

LAIKIPIA



UNIVERSITY

## UNIVERSITY EXAMINATIONS

**2<sup>ND</sup> SEMESTER 2023/2024 ACADEMIC YEAR**

**SECOND YEAR EXAMINATION FOR THE  
DEGREE OF BACHELOR OF COMMERCE**

**BCOM 226: OPERATIONS RESEARCH 1**

***STREAM: R***

***TIME: 2 HRS***

***DAY: TUESDAY (2.30-4.30PM)***

***DATE: 16/4/24***

**THIS QUESTION PAPER CONSISTS OF FIVE (5 PAGES)**

**PLEASE DO NOT OPEN UNTIL THE INVIGILATOR SAYS SO.**



**INSTRUCTIONS:** Answer question **ONE** and any other **TWO** questions

**QUESTION ONE (30 MARKS)**

a).The Kencom Construction Ltd is using a planning net- work for one of its building projects. The net-work consists of nine activities A-I with the following dependencies and durations.

<u>Activity code</u>	<u>Duration of each Activity in days</u>	<u>Proceeding Activity</u>
A	8	–
B	10	–
C	9	–
D	12	A, B
E	9	B, C
F	11	C
G	16	C
H	14	E,F,D
I	3	D

**Required**

Draw the net-work for this project and determine how long the project will take to complete.  
(14marks)

b).Operations Research has become popular to analyzing and solving management problems.

**Required**

Discuss the major characteristics and extent to which operation research has gone in influencing the decision making process  
(8marks)



c).Game theory has been found to be helpful and effective decision making tool under competitive condition.

**Required:**

Discuss the characteristics which a competitive situation must have to constitute a game  
(8marks).

**QUESTION TWO (20 MARKS)**

Egerton University is planning to open a reception desk which will be staffed by one clerk. It is estimated that requests for admission and information average 15 per hour, and requests have a Poisson distribution. Service time is assumed to be exponentially distributed. Previous experience with similar reception desk operations suggest that mean service time should average about 3 minutes per request. Determine each of the following:

- |   |                  |
|---|------------------|
| a) System utilization.  | <b>(6 marks)</b> |
| b) Percentage of time the server (reception desk) will be idle. | <b>(2 marks)</b> |
| c) The expected number of customers waiting to be served.       | <b>(3 marks)</b> |
| d) The average time customers will spend in the system.         | <b>(3 marks)</b> |
| e) The probability of zero customers in the system.             | <b>(3 marks)</b> |
| f) The probability of four customers in the system.             | <b>(3 marks)</b> |

**QUESTION THREE (20 MARKS)**

A stock service offers three investment portfolios for its clients. Portfolio A contains speculative stocks which aim at capital gains through price appreciation; portfolio B's stocks emphasize stable dividend yields over the long run; and portfolio C contains stocks with a moderate potential for growth as well as stable dividend yields.



You are considering investing in one year but you know that the return on your investment will depend on whether the economy during that period is in a state of inflation, recession or depression are 0.40, 0.35 and 0.25 respectively.

	<u>State of economy</u>		
	<u>Inflation</u>	<u>Recession</u>	<u>Depression</u>
Portfolio A	100	50	- 60
Portfolio B	50	45	40
Portfolio C	70	50	- 10

The figures in the tables are in the thousands of shillings.

### Required

(a) If your sole objective is to maximize the return on your investment, which portfolio would you choose? (8marks)

b).An electronics firm carries out a small-scale test launch of a new low-priced pocket calculator. It estimates from this test that if it went into full-scale production it would sell between 1,000 and 2,500 calculators per month, and that its monthly revenue in thousands of shillings over this range of sales could be represented by the equation:  $R = -x^2 + 5x$ ; Where:  $x$  is the monthly output in thousands of calculators (it is assumed that it sells its entire output). From experience of calculator production, the firm estimates its marginal cost in thousands of shillings could be represented by the equation:  $MC = x^2 - x + 2$  and that its fixed costs will be Sh.500 per month.

### Required:

- i) Determine the average cost and revenue equations for this firm. (3 marks)
- ii) Determine the profit-maximizing output, (3 marks)
- iii) The price that should be charged to maximize profit, (3 marks)
- iv) How much each calculator will cost to make. (3 marks)



**QUESTION FOUR (20 MARKS)**

a).Acompany wishes to purchase additional machinery in a capital expansion program. Three types of machines are to be purchased: A, B, and C. Machine A costs \$25,000 and requires 200 square feet of floor space for its operation. Machine B costs \$30,000 and requires 250 square feet of floor space. Machine C costs \$22,000 and requires 175 square feet of floor space. The total budget for this expansion program is \$350,000. The maximum available floor space for the new machines is 4,000 square feet. The company also wishes to purchase at least one of each machine. Given that machines A, B, and C can produce 250, 260, and 225 pieces per day, the company wants to determine how many machines of each type it should purchase so as to maximize daily output (in units) from the new machines.

i).Explicitly define your decision variables and formulate the LP model. (4marks)

ii).Assess the validity of the four underlying LP assumptions for this problem. (4marks)

iii).Discuss the three phases of operations research process (6marks)

iv).Discuss how differential calculus is used by organizations in decision making (6marks)

