(7 pages)

DECEMBER 2014 **P/ID 17531/PCE13**

Time : Three hours Maximum : 100 marks

PART A — (6 × 5 = 30 marks)

Answer any SIX questions.

1. Solve graphically the following L.P.P :

   Max $z = 5x_1 + 3x_2$

   Subject to the constraints

   $3x_1 + 5x_2 \le 15$

   $5x_1 + 2x_2 \le 10$

   $x_1, x_2 \ge 0$

2. Explain Big– M method.

3. Explain the dual simplex method.

4. Obtain an initial basic feasible solution to the following transportation problem by North West Corner rule.

	D	E	F	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Requirement	200	225	275	250	

5. Explain Gomory's all–integer cutting plane method.

6. Use graphic method to find the minimum elapsed total time sequence of 2 jobs and 5 machines, when we are given the following information :

Job :1	Sequence :	A	B	C	D	E
	Time :	2	3	4	6	2
Job :2	Sequence :	C	A	D	E	B
	Time :	4	5	3	2	6

7. The following table gives the activities in a construction project and time duration :

Activity	Preceding activity	Normal time (days)
1–2	–	20
1–3	–	25
2–3	1–2	10
2–4	1–2	12
3–4	1–3, 2–3	5
4–5	2–4, 3–4	10

(a) Draw the activity network of the project.

(b) Find also the total float for each activity.

8. Two manufacturers A and B are competiry, with each other in a restricted market. Over the year, A's customer have exhibited a high degree of loyalty as measured by the fact that customers are using A's product 80% of the time. Also former customers purchasing the product from B have switched back to A's 60% of the time.

   (a) Construct and interpret the state transition matrix in terms of (i) retention and loss (b) retention and gain.

   (b) Calculate the probability of a customer purchasing A's product at the end of the second period. Draw the transition probability diagrams and the transition trees.

PART B — (7 × 10 = 70 marks)

Answer any SEVEN questions.

9. Use two-phase simplex method to

Maximize $Z = 3x_1 + 2x_2 + 2x_3$

Subject to the constraints :

$$5x_1 + 7x_2 + 4x_3 \leq 7$$
$$-4x_1 + 7x_2 + 5x_3 \geq -2$$
$$3x_1 + 4x_2 - 6x_3 \geq 29/7$$
$$x_1, x_2, x_3 \geq 0$$

10. Use revised simplex method to solve the L.P.P.

Maximize $Z = 2x_1 + x_2$

Subject to the constraints :

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

11. Use dual simplex method to solve the L.P.P.

Maximize $z = -3x_1 - x_2$

Subject to the constraints :

$$x_1 + x_2 \geq 1$$
$$2x_1 + 3x_2 \geq 2$$
$$x_1, x_2 \geq 0$$

12. Obtain an optimum basic feasible solution to the following transportation problem :

From	To			Available
	A	B	C	
I	50	30	220	1
II	90	45	175	3
III	250	200	50	4
Requirement	4	2	2	

13. Find the optimum integer solution to the following L.P.P.

Maximize $z = x_1 + 2x_2$

Subject to the constraints :

$$x_1 + x_2 \le 7,$$
$$2x_1 \le 11,$$
$$2x_2 \le 7$$
$$x_1, x_2 \ge 0$$

and are integers.

14. Find the minimum value of $z = y_1^2 + y_2^2 + \cdots + y_n^2$ subject to the constraints : $y_1 . y_2 \cdots y_n = C$, $y_j \ge 0$ for $j = 1, 2, \cdots n$ using dynamic programming problem.

15. Explain the procedure for determining the optimal sequence of jobs by (a) n jobs and two machines (b) n jobs and m machines.

16. A project schedule has the following characteristics :

Activity :	1-2	2-3	2-4	3-5	4-5	4-6	5-7	6-7	7-8	7-9	8-10	9-10
Most likely Time :	2	2	3	4	3	5	5	7	4	6	2	5
Optimistic Time :	1	1	1	3	2	3	4	6	2	4	1	3
Pessimistic Time :	3	3	5	5	4	7	6	8	6	8	3	7

(a) Construct the project network

(b) Find expected duration and variance for each activity.

(c) Find the critical path and expected project length

(d) What is the probability of completing the project in 30 days?

17. Suppose there are two market products of brands A and B respectively. Let each of these brands have exactly 50% of the total market in same period and let the market be of a fixed size. The transition matrix is given below :

$$\begin{array}{cc} & \text{To} \\ & \begin{array}{cc} A & B \end{array} \\ \text{From} \begin{array}{c} A \\ B \end{array} & \begin{pmatrix} 0.9 & 0.1 \\ 0.5 & 0.5 \end{pmatrix} \end{array}$$

If the initial market share breakdown in 50% for each brand, then determine their market shares in the steady state.

18. In a maintenance shop, the inter arrival time at tool crib are exponential with an average time of 10 minutes. The length of the service time is assumed to be exponentially distributed with mean 6 minutes.

Find,

(a) the probability that a person arriving will have to wait

(b) the average queue length

(c) average time that an operator spend in the system

(d) the estimator of the fraction of day that the operator will be idle

(e) the probability that there will be six or more operations waiting for service.

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