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(*Knowledge for Development*)

KIBABII UNIVERSITY

(KIBU)

UNIVERSITY EXAMINATIONS
2020 /2021 ACADEMIC YEAR

END OF SEMESTER EXAMINATION
YEAR THREE SEMESTER TWO EXAMINATION

FOR THE DEGREE
(INFORMATION TECHNOLOGY)

COURSE CODE : BIT 327

COURSE TITLE : OPERATIONS RESEARCH IN IT

DATE: 08/10/2021 **TIME: 9.00 A.M-11.00 A.M**

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTIONS ONE AND ANY OTHER TWO.

QUESTION ONE (COMPULSORY) [30 MARKS]

a. Define the following terms with respect to operations research. **[6 marks]**

- **i.** Operations
- **ii.** Research
- **iii.** Variables
- **iv.** Constraints
- **v.** Queue
- **vi.** Linear programming

b. List the salient features that are unique to operation research **[5 marks]**

c. Enumerate five different types of models that are applied in Operations Research to generate an optimal solution to real-life problems. **[5 marks]**

d. Outline four examples of a real-life queuing system where customers wait to be served. **[4 marks]**

e. You have been hired as a consultant to look into how a production company can effectively use its resources and maximize on profit. Outline the procedure you will follow to come up with a solution to the problem facing the production company applying operations research. **[6 marks]**

f. Distinguish between Graphical and Simplex method as methods used for solving linear programming problems. **[2 marks]**

g. Explain the importance of sensitivity analysis with respect to linear programming problem. **[2 marks]**

QUESTION TWO [20 MARKS]

a. Outline the properties of a linear programming model. **[4 marks]**

b. Explain three major characteristics of Operations Research. **[6 marks]**

c. Describe three methods used to solve an operations research problem. **[6 marks]**

d. A retail store stocks two types of shirts A and B. These are packed in attractive cardboard boxes. During a week the store can sell a maximum of 400 shirts of type A and a maximum of 300 shirts of type B. The storage capacity, however, is limited to a maximum of 600 of both types combined. Type A shirt fetches a profit of Ksh. 2/- per

unit and type B a profit of Ksh. 5/- per unit. How many of each type the store should stock per week to maximize the total profit? Formulate a linear programming problem mathematical model of the problem. **[4 marks]**

QUESTION THREE [20 MARKS]

a. There are 3 jobs A, B, and C and three machines X, Y, and Z. All the jobs can be processed on all machines. The time required for processing job on a machine is given below in the form of matrix. By applying hungarian method, make allocation to minimize the total processing time. **[8 marks]**

Machines (time in hours)

Jobs	*X*	*Y*	*Z*
A	11	16	21
B	20	13	17
C	13	15	12

b. A network set-up project is composed of seven (7) activities whose time estimates are listed below. The activities are identified by their beginning (i) and ending (j) node numbers. **[12 marks]**

Activities		Time in weeks		
I	J	t_0	t_1	t_p
1	2	1	1	7
1	3	1	4	7
1	4	2	2	8
2	5	1	1	1
3	5	2	5	14
4	6	2	5	8
5	6	3	6	15

i. Design the network

ii. Calculate the expected variances for each

iii. Find the expected project completed time

iv. Calculate the probability that the project will be completed at least 3 weeks than expected

v. If the project due date is 18 weeks, what is the probability of not meeting the due date?

QUESTION FOUR [20 MARKS]

a. Contrast between isoprofit line isocost line with respect to linear programming. **[4 marks]**

b. Apply graphical method to design a suitable solution for a linear programming problem:

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

$1a + 1b \leq 4$

$1a - 1b \leq 2$ and both a and b are ≥ 0. **[6 marks]**

c. Four cement stores in major towns: A, B, C and D have cement and the capacity of each store is given below: Store A has 10 tons of cement; B has 8 tons; C has 5 tons and D is 6 tons of cement. The cement has instant demand in three markets 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 cement from each store to the destinations. With clear explanations, generate the Optimal Solution for least cost transportation cost in pounds (£) using North-west corner method. **[10 marks]**

Factories	Cost in Pounds per ton Markets			Availability in tons
	X	Y	Z	
A	4	3	2	10
B	5	6	1	8
C	6	4	3	5
D	3	5	4	6
Requirements in tons	7	12	4	$\sum b = 29; \sum d = 23$

QUESTION FIVE [20 MARKS]

a. Describe two forms of simulation with respect to operations research. **[3 marks]**

b. Explain how monte-carlo simulation process works. **[4 marks]**

c. List the components of a queueing system. **[5 marks]**

d. A company manufactures two products X and Y on three machines Turning, Milling and finishing machines. Each unit of X takes, 10 hours of turning machine capacity, 5 hours of milling machine capacity and 1 hour of finishing machine capacity. One unit of Y takes 6 hours of turning machine capacity, 10 hours of milling machine capacity and 2 hours of finishing machine capacity. The company has 2500 hours of turning machine capacity, 2000 hours of milling machine capacity and 500 hours of finishing machine capacity in the coming planning period. The profit contribution of product X and Y are Ksh. 23 per unit and Ksh. 32 per unit respectively. Generate a summary table for the problem, formulate the linear programming problems (primal problem) and write the dual problem. **[8 marks]**