National University of Lesotho

B.A Examinations

EC3301: Microeconomics Analysis

JANUARY 2024 **100 MARKS** **3 HOURS**

INSTRUCTION:
Answer **Question 1** and ***any*** other **3 questions**

Question 1 (Compulsory)

a. Lesotho's footwear industry currently consists of two footwear manufacturers, one in Maseru and the other in Maputsoe. In Maseru, the marginal benefit associated with pollution cleanup is $MB = 300 - 10Q$, while in Maputsoe, the marginal benefit associated with pollution cleanup is $MB = 200 - 4Q$. Suppose that the marginal cost of cleanup is constant at M12 per unit.

   i. What is the optimal level of pollution cleanup in each of the 2 industries? **[6]**

   ii. Assume that external cost from pollution caused by each firms is M10 per unit, calculate the optimal level of pollution cleanup in each of the 2 industries **[4]**

b. Consider that the supply curve for cold drink is given by $Q^s = 20 + 4P$ and the demand for cold drink is given by $Q^d = 50 - 2P$. Suppose that a tax is imposed on the production of cold drink of M3 per unit. Calculate,

   i. pre-tax and post-tax equilibrium price and quantity of beer. **[8]**

   ii. tax burden borne by the producer and consumer. **[7]**

c. Consider the market for potatoes with inverse demand given by $P = 30 - 2Q^d$ and inverse supply given by $P = 10 + 2Q^s$. Now suppose the government implements a price subsidy programme instead of the price support program. Let the government target price be M24.

   i. Calculate the equilibrium price and quantity. **[3]**

   ii. The government implements a unit subsidy (paid to the farmers) that will ensure that farmers receive a price (after the subsidy) of M24 for their potatoes. Calculate the new equilibrium prices and quantity. **[6]**

   iii. Suppose that the government is concerned about potato farmers' ability to earn adequate income from farming potatoes and decides to implement a price support policy whereby a price floor of M24 will be set in the market for potatoes and the government will purchase and destroy the surplus potatoes at a price of M24. Calculate the quantity exchanged in the marketplace, and the amount of potatoes purchased and destroyed by the government. **[6]**

Question 2

a. The production function is given as $f(l) = 20l - l^2$ and the price is normalised at 1. Let w be the price of the l-input.

   i. Find the factor demand function **[5]**

   ii. What is the profit function? **[7]**

b. NUL Innovation Hub employs workers and machines according to the following production function, $f(L,K) = L^{\frac{2}{5}}K^{\frac{2}{5}}$ for producing high quality honey. The hourly cost of capital is *M10.00* and the hourly cost of labour is *M40.00*, while price of honey is given as *M281.17*. Using 2-step profit maximisation or cost minimization;

   i. Find the optimal output the hub produces **[6]**

   ii. Find the total cost of producing the optimal amount in (i.) above **[2]**

Question 3

a. Chakelo, a student who is faced with linear budget constraint has preferences over vacations (V) and meals (M) given by the following Cobb-Douglas utility function:

$$U(V, M) = V^2 M$$

Last year, the price of vacations was M200 and the price of meals was M50. This year the price of meals rose to M75 while the price of vacations remained the same. In both years, Chakelo had income of M1,500. Calculate, for both vacations and meals, the:

i. Substitution effect **[6]**

ii. Income effect **[6]**

b. Assume a textile industry that produce pairs of jeans using only labour as its factor of payment. The production function is given as follows:

$$Q = l^{0.5}$$

Assume further that the firm is faced with wages of M2.30 per hour when workers work for 8 hours a day and sells a pair of jean for M250.00,

i. Find the profit-maximizing level of output. **[5]**

ii. Find monthly profit. **[3]**

Question 4

a. Consider the following strategic interaction between Bantu FC striker, who was fouled in the penalty area, and Matlama FC goalkeeper. Owing to the foul, Bantu FC striker has a penalty shot at a goal. For simplicity, assume that Bantu striker can shoot left or right and Matlama goalkeeper can dive left or right to try to save the penalty. Given that Bantu striker is right footed, he shoots better to the left than the right. Assume that if Bantu striker shoots left and Matlama goalkeeper dives to the left, Bantu striker scores with a probability of 65%, implying that Matlama goalkeeper saves with with probability of 35%. If instead, the striker shoots right and goalkeeper dives right, the striker has a 40% chance of scoring and thus the goalkeeper saves the shot with a probability of 60%. If the striker shoots left and the goalkeeper dives right, the striker will score with a 90% likelihood, implying that the goalkeeper saves with a probability of 10%. Finally, if the striker shoots to right and goalkeeper dives to left, striker has as 80% chance of scoring and thus goalie saves with probability of 20%.

i. Draw the game table for this interaction **[4]**

ii. Assume that the players play a mixed strategy, find the mixed strategy Nash Equilibrium **[8]**

b. Consider the following problem with the pay-offs given in Table 1. A supplier and a buyer need to decide whether or not to adopt a new purchasing system.

Table 1

	Buyer		
Supplier		New system	Old system
	New system	20,20	0,0
	Old system	0,0	5,5

i. What are the best strategies for both the supplier and the buyer? **[4]**

ii. What is the Nash Equilibrium? **[4]**

Question 5

a. Suppose you face a trade-off between work, earning a wage rate of M10 per hour, and leisure, l, with 60 total hours of endowment per week. Your current earnings can be consumed now as c_1 or saved for retirement consumption, c_2, at an interest rate of 5%. Given that consumption and leisure are normal goods and your tastes are represented by the following utility function:

$$U(c_1, c_2, l) = (c_1^{0.5} l^{0.5})^{0.5} c_2^{0.5}$$

What would be your optimal choice of consumption now and in the future as well as your optimal current leisure consumption? **[8]**

b. Consider the following von Neumann-Morgenstern Expected Utility Function:

$$U(x_B, x_G) = \delta u(x_B) + (1 - \delta) u(x_G)$$

where x_B and x_G represent the outcomes in the "bad state" and "good state", respectively and let δ be the probability of the "bad state".

Suppose an individual is faced with $x_B = 10$, $x_G = 250$, $\delta = 0.25$ and a function that allows to represent the consumer's tastes using the expected utility form is $u(x) = 0.5lnx$.

i. Show that the individual is risk averse. **[6]**

ii. Calculate the risk premium associated with this individual **[6]**