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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; Jan. / Feb. - 2021

Operation Research

Time: 3 hrs *Max. Marks: 100*

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

UNIT - I

1 a. Explain the phases of Operation Research study. 6

b. Bhairava farms uses atleast 360 kg of special feed daily. The special feed is a mixture of corn and Millet meal with the following compositions:

Feed stuff	kg per kg of feed stuff		Cost (`/kg)
	Protein	Fiber	
Corn	0.09	0.02	20
Millet	0.60	0.06	60

8

The dietry requirements of the special feed needs atleast 30% protein and at most 5% fiber. Bhairava farms whishes to determine the daily minimum cost feed mix. Formulate LPP.

c. Maximize $Z = 3x + 2y$

Subjected to $-2x + 3y \leq 9$

$3x - 2y \geq -20$ Where $x \geq 0$ and $y \geq 0$ 6

Solve by Graphical method.

2 a. Define the following: 4

i) Basic feasible solution ii) Optimal solution

b. Solve Graphically;

Maximize $Z = 2x_1 + 3x_2$ subject to the constraints;

$x_1 + x_2 \leq 30$; $0 \leq x_1 \leq 20$

$x_2 \geq 3$; $x_1 - x_2 \geq 0$ and 8

$0 \leq x_2 \leq 12$; $x_1, x_2 \geq 0$

c. A firm can manufacture three types of cloth namely *A*, *B* and *C*. Three types of wool are required for it - red, green and blue. One unit length of type *A* cloth needs two yards of red wool and three yards of blue wool, one unit length of type *B* cloth needs three yards of red, two yards of green and four yards of blue wool while one unit length of type *C* needs 5 yards of green wool and 4 yards of blue wood. The firm has a stock of eight yards of red wool, ten yards of green wool and fifteen yards of blue wool. The income obtained by the firm from one unit length of the cloth of type *A* is ` 3, of the type *B* is ` 5, and that of the type *C* in ` 4. How should the firm allocate the available material so as to maximize total income from the finished cloth? Formulate the linear programming problem. 8

Contd…2

UNIT - II

3 a. Solve by simplex method.

Maximize $Z = 45x_1 + 80x_2$

Show that $5x_1 + 20x_2 \leq 400$; where $x_1, x_2, \geq 0$

$10x_1 + 15x_2 \leq 450$; 10

b. Solve by Big M method:

Maximize $Z = 3x_1 - x_2$ subjected to

$2x_1 + x_2 \geq 2$; $x_2 \leq 4$

$x_1 + 3x_2 \leq 3$; where $x_1, x_2 \geq 0$ 10

4 a. Give the dual of the following LPP:

$Z_{max} = 2x_1 + 3x_2 + x_3$;

Subjected to $4x_1 + 3x_2 + x_3 = 6$;

$x_1 + 2x_2 + 5x_3 = 4$

and $x_1, x_2, x_3 \geq 0$ 10

b. Solve by Big M method

Maximize $Z = 2x_1 + x_2$;

Subjected to $4x_1 + 6x_2 \leq 8$;

$3x_1 - 6x_2 \leq 1$;

$2x_1 + 3x_2 \geq 4$ and $x_1, x_2 \geq 0$ 10

UNIT - III

5 a. Define the following terms with reference to Transportation problem:

i) Feasible solution

ii) Basic Feasible solution

iii) Optimal solution

iv) Non-Degenerate basic feasible solution 8

b. Determine optimal distribution to the following Transportation Problem (T.P.) Use VAM method for initial solution

Destination

Source	D_1	D_2	D_3	D_4	Supply
S_1	21	16	15	3	11
S_2	17	18	14	23	13
S_3	32	27	18	41	19
Demand	6	6	8	23	

12

Contd…3

6 a. A marketing manager has five salesmen and five districts. Considering the capabilities of the salesmen and nature of districts, the marketing manager estimates of sales per month (in hundreds of rupees) for each salesman in each district would be as follows: 10

Districts

Salesmen	A	B	C	D	E
1	32	38	40	28	40
2	40	24	28	21	36
3	41	27	33	30	37
4	22	38	41	36	36
5	29	33	40	35	39

Find the assignment of salesmen to districts that would result in the maximum sales.

b. A travelling salesman has to visit five cities. He is to start from a particular city visits each city only once and then returns back to his starting point. The travelling cost of each city from a particular city is given below. What is the sequence of his visit so that the cost is minimized? 10

To

From	A	B	C	D	E
A	-	3	6	2	3
B	3	-	5	2	3
C	6	5	-	6	4
D	2	2	6	-	6
E	3	3	4	6	-

UNIT - IV

7 a. The cost of a machine is ` 6,100 and its scrap value (resale value) is only ` 100. The maintenance costs are found from the experience to be as follows : 10

Years	1	2	3	4	5	6	7	8
Maintenance cost (`)	100	250	400	600	900	1250	1600	2000

When should the machine be replaced?

b. List any five scopes of Network applications. 5

c. Differentiate between PERT and CPM. 5

8 a. Construct network for the following activities and calculate total floot: 14

Activity (Duration)	A(3)	B(2)	C(3)	D(3)	E(2)	F(7)	G(5)	H(6)
Immediate predecessor	-	A	A	C	C	B, C	B, C	D, F

b. What is replacement? Describe some important replacement situations. 6

Contd…4

UNIT - V

9 a. Explain in brief the main characteristics of queuing system. 8

b. In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter arrival time follows an exponential distribution and the service time distribution is also exponential with an average of 36 minutes. Calculate;

i) Expected queue size (line length) 12

ii) Probability that the queue size exceeds 10

If the input of trains increases to an average of 33 per day, what will be the change in (i) and (ii)?

10 a. Solve 3×4 game given below;

$$\begin{array}{c} \\ A_1 \\ A_2 \\ A_3 \end{array} \begin{array}{c} \begin{array}{cccc} B_1 & B_2 & B_3 & B_4 \end{array} \\ \begin{bmatrix} 4 & -2 & 3 & -1 \\ -1 & 2 & 0 & 1 \\ -2 & 1 & -2 & 0 \end{bmatrix} \end{array}$$ 10

b. Solve the following game using the concept of dominance, whose payoff matrix is given below;

Player B

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

10

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