C 26794 (Pages : 4) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION MAY 2012

ME 09 604—OPERATIONS RESEARCH

(2009 Admissions)

Time : Three Hours Maximum : 70 Marks

Part A

Answer all questions.

1. What is meant by optimal solution of a LP model ?
2. Why should the feasible region exhibit the property of convexity in the LP model ?
3. What is the use of artificial variable in linear programming model ?
4. What is an assignment problem ?
5. State the principle of optimality in your own words.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

6. Reformulate the problems into standard form

Minimise $Z = 2x_1 + 3x_2$

subject to $2x_1 - 3x_2 - x_3 = -4$

$3x_1 + 4x_2 - x_4 = -6$

$2x_1 + 5x_2 + x_5 = 10$

$4x_1 - 3x_2 + x_6 = 18$

$x_3,\ x_4,\ x_5,\ x_6 \geq 0$

7. Write the dual of the following LPP

Maximise $Z = 2x_1 + 5x_2 + 3x_3$

Subject to $2x_1 + 4x_2 - 3x_3 \leq 8$

$-2x_1 - 2x_2 + 3x_3 \geq -7$

$x_1 + 3x_2 - 5x_3 \geq -2$

$4x_1 + x_2 + 3x_3 \leq 4$

$x_1,\ x_2,\ x_3 \geq 0$

Turn over

8. Convert the given transportation problem into a balanced transportation problem :

		Destination				
		1	2	3	4	Supply
Source	1	5	12	6	10	300
	2	7	8	10	3	400
	3	9	4	9	2	300
Demand		200	300	450	250	

9. The assignment cost of assigning any one operator to any one machine is given below Find the optimal assignment.

		Operators			
		I	II	III	IV
Machine	A	10	5	13	15
	B	3	9	18	3
	C	10	7	3	2
	D	5	11	9	7

10. Solve the following game by the principle of dominance

$$\begin{bmatrix} 8 & 10 & 9 & 14 \\ 10 & 11 & 8 & 12 \\ 13 & 12 & 14 & 13 \end{bmatrix}$$

11. If for a period of 2 hours in a day trains arrive at a yard every 20 minutes but the service time continues to remain 36 minutes, then calculate for this period

(a) The probability that the yard is empty.

(b) Average queue length on the assumption that the line capacity of the yard is limited to 4 trains only.

(4 × 5 = 20 marks)

Part C

Answer **all** *questions.*

12. (A) If we drop one of the basic vectors and introduce a non-basic vector in the basic set having a basic feasible solution, then the new solution obtained is also a basic feasible solution. Prove it.

Or

(B) A firm makes two products X and Y, and has a total production capacity of 9 tonnes per day, X and Y requiring the same production capacity. The firm has a permanent contract to supply at least 2 tonnes of X and at least 3 tonnes of Y per day to another company, Each tonne of X requires 20 machine hours production time and each tonne of Y requires 50 machine hours production time the daily maximum possible number of machine hours is 360. All the first out put can be sold and the profit made is Rs.80 per tonne of X and Rs.120 tonne of Y. It is required to determine schedule for maximum profit and calculate this profit.

13. (A) Let $x_1 = 2, x_2, = 4, x_3 = 1$ be a feasible solution to the system of equations,

$$2x_1 - x_2 + 2x_3 = 2$$

$$x_1 + 4x_2 = 18$$

Reduce the given feasible solution to a basic feasible solution.

Or

(B) Using big M method

Maximise $Z = 2x_1 + x_2 + x_3$

subject to $4x_1 + 6x_2 + 3x_3 \leq 8$

$$3x_1 - 6x_2 - 4x_3 \leq 1$$

$$2x_1 + 3x_2 - 5x_3 \geq 4$$

and $x_1, \quad x_2, \quad x_3, \leq 0$

14. (A) Find the basic feasible solution of the following transportation problem. Also find the optimal transportation plan

	1	2	3	4	5	Available
A	4	3	1	2	6	80
B	5	2	3	4	5	60
C	3	5	6	3	2	40
D	2	4	4	5	3	20
Demand	60	60	30	40	10	

Or

(B) Show that the assignment problem is a special case of the transportation problem. Why is the transportation method to find the optimal solution not preferred in the assignment problem ?

15. (A) supermarket has two girls ringing up sales at the counters. If the service time for each customers is exponential with mean 4 minutes, and if people arrive in a Poisson fashion at the rate of 10 an hour, calculate

(a) probability of having to wait for service.

(b) expected percentage of idle time for each girl.

(c) if a customer has to wait, what is the expected length of his waiting time ?

Or

(B) A truck can carry a total of 10 tonnes of product. Three type of product are available for shipment. Their weights and values are tabulated. Assuming that at least one of each type must be shipped. Determine the loading which will maximise the total value.

Type	Value Rs.	Weight (tonnes)
A	20	1
B	50	2
C	60	2

(4 × 10 = 40 marks)