(6 pages)

OCTOBER 2013 **P/ID 17414/RBR**

Time : Three hours Maximum : 75 marks

PART A — (5 × 5 = 25 marks)

Answer ALL questions.

1. (a) Solve graphically :

Minimize $z = -x_1 + 2x_2$

Subject to the constraints

$$-x_1 + 3x_2 \le 10$$
$$x_1 + x_2 \le 6$$
$$x_1 - x_2 \le 2 \text{ and}$$
$$x_1 \ge 0, x_2 \ge 0$$

Or

(b) Using simplex method, find the inverse of the matrix $A = \begin{pmatrix} 3 & 2 \\ 1 & 2 \end{pmatrix}$.

2. (a) (i) Define primal problem and dual problem.

(ii) State the general rules for forming a dual L.P.P.

Or

(b) Solve the following transportation problem :

	To						
	9	12	9	6	9	10	5
From	7	3	7	7	5	5	6
	6	5	9	11	3	11	2
	6	8	11	2	2	10	9
	4	4	6	2	4	2	22

3. (a) Sketch the branch and bound method in integer programming.

Or

(b) Use dynamic programming to find the maximum value of $z = x_1^2 + 2x_2^2 + 4x_3$ subject to the constraints :

$$x_1 + 2x_2 + x_3 \leq 8$$
$$x_1, x_2, x_3 \geq 0$$

4. (a) Define the problem of sequencing. Describe the method of processing n job through two machines.

Or

(b) Distinguish between PERT and CPM.

5. (a) What do you understand by a Markov chain? Give suitable examples.

Or

(b) Briefly explain the important characteristics of queueing system.

PART B — ($5 \times 10 = 50$ marks)

Answer any FIVE questions.

6. Use two-phase simplex method to

Maximize $z = 3x_1 - x_2$ subject to the constraints :

$$2x_1 + x_2 \geq 2$$
$$x_1 + 3x_2 \leq 2$$
$$x_2 \leq 4$$
$$x_1, x_0 \geq 0$$

7. Use Big M method to

Minimize $z = 5x_1 + 6x_2 - 7x_3$

Subject to the constraints :

$$x_1, 5x_2 - 3x_3 \geq 15$$
$$5x_1 - 6x_2 + 10x_3 \geq 0$$
$$x_1 + x_2 + x_3 = 5$$
$$x_1, x_2, x_3 \geq 0$$

8. Solve using dual simplex method :

Maximize $z = -2x_1 - x_2$ subject to the constraints :

$$3x_1 + x_2 \geq 3$$
$$4x_1 + 3x_2 \geq 6$$
$$x_1, 2x_2 \geq 3$$
$$x_1, x_2 \geq 0$$

9. Five men are available to do five different jobs. From past records, the time (in hours) that each man takes to do each job is known and give in the following table :

		I	II	III	IV	V
Men	A	2	9	2	7	1
	B	6	8	7	6	1
	C	4	6	5	3	1
	D	4	2	7	3	1
	E	5	3	9	5	1

Find the assignment of men to jobs that will minimize the total time taken.

10. A salesman is planning to tour cities B,C,D and E starting from his home city A. The inter-city distance are shown in the following table :

City :	A	B	C	D	E
A	∞	103	188	136	38
B	103	∞	262	176	52
C	188	262	∞	85	275
D	136	176	85	∞	162
E	38	52	275	162	∞

How should he plan his tour so that

(a) he visits each of the cities only once and

(b) travels the minimum distance.

11. Solve the following integer programming problem using cutting plane algorithm :

Maximize $z = x_1 - 2x_2$ subject to the constraints :

$$4x_1 + 2x_2 \leq 15$$

$x_1, x_2 \geq 0$ and are integers.

12. A project has the following time schedule :

Activity	Time in weeks	Activity	Time in week
1-2	2	4-6	3
1-3	2	5-8	1
1-4	1	6-9	5
2-5	4	7-8	4
3-6	8	8-9	3
3-7	5		

Construct PERT network and compute :

(a) total float for each activity and

(b) critical path and its duration.

13. Patients arrive at a clinic according to a Poisson distribution at a rate of 30 patients per hour. The waiting room does not accommodate more than 14 patients. Examination time per patient is exponential with mean rate 20 per hour.

(a) Find the effective arrival rate at the clinic.

(b) What is the probability that an arriving patient will not wait?

(c) What is the expected waiting time until a patient is discharged from the clinic?

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