UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR

SPECIAL/SUPPLEMENTARY EXAMINATIONS
YEAR THREE SEMESTER TWO

FOR THE DEGREE
(INFORMATION TECHNOLOGY)

COURSE CODE : **BIT 327**

COURSE TITLE : **OPERATIONS RESEARCH IN IT**

DATE: 10/08/2023   **TIME: 11.00AM - 1.00 PM**

INSTRUCTIONS TO CANDIDATES
ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

QUESTION ONE (COMPULSORY) [30 MARKS]

a. Define the following terms

    i.   Operations research

    ii.   Isocost line

    iii.   Optimal solution

    iv.   Variables

[4 marks]

b. Considering the simplex method of solving a linear programming problem, outline the conditions considered under net valuation row for optimality to be achieved for both maximization case and minimization case.

[2 marks]

c. Explain the importance of duality in solving linear programming problems. **[2 marks]**

d. Describe four different methods which can be applied to solve a linear programming problem.

[4 marks]

e. Consider the following linear programming inequalities:

Maximise $Z = 23a + 32b$ s.t.

$$10a + 6b \leq 2500$$
$$5a + 10b \leq 2000$$
$$2b \leq 500$$
$$a, b \text{ are } \geq 0$$

Convert the inequalities into equations and hence simplex format model to be solved using simplex method.

[5 marks]

f. Describe the term sensitivity analysis.

[2 marks]

g. State the changes which sensitivity analysis tests and can affect the optimal solution.

[3 marks]

h. Distinguish between deterministic and stochastic models of inventory. **[2 marks]**

i. Describe simulation technique as used in operations research. **[2 marks]**

j. The concept of duality problem is important for several reasons. Discuss. **[4 marks]**

QUESTION TWO [20 MARKS]

a. Describe different classifications of simulation models.

[4 marks]

b. State the characteristics of a good operations research model

[4 marks]

c. You have been hired as a chief executive officer by a computer solutions company in Kenya which is nicknamed as a 'sleeping giant' because the competitive edge it has in the current market for its product. The Board of Directors give you one month to table before them a strategy you will use to turn around the company's fortunes in terms of maximizing the profit made on the products manufactured. Applying operations research, describe the procedure you will follow to help the company maximize their profits.

[6 marks]

d. There are five jobs, which are to be processed on two machines A and B in the order AB. The processing times in hours for the jobs are given below. Stating the steps followed, find the optimal sequence and total elapsed time.

Jobs:	1	2	3	4	5
Machine A (Time in hrs.)	2	6	4	8	10
Machine B (Time in Hrs)	3	1	5	9	7

[6 marks]

QUESTION THREE [20 MARKS]

a. Operations research can be applied in real life scenarios to come up with an optimal solution to complex problems faced by man. Describe a real-life scenario where a transport model, sequencing model and an assignment model can each be applied for different organizations to either maximize their returns or minimize their costs. **[6 marks]**

b. Solve graphically the given linear programming problem.

Minimize $Z = 3a + 5b$ S.T

$$-3a + 4b \leq 12$$
$$2a - 1b \geq -2$$
$$2a + 3b \geq 12$$
$$1a + 0b \geq 4$$
$$0a + 1b \geq 2$$

And both a and b are ≥ 0.

[6 marks]

c. A company has five jobs V, W, X, Y and Z and five machines A, B, C, D and E. The given matrix shows the return in Rs. of assigning a job to a machine. Assign the jobs to machines so as to maximize the total returns. [8 marks]

Machines.
Returns in Rs.

Jobs	A	B	C	D	E
V	5	11	10	12	4
W	2	4	6	3	5
X	3	12	5	14	6
Y	6	14	4	11	7
Z	7	9	8	12	5

QUESTION FOUR [20 MARKS]

a. Generate the dual of the given linear programming problem:

Maximize $Z = 2a + 3b$ s.t.

$$1a + 4b \leq 10$$

$$2a + 3b \geq 12$$

and both a and b are ≥ 0.

[5 marks]

b. A company in India manufactures two products X and Y whose profit contributions are Rs.10 and Rs. 20 respectively. Product X requires 5 hours on machine I, 3 hours on machine II and 2 hours on machine III. The requirement of product Y is 3 hours on machine I, 6 hours on machine II and 5 hours on machine III. The available capacities for the planning period for machine I, II and III are 30, 36 and 20 hours respectively.

Generate a summarized table for the problem, the inequalities, equations simplex format of the equations.

Design the optimal product mix clearly showing your working. [15 marks]

QUESTION FIVE [20 MARKS]

a. Explain why it is not advisable to solve a problem having more than two decision variables using graphical method. **[2 marks]**

b. Contrast between transportation model and general linear Programming model. **[4 marks]**

c. A company manufactures two products X and Y. The profit contribution of X and Y are Ksh.3/- and Ksh. 4/- respectively. The products X and Y require the services of four facilities. The capacities of the four facilities A, B, C, and D are limited and the available capacities in hours are 200 hrs., 150 hrs., and 100 hrs. and 80 hours respectively. Product X requires 5, 3, 5 and 8 hours of facilities A, B, C and D respectively. Similarly the requirement of product Y is 4, 5, 5, and 4 hours respectively on A, B, C and D. Generate a summary table; equalities and equations for the problem. **[6 marks]**

d. A major sugar producing factory in Kenya has four regional factories producing sugar and the capacity of each factory is given below: Factory A produces 10 tons of sugar and B produces 8 tons of sugar, C produces 5 tons of sugar and that of D is 6 tons of sugar. The sugar has demand in three market areas X, Y and Z. The demand of market X is 7 tons, that of market Y is 12 tons and the demand of market Z is 4 tons. The following matrix gives the transportation cost of 1 ton of sugar from each factory to the destinations. Applying North-west corner method, find the Optimal Solution for least cost transportation cost. **[8 marks]**