USN | | | | | | | | | | 10MCA25

Second Semester MCA Degree Examination, December 2011
Operations Research

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

1 a. Define operations research. Explain briefly the various phases of OR problems. **(10 Marks)**

b. Two products A and B are to be manufactured. One single unit of product A requires 2.4 minutes of punch press time and 5 minutes of assembly time. The profit for product A is Re.0.60 per unit. One single unit of product B requires 3 minutes of punch press time and 2.5 minutes of welding time. The profit for product B is Rs.0.70 per unit. The capacity of the punch press department available for these products is 1200 minutes/week. The welding department has an idle capacity of 600 minutes/week and assembly department has 1500 minutes/week.
i) Formulate the problem as L.P.P. ii) Use graphical method to determine the quantities of products A and B, so that, total profit is maximized. **(10 Marks)**

2 a. Define i) Basic feasible solution and ii) a corner point feasible solution.
Also explain briefly any four assumptions of L.P.P. **(10 Marks)**

b. Solve by simplex method:
Maximize $Z = 2x_1 + 4x_2 + x_3 + x_4$
Subject to constraints $x_1 + 3x_2 + x_4 \leq 4$; $2x_1 + x_2 \leq 3$; $x_2 + 4x_3 + x_4 \leq 3$;
$x_j \geq 0$ ($j = 1, 2, 3, 4$) **(10 Marks)**

3 a. Explain the degeneracy problem in a LPP. **(05 Marks)**

b. Write the LPP in standard form:
Maximize $Z = 8x_2$
Subject to constraints, $x_1 - x_2 \geq 0$; $2x_1 + 3x_2 \leq -6$; x_1 & x_2 unrestricted. **(05 Marks)**

c. Solve the LPP by Charne's penalty method:
Maximize $Z = 2x_1 + x_2 + 3x_2$
Subject to constraints $x_1 + x_2 + 2x_3 \leq 5$; $2x_1 + 3x_2 + 4x_3 = 12$; $x_1, x_2, x_3 \geq 0$ **(10 Marks)**

4 a. i) Briefly explain how to get the solution to the primal from the final simplex table of the dual LPP. **(04 Marks)**

ii) Write dual of the LPP:
Minimize $Z = 2x_1 + 3x_2 + 4x_3$
Subject to constraints $2x_1 + 3x_2 + 5x_3 \geq 2$
$3x_1 + x_2 + 7x_3 = 3$
$x_1 + 4x_2 + 6x_3 \leq 5$
$x_1, x_2 \geq 0$, x_3 unrestricted. **(06 Marks)**

b. Use dual simplex method to solve the LPP:
Minimize $x_1 + 2x_2 + 3x_3$
Subject to constraints $2x_1 - x_2 + x_3 \geq 4$
$x_1 + x_2 + 2x_3 \leq 8$
$x_2 - x_3 \geq 2$
$x_1, x_2, x_3 \geq 0$.
(10 Marks)

5 a. Use the revised simples method, to solve the following LPP:

Maximize $Z = 2x_1 + x_2$

Subject to constraints $3x_1 + 4x_2 \leq 6$

$6x_1 + x_2 \leq 3$

$x_1, x_2 \geq 0$ **(10 Marks)**

b. A company wants to produce three products A, B and C. The unit profits on these products are Rs.4, Rs.6 and Rs.2 respectively. These products require two sources – manpower and material. Let x_1, x_2 and x_3 denote the number of products A, B and C produced. Solve the LPP:

Maximize $Z = 4x_1 + 6x_2 + 3x_3$

Subject to constraints $x_1 + x_2 + x_3 \leq 3$ (manpower)

$x_1 + 4x_2 + 7x_3 \leq 9$ (material)

$x_1, x_2, x_3 \geq 0$

Let the final simples table be

		$C_j \rightarrow$	4	6	2	0	0	
C_B	Basic variable	b	x_1	x_2	x_3	x_4	x_5	
4	x_1	1	1	0	-1	4/3	-1/3	
6	x_2	2	0	1	2	-1/3	1/3	
	Z = 16		0	0	6	10/3	2/3	Net evaluation ($Z_j - C_j$)

i) Find the range of the values of non-basic variable coefficient C_3 such that the current optional product mix remains optimal.

ii) Find the range on basic variable coefficient C_1 such that the current optimal product mix remains optimal.

iii) Find the effect of changing the objective function to $Z = 2x_1 + 8x_2 + 4x_3$ on the current optimal product mix.

iv) If a new constraint $2x_1 + 3x_2 + 2x_3 \leq 10$ is added, how does the optimal solution given by the final simplex table change? **(10 Marks)**

6 a. i) Briefly explain the transportation problem. Formulate the transportation problem as a LPP. **(05 Marks)**

ii) Using the North-west corner rate, determine an initial basic feasible solution to the given transportation problem for which cost matrix is given. **(05 Marks)**

Destination

		D_1	D_2	D_3	D_4	D_5	D_6	Supply
	Q_1	1	2	1	4	5	2	30
Origin	Q_2	3	3	2	1	4	3	50
	Q_3	4	2	5	9	6	2	75
	Q_4	3	1	7	3	4	6	20
	Demand	20	40	30	10	40	25	

b. Solve the following transportation problem. Use the Vogel's approximation method to get initial basic feasible solution. Given the cost matrix

To

		D_1	D_2	D_3	D_4	D_5	Supply
	A	5	8	6	6	3	800
From	B	4	7	7	6	6	500
	C	8	4	6	6	4	900
	Demand	400	400	500	400	800	

(10 Marks)

7 a. Define:

i) Strategy, pure strategy and mixed strategy of a player in a game.
ii) Pay off matrix, saddle point of a payoff matrix
iii) Value of a game and a fair game. **(08 Marks)**

b. A company has a team of 4 salesmen and there are 4 districts where the company wants to start its business. After taking into account the capabilities of salesmen and the nature of districts, the company estimates that the profit per day in rupees for each salesman in each district is as below. Find the assignment of salesman to various districts which will yield maximum profit. **(12 Marks)**

Salesman \ District	1	2	3	4
A	42	35	28	21
B	30	25	20	15
C	30	25	20	15
D	24	20	16	12

8 a. i) Reduce the given game sing dominance property and solve it. **(04 Marks)**

Player A \ Player B	1	2	3	4	5
I	1	3	2	7	4
II	3	4	1	5	6
III	6	5	7	6	5
IV	2	0	6	3	1

ii) Solve the game by graphical method. **(06 Marks)**

Player A \ Player B	B_1	B_2	B_3	B_4
A_1	2	1	0	-2
A_2	1	3	3	2

b. Define the heuristic method. Explain briefly the nature of metaheuristics. Give outline of a sub-tour reversal algorithm and a basic table search algorithm. **(10 Marks)**

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