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10CS/IS661

Sixth Semester B.E. Degree Examination, Jan./Feb. 2023
Operations Research

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO full questions from each part.***

PART – A

1 a. What is Operations Research? Mention six phases of an Operations Research study. **(05 Marks)**

b. A company manufactures radios and calculators. The Radio's contribute Rs.100 per unit and calculator Rs.150 per unit as profit. Each radio requires 4 diodes and 4 resistors, while each calculator requires 10 diodes and 2 resistors. Radio takes 12 minutes and calculator takes 9.6 minutes of time on the company electronic testing machine and the product manages estimates that 160 hrs of test time is available. The firm has 8000 diodes and 3000 resistors in stock. Formulate the problem as LPP. **(05 Marks)**

c. Solve the following LPP by graphical method
Maximize $Z = 3x_1 + 5x_2$
Subject to
$x_1 \le 4$
$2x_1 \le 12$
$3x_1 + 2x_2 \le 18$ and
$x_1, x_2 \ge 0$. **(10 Marks)**

2 a. Solve the following LPP by simplex method:
Maximize $Z = 3x_1 + 2x_2$
Subject to
$x_1 + x_2 \le 4$
$x_1 + x_2 \le 2$ and
$x_1, x_2 \ge 0$ **(10 Marks)**

b. Solve the following LPP by using simplex method:
Maximize $= 3x_1 + 9x_2$
Subject to
$x_1 + 4x_2 \le 8$
$x_1 + 2x_2 \le 4$ and
$x_1, x_2 \ge 0$ **(10 Marks)**

3 a. Solve the following LPP by BIGM method:
Minimize $= 2x_1 + x_2$
Subject to
$3x_1 + x_2 = 3$
$x_1 + 2x_2 \le 3$
$4x_1 + 3x_2 \ge 6$ and
$x_1, x_2 \ge 0$. **(10 Marks)**

b. Using 2 phase simplex method, solve the following LPP:
Maximize $= 3x_1 - x_2$
Subject to
$2x_1 + x_2 \ge 2$
$x_1 + 3x_2 \le 2$
$x_2 \le 4$ and
$x_1, x_2 \ge 0$. **(10 Marks)**

4 a. Explain the relation between the solution of the primal and dual. **(05 Marks)**

b. Write the dual of the following LPP:

Maximize = $x_1 + 2x_2 + x_3$

Subject to

$2x_1 + x_2 - x_3 \leq 2$

$-2x_1 + x_2 - 5x_3 \geq -6$

$4x_1 + x_2 + x_3 \leq 6$ and

$x_1, x_2, x_3 \geq 0$. **(05 Marks)**

c. Explain the computational procedure of revised simplex method in standard form. **(10 Marks)**

PART – B

5 a. Discuss the working procedure for dual simplex method. **(04 Marks)**

b. Explain the role of duality theory in sensitivity analysis. **(04 Marks)**

c. Use dual simplex method and solve the following LPP:

Minimize = $3x_1 + x_2$

Subject to

$x_1 + x_2 \geq 1$

$2x_1 + 3x_2 \geq 2$

$x_1, x_2 \geq 0$ **(12 Marks)**

6 a. Find the optimal transportation cost of the following cost matrix and use LCM to find initial solution.

	A	B	C	D	E	Supply
P	4	1	2	6	9	100
Q	6	4	3	5	7	120
R	5	2	6	4	8	120
Demand	40	50	70	90	90	

(12 Marks)

b. The processing time in hours for the jobs when allocated to different machines are indicated in following table. Assign machine for the jobs, so that the total processing time is minimum. **(08 Marks)**

	M_1	M_2	M_3	M_4	M_5
J_1	9	22	58	11	19
J_2	43	78	72	50	63
J_3	41	28	91	37	45
J_4	74	42	27	49	39
J_5	36	11	57	22	25

7 a. Solve the game graphically **(10 Marks)**

		B		
		I	II	III
A	I	1	3	11
	II	8	5	2

b. Solve the following m × n game using concept of dominance:

$$\begin{bmatrix} 3 & 5 & 4 & 9 & 2 \\ 5 & 6 & 9 & 7 & 8 \\ 8 & 7 & 7 & 8 & 7 \\ 4 & 2 & 8 & 5 & 3 \end{bmatrix}$$

(10 Marks)

8 Write short note on:

a. Genetic Algorithms b. Tabu search

c. Meta heuristics and its application d. Simulated Annealing. **(20 Marks)**