Sixth Semester B.E. Degree Examination, June/July 2011
Operations Research

Time: 3 hrs.   Max. Marks:100

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

PART – A

1 a. What are the different phases of OR? Explain them briefly. **(08 Marks)**
   b. Define the following with reference to LPP
      i) Unbounded solution. ii) Feasible solution. iii) Slack Variable. **(04 Marks)**
   c. ABC firm manufactures three products P_1, P_2 and P_3. The profits are Rs. 30, Rs. 20 and Rs. 40 respectively. The firm has two machines M1 and M2 and requires processing time in minutes for each machine on each product and total machine available minutes on each machine are given below.

Machine	Machine minutes required			Total machine
	P1	P2	P3	minutes available
M1	4	3	5	2000
M2	2	2	4	2500

The firm must manufacture at least 100 P_1's and 200 P_2's and 50 P_3's but not more than 150 P_1's. Setup LP model to solve by simplex method. **(08 Marks)**

2 a. Briefly explain assumptions required in Linear programming models. **(05 Marks)**
   b. Use graphical method to solve the following:

   Maximize $z = x_1 + \dfrac{x_2}{2}$

   subject to $3x_1 + 2x_2 \le 12$ **(12 Marks)**

   $5x_1 \le 10, \quad x_1 + x_2 \le 18$

   $-x_1 + x_2 \ge 4, \quad x_1 \text{ and } x_2 \ge 0$

   c. Why is simplex method a better technique than graphical for most real case? Explain **(03 Marks)**

3 a. Explain the concept of degeneracy in simplex method. **(04 Marks)**
   b. Use penalty method to solve the following LPP

   Minimize $z = 5x_1 + 3x_2$

   Subject to $2x_1 + 4x_2 \le 12$

   $2x_1 + 2x_2 = 10, \quad 5x_1 + 2x_2 \ge 10$

   $x_1 \text{ and } x_2 \ge 0$ **(16 Marks)**

4 a. Construct the dual problem for the following LPP

   Maximize $Z = 16x_1 + 14x_2 + 36x_3 + 6x_4$

   Subject to $14x_1 + 4x_2 + 14x_3 + 8x_4 = 21$; $13x_1 + 17x_2 + 80x_3 + 2x_4 \le 48$

   $x_1, x_2 \ge 0$; x_3 ; x_4 unrestricted. **(06 Marks)**

   b. Use revised simplex method to solve the following LPP

   Maximize $z = x_1 + 2x_2$

   subject to $x_1 + x_2 \le 3, \quad x_1 + 2x_2 \le 5$ **(14 Marks)**

   $3x_1 + x_2 \le 6, \quad x_1, x_2 \ge 0$

PART – B

5 a. Briefly discuss about sensitivity analysis.

(06 Marks)

b. Find the maximum of $z = 6x_1 + 8x_2$

subject to $5x_1 + 2x_2 \leq 20$

$x_1 + 2x_2 \leq 10$

$x_1 \,\&\, x_2 \geq 0$

by solving its dual problem using simplex method.

(14 Marks)

6 a. Define feasible solution, basic feasible solution, non-degenerate solution and optimal solution in a Transportation problem.

(06 Marks)

b. A product is produced by 4 factories F_1, F_2, F_3 and F_4. Their unit production costs are Rs. 2, 3, 1 and 5 respectively. Production capacity of the factories are 50, 70, 30 and 50 units respectively. The product is supplied to 4 stores S_1, S_2, S_3 and S_4, the requirements of which are 25, 35, 105 and 20 respectively. Unit costs of transportation are given below.

Stores / Factories	S_1	S_2	S_3	S_4
F_1	2	4	6	11
F_2	10	8	7	5
F_3	13	3	9	12
F_4	4	6	8	3

Find the transportation plan such that the total production and transportation cost is minimum.

(14 Marks)

7 a. Solve the following assignment problem. If it is treated as a salesman problem and the cell entries represent cost in rupees, find the least cost route such that salesman does not visit any city twice.

	A	B	C	D	E
A	–	2	5	7	1
B	6	–	3	8	2
C	8	7	–	4	7
D	12	4	6	–	5
E	1	3	2	8	–

(14 Marks)

b. Explain the following
i) Minimax and Maximin principles.
ii) Pure and Mixed strategies.
iii) Two persons zero sum game.

(06 Marks)

8 a. Write a brief note on Tabu search algorithm.

(04 Marks)

b. Reduce the following $(2 \times n)$ game to (2×2) game by graphical method and hence solve.

		B				
		I	II	III	IV	V
A	I	2	-1	5	-2	6
	II	-2	4	-3	1	0

(08 Marks)

c. A news paper boy has the following probabilities of selling a magazine

No. of copies sold	10	11	12	13	14
Probability	0.10	0.15	0.20	0.25	0.30

Cost of a copy is 30 paise and sale price is 50 paise. He can not return unsold copies. How many copies should he order?

(08 Marks)

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