

(7 pages)

DECEMBER 2014

P/ID 17414/RBR

Time : Three hours

Maximum : 75 marks

PART A — (5 × 5 = 25 marks)

Answer ALL questions.

1. (a) Solve the following linear programming problems by graphical method.

$$\text{Minimize : } z = 2x_1 + x_2$$

Subject to the constraints :

$$5x_1 + 10x_2 \leq 50,$$

$$x_1 + x_2 \geq 1$$

$$x_1 \leq 4$$

$$x_1, x_2 \geq 0.$$

Or

- (b) Explain simplex method of L.P.P.
2. (a) Explain Vogels approximation method of Transportation problem.

Or

- (b) (i) Define Primal problem.
(ii) Write the dual of the L.P.P.

$$\text{Minimize : } z = 4x_1 + 6x_2 + 18x_3$$

Subject to the constraints :

$$x_1 + 3x_2 \geq 3$$

$$x_2 + 2x_3 \geq 5$$

$$x_j \geq 0 \ (j = 1, 2, 3) .$$

3. (a) Find the optimum integer solution to the following L.P.P.

$$\text{Maximize : } z = x_1 + 4x_2$$

Subject to constraints :

$$2x_1 + 4x_2 \leq 7$$

$$5x_1 + 3x_2 \leq 15$$

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

Or

- (b) Use dynamic programming to find the value of

$$\text{Maximize : } z = y_1 \cdot y_2 \cdot y_3$$

Subject to the constraints : $y_1 + y_2 + y_3 = 5$

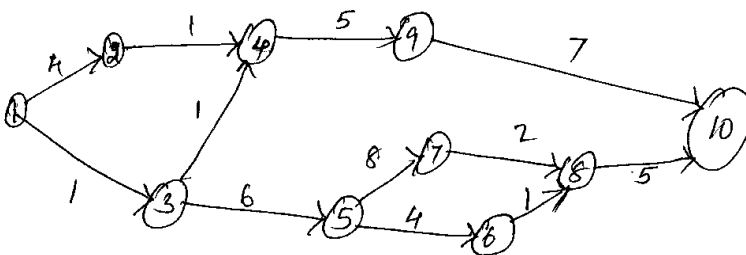
$$y_1, y_2, y_3 \geq 0 .$$

4. (a) Use graphic method to find the minimum elapsed total time sequence of 2 jobs and 4 machines when we are given the following information.

Job	Sequence	A	B	C	D
1	Time	4	6	7	3
Job	Sequence	D	B	A	C
2	Time	4	7	5	8

Or

- (b) Find the critical path and calculate the slack time for the following PERT diagram.



5. (a) Two manufactures A and B are competing with each other in a restricted market. Over the year A's customers have exhibited a high degree of loyalty as measured by the fact that customers using A's product 80 percent of the time. Also former customers purchasing the product from B have switched back to A's 60 percent of the time.

- (i) Construct and interpret the state transition matrix terms of (1) retention and loss (2) retention and gain.
- (ii) 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.

Or

- (b) A xerox machine in an office is operated by a person who does other jobs also. The average service time for a job is 6 minutes per customer. On an average, every 12 minutes one customer arrive for Xeroxing. Find
 - (i) The Xerox machine utilisation
 - (ii) Percentage of time that an arrival has not to wait
 - (iii) Average time spent by a customer.

PART B — (5 × 10 = 50 marks)

Answer any FIVE questions.

6. Use revised simplex method to solve the linear programming problem.

$$\text{Maximize : } z = 5x_1 + 3x_2$$

Subject to the constraints :

$$4x_1 + 5x_2 \geq 10$$

$$5x_1 + 2x_2 \leq 10$$

$$3x_1 + 8x_2 \leq 12$$

$$x_1, x_2 \geq 0.$$

7. Use Big-M simplex method to

$$\text{Maximize : } z = 6x_1 + 4x_2$$

$$\text{Subject to the constraints : } 2x_1 + 3x_2 \leq 30$$

$$3x_1 + 2x_2 \leq 24$$

$$x_1 + x_2 \geq 3$$

$$x_1, x_2 \geq 0.$$

8. Solve the following transportation problem.

From	To			Available
	A	B	C	
I	50	30	220	1
II	90	45	170	3
III	250	200	50	4
Requirement	4	2	2	

9. Using the bounded variable technique, solve the following linear programming problem.

$$\text{Maximize : } z = x_2 + 3x_3$$

$$\text{Subject to the constraints : } x_1 + x_2 + x_3 \leq 10$$

$$x_1 - 2x_3 \geq 0$$

$$2x_2 - x_3 \leq 10$$

$$0 \leq x_1 \leq 8$$

$$0 \leq x_2 \leq 4 ; x_3 \geq 0.$$

10. Use Gomory's method to solve the L.P.P.

Maximize : $z = x_1 + 2x_2$

Subject to the constraints :

$x_1 + x_2 \leq 7$

$2x_1 \leq 11$

$2x_2 \leq 7, x_1, x_2 \geq 0$ and are integers.

11. Solve the following integer programming problem.

Maximize : $z = 2x_1 + 20x_2 - 10x_3$

Subject to the constraints :

$2x_1 + 20x_2 + 4x_3 \leq 15$

$6x_1 + 20x_2 + 4x_3 = 20$

$x_1, x_2, x_3, x_4 \geq 0$ and are integers.

12. (a) Find the sequence that minimizes the total time required in performing the following jobs on three machines in the order ABC :

Processing time (in hours) on	Job					
	1	2	3	4	5	6
Machine A	8	3	7	2	5	1
Machine B	3	4	5	2	1	6
Machine C	8	7	6	9	10	9

- (b) Explain sequencing problem.

13. (a) Explain queueing problem.
- (b) Customers arrive at the rate of twenty per hour and the present serving arrangements can cope with thirty per hour for an eight hour day. Calculate and state.
- (i) The average time in the queue
- (ii) The implied value of customer's time if the service has considered but rejected a faster service arrangement which would cost an extra Rs. 20 for an 8 hour day and would raise the service rate to 40 per hour.
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