C_1 = 6q_1$ , while firm 2's costs given by  $C_2 = 8q_2$ , where subscripts indicate the respective firms. The total output in the market is equal to the sum of the firm outputs.
- (5 marks) Solve for the Cournot equilibrium values of price, market output and firm outputs.
  - (5 marks) Suppose firm 1 chooses its output level first and firm 2 follows. Solve for the Stackelberg equilibrium values of price, market output, and firm outputs.
  - (5 marks) Now suppose that the two firms merge and become a monopolist in the market. The new firm decides to produce using only the factory of firm 2. Solve for the equilibrium values of price and output. Was the decision to use firm 2's factory profit maximizing?
9. (10pts total) Suppose two firms (firm 1 and firm 2) compete in a market for breakfast cereal; there are no other firms in the market. For simplicity assume they can each set either a high price or a low price, and let their profit conditional on their price and their opponents price be given in the following game:

		Firm 2	
		High price	Low price
Firm 1	High price	(50, 50)	(10, 60)
	Low price	(40 + x, 40 - x)	(20, 20)

Assume that  $x > 0$  when answering the following.

- (5pts) For what values of  $x$  do both firms have a dominant strategy? What is the Nash equilibrium (or equilibria) in these cases?
- (5pts) For what values of  $x$  does only one firm have a dominant strategy? What is the Nash equilibrium (or equilibria) in these cases?

