



THE CO-OPERATIVE UNIVERSITY OF KENYA

**SPECIAL / SUPPLEMENTARY EXAMINATION OCTOBER -2022
EXAMINATION FOR THE DEGREE OF BACHELOR OF COMMERCE
(YR III SEM I)**

UNIT CODE: BSTA 3107

UNIT TITLE: OPERATIONS RESEARCH

DATE: MONDAY 24TH OCTOBER, 2022

TIME: 2:30 PM – 4:30 PM

INSTRUCTIONS:

- Answer question ONE (compulsory) and any other TWO questions

QUESTION ONE

- (a) What is the main difference between **Least Cost Method** and **Vogel approximation Method (VAM)** (4 Marks)
- (b) How do you check for optimality in the **SIMPLEX method** (2 Marks)
- (c) Outline five steps in implementing Operations research (5 Marks)
- (d) Name and explain four types of integer programming (8 Marks)

- (e) State two benefits and two limitations of sensitivity analysis (4 Marks)

- (f) Find the dual of the following Linear Programming problem (7 marks)

$$\text{Max } Z = 3x_1 - 2x_2 + 4x_3$$

$$\text{Subject to } 3x_1 + 5x_2 + 4x_3 \geq 7$$

$$6x_1 + x_2 - 3x_3 \geq 4$$

$$7x_1 - 2x_2 - x_3 \leq 10$$

$$x_1 - 2x_2 + 5x_3 \geq 3$$

$$4x_1 + 7x_2 - 2x_3 \geq 2$$

$$x_1, x_2, x_3 \geq 0$$

QUESTION TWO (20 MARKS)

- (a) Define the following terminologies as used in Linear programming (6 Marks)

- Operations Research
- Linear Programming
- Sensitivity analysis

- (b) Identify two areas where operation research can be applied (2 marks)

- (c) For a maximization problem, which optimal z value is larger, an integer programming problem or its Linear programming relaxation? Give reason for your answer. (3 Marks)

- (d) A company that operates 10 hours a day manufactures 2 Paints on 3 sequential processes. The table below summarizes the data of the problem

Product	Process 1	Process 2	Process 3	Unit Profit
A	20	6	8	2
B	5	20	10	3

Determine the optimal mix of the two paints (9 Marks)

QUESTION THREE (20 MARKS)

- (a) Represent on the same graph the solution to the inequalities below and use your graph to determine the minimum and the maximum values of $3x + 4y$. **(10 Marks)**
 The inequalities are $x \geq 0$, $y \geq 0$, $x + y \leq 10$, $x + 2y \leq 16$

- (b) Use the SIMPLEX method to find the Maximum Value of $Z = 4x_1 + 6x_2$
 Subject to $-x_1 + x_2 \leq 11$
 $x_1 + x_2 \leq 27$
 $2x_1 + 5x_2 \leq 90$
 $x_1, x_2 \geq 0$

(10 Marks)**QUESTION FOUR (20 MARKS)**

- (a) Differentiate between simplex method and graphical method of solving Linear Programming Problem **(4 Marks)**
- (b) Between linear programming relaxation and integer programming which one have a larger feasible region and why? **(3 Marks)**
- (c) Use branch and bound algorithm method to solve **(10 Marks)**

$$\text{Max } Z = 5x_1 + 4x_2$$
 Subject to $x_1 + x_2 \leq 5$
 $10x_1 + 6x_2 \leq 45$
 $x_1, x_2 \geq 0$; Integers
- (d) State three conditions that will prompt you to **fathom/ terminate** a node in branch and bound algorithm. **(3 Marks)**

QUESTION FIVE (20 MARKS)

- (a) Solve the following assignment problem using Hungarian Method. The Matrix entries are representing the processing time for each person in hours. **(10 marks)**

	I	ii	iii	iv	v
1	20	15	18	20	25
2	18	20	12	14	15
3	21	23	25	27	25
4	17	18	21	23	20
5	18	18	16	19	20

- (b) Siginon freight company ships truckloads of grain from three silos to four mills. The supply (in truckloads) and demand (in truckloads) together with the unit cost of transportation per truckload on the different routes are summarized in the table below.

	D	E	F	G	AVAILABLE
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
REQUIREMENT	200	225	275	250	

Use the North west – corner method to minimize the cost of transportation **(10 Marks)**