Bowen University
College of Management and Social Sciences

Economics Programme

BSc. Degree Examination

First Semester 2020/2021 Academic Session

COURSE CODE: ECN 303 [2 Credits] **COURSE TITLE: Mathematical Economics**

DATE: 27 March 2021 **TIME ALLOWED: 2 hours 15 minutes**

INSTRUCTION: Answer any **four** questions

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1 (a) Verify the commutative law, the associative law, and the distributive law, given that

A = {6, 7}, B = {5, 8, 9}, and C = {4, 5}.

(b) Given that **S_1 = {3, 6, 9}, S_2 = {a, b}, and S_3 = {m, n}**, Find the cartesian products:

(i) $S_1 \times S_2$ (ii) $S_2 \times S_3$ (iii) $S_3 \times S_1$ (iv) $S_1 \times S_2 \times S_3$

In general, is it true that $S_1 \times S_2 = S_2 \times S_1$? Under what conditions will these two cartesian products be equal?

2. Find the equilibrium solution for each of the following models:

(a)
$Q_d = Q_s$
$Q_d = 3 - P^2$
$Q_s = 6P - 4$

(b)
$Q_d = Q_s$
$Q_d = 8 - P^2$
$Q_s = P^2 - 2$

(c) Given the cost function of a firm as $\mathbf{C = q^3 - 5q^2 + 8q + 5}$ and the market price as ₦50

(i) Identify the cost function
(ii) Find the marginal and cost
(iii) State the condition for profit maximization
(iv) Determine the output where highest profit is attainable

3 Given in a two-commodity market model:

(a)
$Q_{d1} - Q_{s1} = 0$
$Q_{d1} = a_0 + a_1P_1 + a_2P_2$
$Q_{s1} = b_0 + b_1P_1 + b_2P_2$

$Q_{d2} - Q_{s2} = 0$
$Q_{d2} = \alpha_0 + \alpha_1P_1 + \alpha_2P_2$
$Q_{s2} = \beta_0 + \beta_1P_1 + \beta_2P_2$

(b)
$Q_{d1} - Q_{s1} = 0$
$Q_{d1} = 10 - 2P_1 + P_2$
$Q_{s1} = -2 + 3P_1$

$Q_{d2} - Q_{s2} = 0$
$Q_{d2} = 15 + P_1 - P_2$
$Q_{s2} = -1 + 2P_2$

Find P_1*, P_2*, Q_1*, and Q_2*.

(c) The demand and supply functions of a two-commodity market model are as follows:

$Q_{d1} - Q_{s1} = 0$
$Q_{d1} = 18 - 3P_1 + P_2$
$Q_{s1} = -2 + 4P_1$

$Q_{d2} - Q_{s2} = 0$
$Q_{d2} = 12 + P_1 - 2P_2$
$Q_{s2} = -2 + 3P_2$

Find P_1*, P_2*, Q_1*, and Q_2*.

4 (a) Given the following model:

$Y = C + I_0 + G_0$

$C = a + b(Y - T)$ $\quad (a > 0,\ 0 < b < 1)$ $\quad$ [T: taxes]

$T = d + tY$ $\quad (t > 0,\ 0 < t < 1)$ $\quad$ [t: income tax rate]

(i) How many endogenous variables are there?

(ii) Find Y^*, T^*, and C^*.

(b) Let the national-income model be:

$Y = C + I_0 + G_0$

$C = a + b(Y - T_0)$ $\quad (a > 0,\ 0 < b < 1)$

$G = gY$ $\quad (0 < g < 1)$

(i) Identify the endogenous variables

(ii) Give the economic meaning of the parameter g.

(iii) Find the equilibrium national income, Y^*

(iv) What restriction on the parameters is needed for a solution to exist?

(c) Find Y^* and C^* from the following:

$Y = C + I_0 + G_0$

$C = 25 + 6Y^{1/2}$

$I_0 = 16$

$G_0 = 14.$

5 (a) An appliance store has 25 refrigerators, 30 ranges, and 10 dishwashers in stock, and a second store with 15 refrigerators, 25 ranges, and 20 dishwashers in stock. If the value of each refrigerator is $600, each range is $300 and each dishwasher is $250, find the total value of the inventory at the two appliance stores.

(b) A pet store has 6 kittens, 10 puppies, and 7 parrots in stock, and a second store with 8 kittens, 14 puppies, and 9 parrots in stock. If the value of each kitten is $55, each puppy is $150 and each parrot is $35, find the total value of the pet store's inventory.

6. Consider the following two markets model

$Q^d_1 = 20 - P_1 + 2P_2$ $\qquad$ $Q^s_1 = 2P_1 - 2$

$Q^d_2 = 18 - 2P_2 + 3P_1$ $\qquad$ $Q^s_2 = 2 + 4P_2$

(a) What relationship in demand do these goods have?

(b) Use Cramer's rule to find the inverse demand functions

$P_1 = P_1(Q_1, Q_2)$ $\qquad$ $P_2 = P_2(Q_1, Q_2)$.