The Management University of Africa

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UNDERGRADUATE UNIVERSITY EXAMINATIONS

SCHOOL OF MANAGEMENT AND LEADERSHIP

DEGREE OF BACHELOR OF MANAGEMENT AND LEADERSHIP

BML 303: OPERATIONS RESEARCH

DATE: ***9TH DECEMBER 2020***

DURATION: 2 HOURS

MAXIMUM MARKS: 70

INSTRUCTIONS:

1. Write your registration number on the answer booklet.
2. **DO NOT** write on this question paper.
3. This paper contains **SIX (6)** questions.
4. Question **ONE** is compulsory.
5. Answer any other **THREE** questions.
6. Question **ONE** carries **25 MARKS** and the rest carry **15 MARKS** each.
7. **Write all your answers in the Examination answer booklet provided.**

QUESTION ONE

a. List the steps required for the analysis of a problem under operations research. **(5 marks)**

b. A firm uses three machines in the manufacture of three products. Each unit of product A requires 3, 2 and 1 hour on machine I, II and III respectively. Each unit of product B requires 4, 1 and 3 hour on machine I, II and III respectively while each unit of product C requires 2hours each on the three machines. The contribution margin of the three products is Sh. 30, Sh. 40 and Sh. 35 per unit respectively. The machine hours available on the three machines are 90, 54 and 93 respectively. Required:-

   i. Formulate the above problem as a linear programming problem. **(3 marks)**

   ii. Obtain an optimal solution to the problem using the simplex method. **(8 marks)**

   iii. Obtain the dual program **(3 marks)**

   iv. Deduce the solution of dual program from the solution of the primal program **(2 marks)**

c. Briefly explain any five assumptions of game theory **(4 marks)**

QUESTION TWO

Consider the following transportation table for a minimization problem.

		Destinations			
		A	**B**	**C**	**Total Supply**
Sources	**1**	6	8	10	**150**
	2	7	11	11	**175**
	3	4	5	12	**275**
	Total Demand	**200**	**100**	**300**	**600**

Required: determine the initial basic feasible solution using:

i. Least Cost Method (LCM) **(4 marks)**

ii. North West Corner Rule (NWC) **(4 marks)**

iii. Vogel's Approximation Method (VAM) **(7 marks)**

QUESTION THREE

a. Define the following terms as used in queueing theory

i. Balking **(2 marks)**

ii. Reneging **(2 marks)**

iii. Jockeying **(2 marks)**

iv. Combining **(2 marks)**

v. Cycling **(2 marks)**

b. Given the following primal program

Max $Z = 1000X_1 + 800X_2$

s.t

$6X_1 + 2X_2 \leq 12$ …….. R_1

$10X_1 + 4X_2 \leq 24$……..R_2

$X_1, X_2 \geq 0$

Suppose optimal solution is $X_1 = 1$, $X_2 = 2$ and maximum profit is 8,000. Also, suppose R_1 increased by 10% and R_2 decreased by 20%. Find if the new product mixes are feasible solution. **(5 marks)**

QUESTION FOUR

a. State any three limitations of operations research **(3 marks)**

b. Differentiate between duality and sensitivity analysis as used in linear programming **(2 marks)**

c. A firm is engaged in both shipping and receiving activities. The management is always interested in improving the efficiency of new innovation in loading and unloading procedures. The arrival distribution of trucks is found to be poison with arrival rate of 3 trucks per hour. The service time distribution is exponential and it takes 15 minutes to unload each truck.

Required: Determine:

i. Expected numbers of trucks in the queue **(2 marks)**

ii. Expected waiting time of the truck in the queue **(2 marks)**

iii. Expected number of trucks in the systems **(2 marks)**

iv. Expected waiting time of trucks in the systems **(2 marks)**

v. Probability that the loading and uploading dock will be idle **(2 marks)**

QUESTION FIVE

a) Explain the difference between assignment and transportation problems. **(2 marks)**

b) State the assumptions made in solving a transportation problem. **(3 marks)**

c) Umoja Engineering Works Ltd. Has a network of branches all over Kenya. The branches are used to service, repair and install equipment for their clients. Currently, the Nairobi branch has four clients who require installation of equipment. Each client requires the services of one engineer. There are four engineers who are not engaged at the moment and can be assigned any one of the tasks. However, these engineers have to travel from different locations and the Nairobi branch has to meet their travel and subsistence allowances. The allowances vary from one engineer to another and according to the client; the engineer has been assigned to work for. The table below shows the costs (in thousands of shillings) associated with each engineer.

	Client			
Engineer	1	2	3	4
A	37.0	27.0	34.0	21.0
B	57.0	22.0	79.0	34.0
C	22.0	25.0	61.0	45.0
D	39.0	42.0	54.0	43.0

Required:

i. The assignments to be made in order to minimize the total cost of the engineers. **(8 marks)**

ii. The minimum cost of using engineers. **(2 marks)**

QUESTION SIX

a) Define the following terms used in game theory:

i) Dominance. **(2 marks)**

ii) Saddle point. **(2 marks)**

iii) Mixed strategy. **(2 marks)**

iv) Value of the game **(2 marks)**

b) Consider the two person zero sum game between players A and B given the following pay-off table:

		Player B Strategies			
		1	2	3	4
Player A Strategies	1	2	2	3	-1
	2	4	3	2	6

Required:

i) Using the maximin and minimax values, is it possible to determine the value of the game? Give reasons. **(3 marks)**

ii) Use graphical methods to determine optimal mixed strategy for player A and determine the value of the game. **(4 marks)**