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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Seventh Semester, B.E. - Industrial and Production Engineering

Semester End Examination; February - 2022

Operations Research

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Define OR and mention its practical applications and limitations. 6

b. A company produces two types of Hats. Each hat of the first type requires twice as much labour time as the second type. If all hats are of the second type only, the company can produce a total of 500 hats a day. The market limits daily sales of the first and second type to 150 and 250 hats. Assuming that the profit per hat are Rs.8 for type A and Rs. 5 for type B, formulate the problem as an LLP and determine the number of hats to be produced of each type so as to maximize the profit. 14

2 a. Define the Following: 6

i) Basic Feasible Solution ii) Slack and Surplus Variable

b. A company is manufacturing two products A and B. Production is limited to 80 units of product A and 60 units of product B, due to limited supply of raw material. Productions of each of these products require five units and six units of electronic components respectively. The electronic components are supplied by another manufacturer and the supply is limited to 600 units per day. The company has 160 employees and labour supply amounts to 160 man-days. One unit of product A requires 1 man day of labour and one unit of product B requires 2 man day of labour. Each unit of these products is sold at a profit of Rs. 50 and Rs. 80 respectively. Determine how many units of each product the company should produce to maximize profit. Solve graphically. 14

UNIT - II

3 a. Solve by simplex method; 10

Maximize $Z = 30x_1 + 16x_2 + 25x_3$

Sub to $8x_1 + 4x_2 + 5x_3 \leq 1000,$

$5x_1 + 3x_2 + 3x_3 \leq 650, \quad 9x_1 + 6x_2 + 9x_3 \leq 1260, \quad x_1, x_2, x_3 \geq 0$

b. Solve following LPP by simplex method; 10

Maximize $Z = 3x_1 + 2x_2$

Subject to $x_1 + x_2 \leq 4,$

$x_1 - x_2 \leq 2, \quad x_1, x_2 \geq 0$

Contd... 2

4 a. Construct the dual of the following primal problem. 6

Max $Z = 4x_1 + 5x_2 - 3x_3$

Subjected to $x_1 + x_2 + x_3 = 10$

$x_1 - x_2 \geq 1$, $2x_1 + 3x_2 + x_3 \leq 40$, $x_2, x_3 \geq 0$, x_1 is unrestricted

b. Solve following LPP by Big-M method; 14

Maximize $Z = x_1 + x_2 + 3x_3$

Subjected to $3x_1 + 2x_2 + x_3 \leq 3$,

$2x_1 + x_2 + 2x_3 \geq 2$, $x_1, x_2, x_3 \geq 0$.

UNIT - III

5 a. What is degeneracy in transportation problem and how do you over come from it? 4

b. A company has three factories F1, F2 and F3, which supply 4 warehouses at W1, W2 W3 and W4. Monthly factory capacities are 7 units, 9 units and 18 units respectively. Monthly ware house requirements are 5 units, 8 units, 7 units and 14 units respectively. Unit shipping costs are given below. Determine the optimum distribution for this company to minimize total cost. Find initial solutions by; 16

i) North-west corner method ii) VAM method

	W1	W2	W3	W4
F1	19	30	15	10
F2	70	30	40	60
F3	40	8	70	20

6 a. What are the difference between transportation and assignment problem? 4

b. Rahul company has 4 machines and 4 operators available for assignment. The operation time/product is as shown below; 16

		OPERATOR			
		1	2	3	4
M/C	A	1	8	4	1
	B	5	7	6	5
	C	3	5	4	2
	D	3	1	6	3

i) Determine the optional assignment.

ii) A 5th operator is available who can operate A or B or C or D whose processing time are 2, 2, 2, 8 on the 4 machine respectively. Is it worth utilizing the service of 5th operator, if so which operator must be neglected justify your answer.

UNIT - IV

7 a. What is replacement? Explain different types of replacement. 6

b. Following failure rates have been observed for a certain types of light bulbs: 14

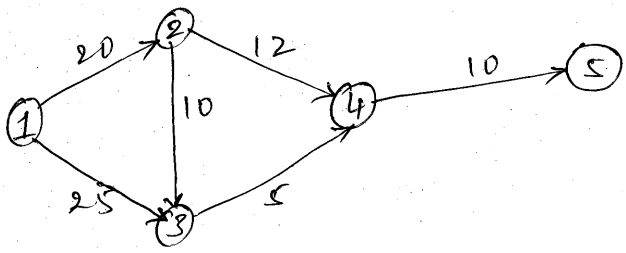
Week	1	2	3	4	5
Percentage failing by the End of week	10	25	50	80	100

Contd... 3

There are 1000 bulbs in use, and it costs Rs. 10 to replace an individual bulb which has burnt out If all bulbs were replaced simultaneously it would cost Rs. 4 per bulb. It is proposed to replace all bulbs at fixed intervals of time, whether or not they have burnt out, and to continue replacing burnt out bulbs as and when they fail. At what intervals all the bulbs should be replaced? At what group replacement price per bulb would a policy of strictly individual replacement become preferable to the adopted policy?

8 a. Explain the Phases of PERT and CPM. 6

b. Consider the network shown below; determine the following EST, EFT, LST, LFT, total float and free float. 14



UNIT - V

9 a. Explain the characteristics of Queuing system. 7

b. A company distributes its products by trucks loaded at its only loading station. Both, company's trucks and contractors trucks, are used for this propose, It was found out that an average every five minutes one truck arrived and the average loading time was three minutes. 50% of the trucks belong to the contractor. Find out; 13

i) The probability that a truck has to wait

ii) The waiting time of truck that waits and

iii) The expected waiting time of contractor's trucks per day, assuming a 24-hours shift.

10 a. Solve the following (2×4) games. 12

		B			
		I	II	III	IV
A	I	2	2	3	−1
	II	4	3	2	6

b. Solve the following game using the concept of dominance, whose pay off matrix is given below. 8

		Player B				
		I	II	III	IV	V
Player A	I	3	5	4	9	6
	II	5	6	3	7	8
	III	8	7	9	8	7
	IV	4	2	8	5	3

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