MC-MCA-2-WP1S

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester MCA (Two Years) Degree (R, S) Examination December/January 2023-24

Course Code: 20MCA261

Course Name: OPERATIONS RESEARCH

Max. Marks: 60 Duration: 3 Hours

PART A

Answer all questions, each carries3 marks. Marks

1 Write down the basic structure of linear programming problem in the mathematical form. (3)

2 Define slack, surplus variables and optimal basic feasible solution in Linear Programming Problem. (3)

3 Formulate the dual of the following linear programming problem (3)

Maximize $Z = 5x_1 + 3x_2$

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

$5x_1 + 2x_2 \leq 10$

with $x_1 \geq 0,\ x_2 \geq 0$

4 State complementary slackness theorem in linear programming problem. (3)

5 Describe the matrix minima method for finding an initial solution for transportation problem. (3)

6 Find the initial basic feasible solution to the transportation given below, by north- west corner rule. (3)

	D_1	D_2	D_3	Supply
O_1	2	7	4	5
O_2	3	3	1	8
O_3	5	4	7	7
O_4	1	6	2	14
Demand	7	9	18	

7 Write six differences between the methods PERT and CPM in Network Analysis. (3)

8 What are the rules of network construction? (Write six points.) (3)

9 Describe Little's formula for relating average queue length and average waiting time of M/M/1 queuing system. (3)

10 A television repairman finds that the time spent on his jobs has exponential distribution with a mean of 30 minutes. If he repairs sets in the order in which they came in, and if the arrival of sets follows a Poisson distribution approximately with an average rate of 10 per 8-hour day, what is the repairman's expected idle time each day? (3)

PART B

Answer any one question from each module. Each question carries 6 marks.

Module I

11 Solve the following linear programming problem by Simplex Method (6)

Min $Z = x_1 - 3x_2 + 2x_3$ subject to

$$3x_1 - x_2 + 3x_3 \leq 7$$
$$-2x_1 + 4x_2 \leq 12$$
$$-4x_1 + 3x_2 + 8x_3 \leq 10$$

with $x_1, x_2, x_3 \geq 0$

OR

12 Solve the following linear programming problem by Big M method (6)

Min $Z = 5x_1 + 6x_2$ subject to

$$2x_1 + 5x_2 \geq 150$$
$$3x_1 + x_2 \geq 120$$

with $x_1 \geq 0, \quad x_2 \geq 0$

Module II

13 Use the duality to solve the following L.P.P (6)

Min $Z = 2x_1 + x_2$ subject to

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

with $x_1, x_2 \geq 0$

OR

14 Use revised simplex method to solve the L.P.P (6)

Maximize $Z = 3x_1 + 2x_2 + 5x_3$ subject to

$x_1 + x_2 + x_3 \leq 430$ (3)
$3x_1 + 2x_2 \leq 460$ (3)
$x_1 + 4x_2 \geq 420$ (3)
with $x_1, x_2, x_3 \geq 0$

Module III

15 Solve the following transportation problem using Vogel's approximation method and MODI method. (6)

	W_1	W_2	W_3	W_4	W_5	Available
F_1	3	4	6	8	9	20
F_2	2	10	1	5	8	30
F_3	7	11	20	40	3	15
F_4	2	1	9	14	16	13
Required	40	6	8	18	6	

OR

16 A company has 4 machines to do three jobs. Each job can be assigned to one and only one machine. The cost of each job on each machine is given in the following table. Determine an optimum assignment which minimizes the cost. (6)

		Machines			
		1	2	3	4
Job	A	18	24	28	32
	B	8	13	17	19
	C	10	15	19	22

Module IV

17 Explain the different components of critical path analysis. (6)

OR

18 The following table lists the jobs of a network along with their time estimates. (6)

a) Draw the PERT network and find out the expected completion time.

b) What is the probability that the jobs on the critical path will be completed in 26 days?

Activity	Estimated duration (days)		
	Optimistic	Most likely	Pessimistic
1-2	6	9	12
1-3	3	4	11
2-4	2	5	14
3-4	4	6	8
3-5	1	1.5	5
2-6	5	6	7
4-6	7	8	15

Module V

19 Explain the elements of queuing system. (6)

OR

20 A road transport company has one reservation clerk on duty at a time. He handles information of bus schedules and makes reservations. Customers arrive at a rate of 8 per hour and the clerk can, on average service 12 customers per hour. (6)

Find a) Average number of customers waiting for the service of the clerk.

b) Average time a customer has to wait before being served.

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