PG – 769 PGDAM–11

P.G. DIPLOMA IN APPLIED MATHEMATICS EXAMINATION — DECEMBER, 2019.

(AY 2003–04 and CY–2004 batch only)

OPERATIONS RESEARCH

Time : 3 hours Maximum marks : 75

PART A — (5 × 5 = 25 marks)

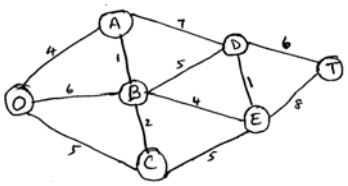
Answer any FIVE questions

1. What are the major assumptions and limitations of linear programming.

2. A firm produces two products say X and Y. Product X sells for a net profit of Rs. 80 per unit, while product Y sells for a net profit of Rs. 40 per unit. The goal of the firm is to earn Rs. 900 in the next week. Also, the management want to achieve sales volume for the two products close to 17 and 15 respectively. Formulate this problem as a goal peogramming model.

3. What is dynamic programming?

4. Consider the following networks where the numbers on links represent actual distances between the corresponding nodes. Find the minimal spanning tree:



5. Solve the following game:

		Player B			
		I	II	III	IV
Player A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

6. Solve the following game by graphical method

	Player B		
Player A	3	-3	4
	–1	1	–3

7. A supermarket has a single cashier. During the peak hours, customers arrive at a rate of 20 customers per hour. The average number of customers that can be processed by the cashier is 24 per hour.

Calculate:

(a) the probability that the cashier is idle.

(b) the average number of customer in the queuing system.

(c) the average time a customer spends in the system.

(d) the average number of customer in the queue.

(e) the average time a customer spends in the queue waiting for services.

8. Use separable convex programming to solve the non linear programming problem:

Maximize $f(x) = 3x_1 + 2x_2$

Subject to the constraints:

$g(x) = 4{x_1}^3 + {x_2}^2 \leq 16$ and $x_1, x_2 \geq 0$.

PART B — ($5 \times 10 = 50$ marks)

Answer any FIVE questions.

9. Use simplex method to solve the following L.P.P.

Maximize $z = 4x_1 + 10x_2$

Subject to the constraints:

$2x_1 + x_2 \leq 50,$
$2x_1 + 5x_2 \leq 100,$
$2x_1 + 3x_2 \leq 90,$
$x_1 \geq 0$ and $x_2 \geq 0.$

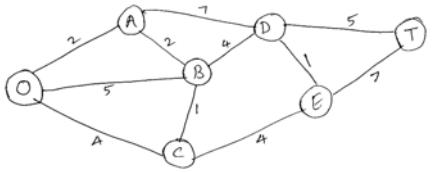
10. Use dual simplex method to solve the LPP

Maximize $z = -3x_1 - 2x_2$

Subject to the constraints:

$x_1 + x_2 \geq 1,$
$x_1 + x_2 \leq 7$
$x_1 + 2x_2 \geq 10,$
$x_2 \leq 3$ and
$x_1, x_2 \geq 0.$

11. Determine a shortest path from O to T for the following network:



12. The following table lists the jobs of a network along with their estimates:

Job		Duration (days		
i	j	Optimistic	Most likely	Pessimistic
1	2	3	6	15
1	6	2	5	14
2	3	6	12	30
2	4	2	5	8
3	5	5	11	17
4	5	3	6	15
6	7	3	9	27
5	8	1	4	7
7	8	4	19	28

(a) Draw the project network.

(b) Calculate the length and variance of the critical path.

(c) What is the approximate path will be completed in 45 days?

(d) What is the chance of project duration exceeding 46 days?

13. Solve the following game:

		Player B			
		I	II	III	IV
Player A	1	6	8	3	13
	2	4	1	5	3
	3	8	10	4	12
	4	3	6	7	12

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

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

Subject to the constraints:

$-x_1 + 2x_2 + x_3 \leq 4,$
$4x_2 - 3x_3 \leq 2$
$x_1 - 3x_2 + 2x_3 \leq 3,$
x_1, x_2 and x_3

all are non-negative integers.

15. 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 lines, one of which is reserved for shunting purposes) Calculate the probability that the yard in empty and find the average queue length.

16. Using geometric programming, solve the following problem:

Minimize $f(x) = 5x_1^{-1}x_2^{-1}x_3^{-1} + 5x_2x_3$

Subject to the constraints:

$2x_1x_3 + x_1x_2 = 4, x_1, x_2, x_3 > 0.$