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B. M. S. College of Engineering, Bengaluru - 560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: V**
Branch: Mechanical Engineering **Duration: 3 hrs.**
Course Code: 20ME5DCORE **Max Marks: 100**
Course: Operation Research **Date: 30.09.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.
3. Use of statistical tables is permitted.

UNIT - I

1. a) Explain the scope of Operations Research. **10**

   b) A man goes to market to purchase buttons. He needs at least 20 large buttons and at least 30 buttons. The shopkeeper sells button in two forms (i) boxes and (ii) cards. A box contains 2 large buttons and 5 small buttons and a card 10 large buttons and 5 small buttons. Find the most economical way in which he should purchase the buttons, if a box costs 10 paisa and a card costs 25 paisa only. Formulate the problem and solve using graphical method. **10**

OR

2. a) Explain feasible, basic feasible and optimal solution. **06**

   b) Solve the following LPP by the simplex method. **14**

   Max $Z = 3x_1+2x_2$

   Subject to constraints

   $2x_1+x_2 \leq 1$

   $3x_1+4x_2 \geq 4$

   $x_1, x_2 \geq 0$

UNIT - II

3. a) Using the dual, solve the following linear programming problem **14**

   Max $Z = 3x_1 - 2x_2$

   Subject to constraints $x_1 \leq 4$

   $x_2 \leq 6$

   $x_1+x_2 \leq 5$

   $-x_1 \leq -1$

   $x_1, x_2 \geq 0$

b) What are the advantages of Revised simplex method over standard simplex method? **06**

UNIT - III

4. Power stations P_j, J=1,2,3,4 run on coal found in coal mines Q_i, i=1,2,3. Quantity of coal produced at Q_i is a_i. Maximum possible production of power at P_j is b_j. The cost of unit quantity of coal at Q_i is Ci and its transportation cost to Pi is Cij. A unit quantity of coal produces hj units of power at Pj. How should coal be distributed so that the total cost of coal at power station is minimum. How much of power is produced at each station? Solve using the following data. **20**

Agencies

i	C_{i1}	C_{i2}	C_{i3}	C_{i4}	C_i	a_i
1	4	3	2	1	10	750
2	3	5	6	2	15	350
3	0	4	3	3	20	400
hj	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$		
bj	100	150	300	200		
j	1	2	3	4		

OR

5. a) A manager has to assign four jobs to three production facilities. The assignment of job will increase profits by the amount shown below: **08**

Facilities

Jobs	1	2	3
A	1200	900	1350
B	1000	1100	1250
C	1150	1000	1000
D	1300	1200	1050

If only one job can be assigned to a production facility, determine the optimal assignment.

b) A salesman wants to visit four cities B, C, D and E and then come back to his headquarters A. The distance matrix for these cities is given below. Find the optimal route for the salesman and the corresponding total distance he has to cover in one such cycle. **12**

				To		
		A	B	C	D	E
From	A	-	50	90	20	140
	B	50	-	40	80	70
	C	90	40	-	120	110
	D	20	80	120	-	65
	E	140	70	110	65	-

UNIT - IV

6. a) Explain the following terms with reference to game theory: **06**

   i) Saddle point ii) Mixed strategy iii) 2-person zero sum game

   b) There are six jobs, each of which is to be processed through three machines A, B and C in the order ACB, processing time in hours are shown in the table below. **14**

	Machines		
Jobs	A	B	C
U	12	7	6
V	10	6	5
W	9	6	6
X	14	5	4
Y	7	4	2
Z	9	4	4

The suggested sequence is Y-W-Z-V-U-X. Find out the total elapsed time for the sequence suggested. Do you think that the given sequence is optimal? If not find out the optimal sequence and the minimum elapsed time associated with it.

UNIT - V

7. a) At the interest rate of 10%, determine the best replacement policy for a machine purchased today at the cost of Rs 8000/-. The following information is available with regard to the machine. **14**

Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Running cost (assumed to have occurred at mid-year)	1300	1500	1700	1900	2100	2500	4000
Resale value (assumed to have occurred at the end of the year)	4100	2700	2100	1600	1100	700	600

   b) Explain replacement policy for the items that fail suddenly**.** **06**

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