QUEEN'S UNIVERSITY FINAL EXAMINATION
FACULTY OF ART AND SCIENCE
DEPARTMENT OF ECONOMICS

Microeconomic Theory I ECON 212, SECTION 001-002
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INSTRUCTIONS TO STUDENTS:

1. This examination is 3 HOURS in length.
2. There are four short answer questions, with multiple parts per question.
3. There is no choice. Please answer ALL questions in the answer booklets.
4. Put your student number on all pages of all answer booklets, including the front.
5. Put your **section number** on the front page of all answer booklets. (Yiran Gong-001; Rajni Dogra-002)

The following aid is allowed:
Casio FX-991 calculator

GOOD LUCK!

PLEASE NOTE:
Proctors are unable to respond to queries about the interpretation of exam questions.
Do your best to answer exam questions as written.

1. Will's preferences over butter and Nutella can be represented by the following utility function: $u(x, y) = \sqrt{4x + 3} + 2y$, where x denotes his consumption of butter and y denotes his consumption of Nutella. He has \$8 to spend on these two goods each day. The price of butter is \$1.

(a) When the price of Nutella is \$1, what is Will's optimal choice of butter and Nutella? (**3 points**)

(b) When the price of Nutella is \$6, what is Will's optimal choice of butter and Nutella? (**3 points**)

(c) When the price of Nutella increases from \$1 to \$6, calculate Will's substitution effect and income effect. (**5 points**)

(d) According to your calculation in (c), is Nutella a normal good or an inferior good? Explain. Is Nutella an ordinary good or a Giffen good? Explain. (**4 points**)

2. Cameron runs a dessert shop in Napanee. She uses mixers (x_1) and machines (x_2) to make baklavas. Her production function is $f(x_1, x_2) = x_1^{\frac{1}{3}} x_2^{\frac{1}{3}}$. The price of baklavas is \$20, the price of mixers is \$5, and the price of machines is \$2.

(a) Calculate the marginal product (MP_1) for the mixers. Does the production function have increasing, decreasing, or constant marginal product for the mixers? (**2 points**)

(b) Suppose in the short run the amount of machines she has is fixed at 27. How many mixers should she use? How many baklavas will she produce? How much profit will she make? (**4 points**)

(c) Using an isoprofit line, as well as the production function, draw a diagram of your solution from (b). Carefully label all the intercepts and slopes. (**3 points**)

(d) In the long run, how many mixers should she use? How many machines? How many baklavas will she make? (**4 points**)

(e) Suppose that the government decides to provide a \$1 subsidy per mixer. What is the profit-maximizing amount of each input to use now? (**2 points**)

3. Spark Studio produces commercials for other companies. A 2-minute commercial, for example, needs exactly 5 minutes of filming and 8 minutes of editing. Let x_1 denote the minutes of filming and x_2 denote the minutes of editing.

(a) Write down Spark Studio's production function $f(x_1, x_2)$. (*Hint: it should have the form* $f(x_1, x_2) = \min\{ax_1, bx_2\}$.) **(2 points)**

(b) Does this production function have constant, increasing, or decreasing returns to scale? **(2 points)**

(c) Suppose that filming costs \$45 per minute and that editing costs \$10 per minute. To produce a 5-minute commercial, how many minutes of filming and how many minutes of editing does Spark Studio need to minimize the cost? How much is this minimum cost? Draw a graph of the isoquant and isocost line to show this optimal bundle. **(5 points)**

(d) Suppose that filming costs w_1 per minute and that editing costs w_2 per minute. Let y denote the length (in minutes) of commercials produced. Derive Spark Studio's conditional factor demand functions $x_1(w_1, w_2, y)$ and $x_2(w_1, w_2, y)$ and its cost function $c(w_1, w_2, y)$. **(4 points)**

(e) Rocket Media, another commercial production company, uses a different technology. The length of commercials it produces is equal to the longer of the two: one-third of the length of filming and one-fourth of the length of editing. When $w_1 = 15$ and $w_2 = 10$, derive Rocket Media's cost function $c(y)$. **(3 points)**

4. Pot & Gold Inc. makes and sells Christmas ornaments in a perfectly competitive market. Its production function is given by $f(x, z) = \sqrt{x + \frac{3}{2}z}$, where x denotes the amount of plastic and z denotes the amount of wood. The price of plastic is w_1 and the price of wood is w_2. Let y denote the amount of Christmas ornaments produced and p denote the price of Christmas ornaments ($p > 0$).

(a) Calculate the technical rate of substitution TRS. **(1 point)**

(b) Derive the cost function $c(w_1, w_2, y)$ for Pot & Gold Inc. **(4 points)**

(c) When $w_1 = 5$ and $w_2 = 8$, calculate the average cost $AC(y)$ and the marginal cost $MC(y)$. For $y > 0$, which one is larger, $AC(y)$ or $MC(y)$? **(3 points)**

(d) When $w_1 = 8$ and $w_2 = 9$, derive the supply function $y(p)$ for Pot & Gold Inc. **(3 points)**

(e) Suppose that Pot & Gold Inc. has to pay a quasi-fixed cost of \$50. When $w_1 = 8$ and $w_2 = 9$, derive the supply function $y(p)$ for Pot & Gold Inc. **(3 points)**