QUEEN'S UNIVERSITY FINAL EXAMINATION
FACULTY OF ARTS
DEPARTMENT OF ECONOMICS

ECON 212, 001-002 – MARKO TESIC
April 17, 2021

INSTRUCTIONS TO STUDENTS:
This examination is 30 HOURS in length.
There are two sections to this examination.

> **The following aids are allowed:**
> Casio FX-991 calculator
> Dictionary

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.

Section A: Four questions @ 5 marks. Total 20 marks.

1. For the following production functions, draw a graph of two isoquant curves with L on the horizontal axis and K on the vertical axis, corresponding to $Q(L, K) = 10$ and $Q(x, y) = 20$. Label all relevant points.
   a. $Q(L, K) = \min(3L, 4K)$
   b. $Q(L, K) = KL^{1/2}$

2. A firm is using 7 units of labor and 100 units of capital to produce 1000 units of goods. At these levels of inputs, the marginal product of labor is 5 and the marginal product of capital is 50. The cost of labor is \$15 per unit and the cost of capital is \$2 a unit. Is the firm minimizing its costs? If not explain how the firm could save on costs while still producing 1000 units.

3. Firm A and Firm B produce a homogenous good and compete via Bertrand competition. That is, they both post prices consumers see both prices and go to the firm with the lowest price. If the marginal cost of production is c_a for Firm A and c_b for Firm B, what will be the equilibrium price if $c_a < c_b$?

4. The demand curve for a good has the form $Q = P^{-\epsilon}$ with $\epsilon < 1$, it has constant elasticity of demand. Suppose a monopolist with marginal cost equal to c supplies the market with $\bar{Q}$ units of goods. Could the monoplist increase their profits, if so how? What does this imply about the equilibrium price and quantity?

Section B: Four question @ 20 marks. Total 80 marks

1. A firm produces goods with capital (K) and labor (L) using the production function $Q(L, K) = L^{1/4}K^{3/4}$. The cost of a unit of capital is r, and the cost of a unit of labor is w.
   a. [10 Marks] Find the firms optimal input demand functions when it needs to produce $\bar{Q}$ units of goods.
   b. [5 Marks] Find the firms total cost function in the long run.
   c. [5 Marks] Draw a graph showing the firms optimal demand for capital as a function of its price, r.

2. Consider a market with demand given by $Q_d = a - bp$ and supply given by $Q_s = dp$. Suppose the government imposes a tax per unit equal to T.
   a. [5 Marks] Suppose that $d > 0$, what must the value of b be for consumers to bear the whole burden of the tax? Now suppose that $b > 0$ what must the value of d be for suppliers to bear the whole burden of the tax?
   b. [10 Marks] Find an expression for the deadweight loss generated by the tax.
   c. [5 Marks] Suppose the government wishes the equilibrium quantity to be $\bar{Q}$, which is less than the equilibrium quantity, what should the tax be per unit of good?

3. Suppose market demand is $Q_d = a - bp$ and each firm has a total cost function given by $TC(Q) = Q + eQ^2 + e$
   a. [5 Marks] Prove that if $P = AC$ each firm will earn zero profits. Then prove that $P = AC$ when firms earn zero profits.
   b. [10 Marks] Solve for the equilibrium price, market output and number of firms.
   c. [5 Marks] What happens to the number of firms in equilibrium as e falls, but is still positive? Can you solve for the number of firms in equilibrium when $e = 0$?

4. Consider a market where demand is given by $P = 100 - Q$.
   a. [5 Marks] Suppose a monopolist with marginal cost equal to 10 supplies the market, find the equilibrium quantity price and profits for the monopolist.
   b. [10 Marks] Suppose now that two firms who compete via Cournot competition supply the market. They each have marginal cost equal to 10. Find the equilibrium quantity price and profits for each firm.
   c. [5 Marks] Consider a simultaneous move game where the strategies for each firm is to produce according to their best response function in the Cournot equilibrium or half the monopoly quantity. Construct the payoff matrix for this game and find the Nash Equilibrium. Are the firms happy with this outcome, that is by playing other strategies could both firms do better than in the Nash Equilibrium?