Note : Q1 is compulsory.   Date 20-04-2015   **60 Marks/ 3 hrs**

Attempt any four of the remaining questions.

Q 1   Answer the following with justification of your answer.   **(2 *10 =20)**

1. Assignment can be made 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.
   b.   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 no.s 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 8.

9 A transportation problem is balanced when

a. Total availability (TA) and Total demand (TD) are equal and number of sources is equal to number of destinations.
b. TA 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. Answer any 2 from below.   **(5 each)**

(a) A company has 3 salesmen which are to be assigned to 4 areas .The operating cost is as given below for different combination. Obtain optimum assignment.

Region	E	N	S	W
A	16	40	3	26
Salesmen B	5	22	23	5
C	8	6	14	5

(b) Solve the above problem if the numbers are of operating profit.

(c) Explain various applications of assignment method.

Q 3.   Answer any 2 from below.   (5 Each)

(a) A company has 3 factories at different locations. The product manufactured at these factories is to be transported to any of 4 distribution centers.

The cost of transportation (Rs/unit) from any factory to any distribution center is given below.The capacity of each factory & demand at each distribution center is given in no.of units. Obtain optimum distribution pattern & associated total cost.

		Distribution Centres				Manufacturing Capacity
		D1	D2	D3	D4	
	F1	5	7	3	8	400
Factory	F2	6	3	4	9	500
	F3	10	8	2	6	600
	Demand	200	400	500	400	

(b) Solve the above problem if the operating cost is termed as operating profit.

(c) Explain various methods to determine initial solution in transportation method.

Q 4. Answer any 2 from below: (5 each)

(a) A company produces three products A, B and C. Each product can be produced on either of the two machines M1 or M2. The time required per unit of the product of the machines are:

Product	hrs/ unit of product		
	Machine 1	Machine 2	price/unit
A	0.5	0.6	50
B	0.7	0.8	60
C	0.9	1.05	70

For a planning period 85 hours of machine time is available on each of the machines. The operating cost of M1 is Rs.5 / hour and for M2 it is Rs.4/ hour. Formulate a LP model to maximize total profit.

(b) Explain the applications of linear programming in recruitment.

(c) Form the dual of problem given below:

Maximize Z   5 X1 + 6 X2

Subject to   3 X1 +2 X2 <= 32

X1 + 4 X2 >= 34

X1 + 4 X2   = 24

Q5   Answer any 2 of given below: (5 Each)

(a) Solve the problem given below:

Maximize Z   5 X1 + 6 X2

Subject to   3 X1 +2 X2 <= 32

X1 + 4 X2 <= 34

X1 + 4 X2   <= 24

(b) Explain the economic significance of dual .

(c) Find range for capacity of constraint 1 for the problem given below.

Maximise   5 X1 + 8 X2

Subject to   2 X1 +   X2 <= 80

X1 +   3 X2 <= 90

Q6. Answer any 2 of given below. (5 Each)

(a) 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
Random numbers   12 45 3 67 89 45 34 1 8 29

(b) Consider the information for a part of project.

Activity		Normal Time	Normal cost (Rs.)	Crash Time	Crash Cost (Rs.)
A	_	3	50	2	100
B	_	2	75	1	150
C	_	6	140	4	260
D	A	5	100	3	180
E	A	7	115	6	145
F	B	2	80	2	80
G	C , D , F	4	100	2	240

O/H cost is 90 / day. Determine optimum duration and cost

(c) Explain the applications of simulation in Business.

Q7 Answer any 2 of given below.   **(5 Each)**

(a) **)** Consider 2 players A & B. Each shows 1 or 2 fingers & announces one number from 2 or 3 or 4. If number announced is equal to sum of the fingers shown then that player wins sum equal to sum of fingers shown. If both win or lose then it is a draw. Construct payoff or gains to row player A.

(b) 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.

(c) A retail outlet has following demand pattern based on past data.

 Demand   10 20   30   40 50

Probability(%)   5   10 25 35 25

Simulate the event for demand for next 10 days using random no.s given.

12 45 3 67 89   45   34   1 8 29   Find average demand .