(6 pages)

OCTOBER 2012 **P/ID 17414/RBR**

Time : Three hours Maximum : 75 marks

PART A — (5 × 5 = 25 marks)

Answer ALL questions.

1. (a) A manufacturer produces two types of models M_1 and M_2. Each model of the type M_1 requires 4 hours of grinding and 2 hours of polishing; whereas each model of the type M_2 requires 2 hours of grinding and 5 hours of polishing. The manufacturer has 2 grinders and 3 polishers. Each grinder works 40 hours a week and each polisher works for 60 hours a week. Profit on M_1 model is Rs. 3.00 and on model M_2 is 4.00. Whatever is produced in a week is sold in the market. How should the manufacturer allocate his production capacity to the two types of models, so that he may make the maximum profit in a week? Formulate the problem as a LPP and do not solve.

Or

(b) Solve the following LPP by graphical method :

Maximize $Z = x_1 - 3x_2$

$$x_1 + x_2 \leq 300$$
$$x_1 - 2x_2 \leq 200$$
$$2x_1 + x_2 \leq 100$$
$$x_2 \leq 200$$
$$x_1, x_2 \geq 0.$$

2. (a) Write the dual of the following LPP :

Minimize $Z = 4x_1 + 5x_2 - 3x_3$

subject to :
$$x_1 + x_2 + x_3 = 22$$
$$3x_1 + 5x_2 - 2x_3 \leq 65$$
$$x_1 + 7x_2 + 4x_3 \geq 120$$

$x_1, x_2 \geq 0$ and x_3 is unrestricted.

Or

(b) Explain some important applications of LPP.

3. (a) Narrate the steps involved in solving Gomory cutting plane algorithm.

Or

(b) What are the characteristics of dynamic programming problem?

4. (a) Differentiate PERT from CPM.

Or

(b) Write short notes on cost consideration in PERT/CPM.

5. (a) Define :

(i) Strictly stationary process.

(ii) Renewal process.

(iii) Wide-sense stationary process.

Or

(b) Narrate the characteristics of queueing system.

PART B — (5 × 10 = 50 marks)

Answer any FIVE questions.

6. Use simplex method to solve the following LPP :

Minimize $Z = x_2 - 3x_3 + 2x_5$

subject to :
$$3x_2 - x_3 + 2x_5 \leq 7$$
$$-2x_2 + 4x_3 \leq 12$$
$$-4x_2 + 3x_3 + 8x_5 \leq 10$$
$$x_2, x_3, x_5 \geq 0.$$

7. Use two-phase simplex method to solve :

Maximize $Z = 5x_1 + 3x_2$

subject to :
$$2x_1 + x_2 \leq 1$$
$$x_1 + 4x_2 \geq 6$$
$$x_1, x_2 \geq 0.$$

8. Solve the following transportation problem starting with the initial solution obtained by VAM.

		Destination				Supply
		D_1	D_2	D_3	D_4	
Origin	O_1	2	2	2	1	3
	O_2	10	8	5	4	7
	O_3	7	6	6	8	5
Demand		4	3	4	4	15

9. Solve the following travelling salesman problem.

		To City				
		A	B	C	D	E
From City	A	∞	4	10	14	2
	B	12	∞	6	10	4
	C	16	14	∞	8	14
	D	24	8	12	∞	10
	E	2	6	4	16	∞

10. Use dynamic programming to solve the following :

Minimize $Z = y_1^2 + y_2^2 + y_3^2$

subject to : $y_1 + y_2 + y_3 \geq 15$

$y_1, y_2, y_3 \geq 0.$

11. Find the sequence that minimizes the total elapsed time required to complete the following tasks.

Tasks :	*A*	*B*	*C*	*D*	*E*	*F*	*G*
Machine I :	3	8	7	4	9	8	7
Machine II :	4	3	2	5	1	4	3
Machine III :	6	7	5	11	5	6	12

Also find the total elapsed time and idle time of the machines.

12. A small project is composed of 7 activities whose time estimates are listed in the table below. Activities are identified by their beginning (*i*) and ending (*j*) node numbers.

Activity	Estimated Duration (Weeks)		
(*i* – *j*)	Optimistic	Pessimistic	Pessimistic
1 – 2	1	1	7
1 – 3	1	4	7
1 – 4	2	2	8
2 – 5	1	1	1
3 – 5	2	5	14
4 – 6	2	5	8
5 – 6	3	6	15

(a) Draw the network diagram of activities in the project.

(b) Find the expected duration and variance for each activity. What is the expected project length?

(c) What is the probability that the project will be completed?

(i) at least 4 weeks earlier than expected time

(ii) nor more than 4 weeks later than expected time.

13. Assume that the goods trains are coming in a yard at the rate of 30 trains per day and suppose that the inter-arrival times follow an exponential distribution. The service time for each train is assumed to be exponential with an average of 36 minutes. If the yard can admit 9 trains at a time (there being 10 trains, one of which is reserved for shunting purposes). Calculate the probability that the yard is empty and find the average queue length.

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