VPM's
DR VN BRIMS, Thane
Programme: MMS (2015-17)
Second Semester Examination April 2016

Subject	**Operations Research**		
Roll No.		**Marks**	**60 Marks**
Total No. of Questions	**7**	**Duration**	**3 Hours**
Total No. of printed pages	**3**	**Date**	**18.04.2016**

Note: Q1 is compulsory and solve any FOUR from the remaining SIX questions.
Q1) 20 Marks (Compulsory)

Answer the following with justification of your answer. (2 *10 =20)

1.) Assignment can be made in a square matrix of size "n"when the minimum number of lines in a Reduced-Cost Table with which all zeros can be covered is:
   a. Exactly equal to n. b. Equal to or greater than n.
   c. Equal to or less than n. d. Less than or greater than n.

2.) Which of the following statements is true about converting primal into dual?
   a. The RHS of each constraint must be >= 0.
   b. No of decision variables become no of constraints.
   c. All constraints of the given problem need to be ≤ type.
   d. All constraints should be converted into "==" type.

3.) The feasible region is bounded by points having coordinates (12, 0), (0, 18), (0, 20), (16, 16) and (18, 0) respectively. The objective function is Min 5X1+4X2. Which of these will be solution?
   a. First b. Second c. Third d. Fourth

4.) In linear programming, sensitivity analysis is a technique to:
   a. Allocate resources optimally.
   b. Minimize cost of operations.
   c. Spell out relation between objective & variables.
   d. Determine how optimal solution to LPP changes in response to problem inputs:

5.) CPM is: a. Critical Project Management b. Critical Path Management
   c. Critical Path Method d. Crash Project Method

6.) Mark the wrong statement:
   a. A project is a set of activities that can be performed in a certain logical sequence.
   b. A network represents relationship among the activities of a project.
   c. An arrow representing an activity can have any length and shape.
   d. An activity cannot be represented by more than one arrow but an arrow can represent one or more activities.

7.) In simulation, mark the false statement:
   a. The objective variable can be only 1. b. The variable under control need not be only 1.
   b. Random numbers used can be of 3 digits. d. The random numbers must be between 00-99.

8.) It is known that in a project, an activity 4-6 has duration of six days and total float of three days. The E and L times at node 4 are 8 and 11 respectively and at node 6, both are 17. Which of the following is a true statement about 4-6?
   a. Its total float is two days. b. Its total float is 0.
   b. It is a critical activity. d. The Earliest Start of this activity is 11.

9.) A transportation problem is balanced when:
   a. Total capacity & Total demand are equal and no. of sources is = to no. of destinations.
   b. TC and TD are equal irrespective of the number of sources and destinations.
   c. Number of sources matches with number of destinations.
   d. Some of the routes are prohibited.

10.) Mark the wrong statement:

a. An unbalanced transportation problem can be converted into a balanced transportation problem through the addition of an appropriate slack variable.
b. In North-West Corner Rule, first allocation is always made by beginning from the upper-left hand corner of the tableau.
c. The North-West Corner Rule provides a systematic but inefficient method of finding initial solution to a transportation problem.
d. It is necessary to make number of sources and destinations equal before applying N-W Corner Rule.

Q2) *Any two from (a) or (b) or (c) ———— (5x2) = 10 Marks*

a) Solve the following problem with cost no.s by North-West Corner Method OR Least Cost Method.

From\To	D	E	F	Supply
A	6	4	1	50
B	3	8	7	40
C	4	4	2	60
Demand	**20**	**95**	**35**	**150**

b) Find the optimal solution for the cost and supply/demand matrix as given below

Supply points	Destinations				Supply
	D_1	D_2	D_3	D_4	
A	19	30	50	10	7
B	70	30	40	60	9
C	40	8	70	20	18
Demand	5	8	7	14	

c) Describe the computational procedure of the optimality test in a transportation problem.

Q3) *Any two from (a) or (b) or (c) ———— (5x2) = 10 Marks*

a) Assign workers 1, 2, 3, 4 to jobs A, B, C, D. Time taken by workers for different jobs is given in the matrix:

Workers	Jobs			
	A	B	C	D
1	45	40	51	67
2	55	40	61	53
3	49	52	48	64
4	41	45	60	55

b) The inter-arrival times of customers in a Banks in minutes is given.
2,5,8,4,6,15,18,22,5,15. The service time is uniform at 8 minutes

Simulate the event of arrivals using the following random numbers . Find total waiting time.

Random numbers 12 45 3 67 89 45 34 1 8 29

c) Describe the computational procedure for the allocation of salesman problem.

Q4) *Any two from (a) or (b) or (c) ———— (5x2) = 10 Marks*

Assume that two firms are competing for market share for a particular product. Each firm is considering what promotional strategy to employ for the coming period. Assume that the following payoff matrix describes the increases in market share of Firm *A* & the decreases in market share for Firm *B*. Determine the optimal strategies.

	Firm B		
Firm A	**No Promotion**	**Moderate Promotion**	**Much Promotion**
No Promotion	5	0	-10
Moderate Promotion	10	6	2
Much Promotion	20	15	10

a) Which firm would be the winner, in terms of market share?
b) Would the solution strategies necessarily change if original matrix is transposed ?

c) What would be the solution if a constant of 12 is added to original matrix?

Q5) ***Any two from (a) or (b) or (c) ———— (5x2) = 10 Marks***

(a) Solve the problem given below:

Maximize Z 5 X1 + 6 X2

Subject to 3 X1 +2 X2 <= 30

X1 + 4 X2 <= 36

X1 + 4 X2 <= 24

(b) Explain the economic significance of dual .

(c) Form and solve dual..

Maximise 8 X1 + 6 X2 + 8 X3

Subject to 2 X1 + X2 + X3 <= 80

X1 + 3 X2 + 2 X3 <= 90

Q6) ***Any two from (a) or (b) or (c) ———— (5x2) = 10 Marks***

The following tables give the activities in a construction project along with cost.

Activity	**Predecessor**	**Time (days)**		**Cost (Rs)**	
		Normal	**Crash**	**Normal**	**Crash**
A	-	4	3	60	90
B	-	6	4	150	250
C	-	2	1	38	60
D	A	5	3	150	250
E	C	2	2	100	100
F	A	7	5	115	175
G	D, B, E	4	2	100	240

Indirect cost varies as follows

Days:	14	13	12	11	10	9	8	7
Cost (Rs):	500	400	250	175	100	75	50	35

a) Draw the network diagram

b) Expected project completion time

c) Using crash costs, find the project duration which will require minimum project cost.

Q7) ***Any two from (a) or (b) or (c) ———— (5x2) = 10 Marks***

a) **)** Patients enter the doctor's clinic with average inter-arrival time of 12 minutes .The average service time for the patient is 10 minutes. Find proportion of time doctor is idle. Find average length of system & queue.

b) The weight of a special purpose brick is 5 kg and it contains two basic ingredients B1, and B2. B1 costs Rs. 5 per kg and B2 costs Rs. 8 per kg. Strength consideration dictates that the brick contains not more than 4 kg of B1 and a minimum of 2kg of B2. Since the demand for the production is likely to be related to the price of the brick. Formulate a LPP problem ONLY and solve it graphically.

c) What is meant by feasible region? Why this must be a well-defined boundary for the maximization problem?

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