Seat No. : _______________

ND-110

December-2015

B.B.A., Sem.-V

CC-304 : Operations Research and Quantitative Techniques

Time : 3 Hours] **[Max. Marks : 70**

Instructions : (1) Graph paper will be supplied on request.

(2) Use of simple calculator is allowed.

1. Answer the following questions : **14**

(i) Define objective function.

(ii) When a solution is called degenerate solution ?

(iii) The graphical method can be used only when there are only ________ variables in a L.P.P.

(iv) What is basic condition for applying MODI method ?

(v) For any transportation problem, problem of order 4×5, how many solutions exists ?

(vi) If total supply _____ total demand, then dummy row is added to make it balance.

(vii) In PERT the completion of an activity is called an _____, while in CPM it is called _____.

(viii) For an activity of a project the optimistic time is 6 hours, pessimistic time is 10 hours and the most likely time is 10 hours. Find the expected time of the activity.

(ix) Prepare a PERT-chart for the following project :

Activity	1 – 2	2 – 3	2 – 4	3 – 4	3 – 5	4 – 5
Time	2	3	1	2	3	5

(x) Define EST.

(xi) The competitors are called _____.

(xii) What is saddle point ?

(xiii) What do you mean by unbalanced assignment problem ?

(xiv) Give one assumption of the game.

2. (a) Discuss various types of modelling in O.R. **4**

OR

Define the following terms :

(i) Constraints

(ii) Solution

(iii) Non-degenerate Basic Feasible solution

(iv) Unbounded solution

(b) What is Linear Programming ? Give its mathematical formulation. **4**

OR

Write dual of following :

Minimize $z = 60x + 40y$

Subject to $30x + 10y \geq 24$

$10x + 10y \geq 16$

$20x + 60y \geq 48$

$x, y \geq 0$

(c) Solve the following L.P.P. by graphical method : **6**

Maximize $z = 10x + 15y$

Subject to $11x + 5y \leq 2700$

$5x + 10y \leq 2000$

$x + 2y \leq 450$

$x, y \geq 0$

OR

A factory manufactures two products X and Y on which the profits earned per unit are ₹ 5 and ₹ 6, respectively. Each product is processed on two machines – M_1 and M_2. Product X requires one minute of processing time on M_1 and two minutes on M_2 while Y requires one minute on M_1 and one minute on M_2. Machine M_1 is available for not more than 7 hours and 40 minutes while machine M_2 is available for not more than 10 hours during any working day. Find the number of units of products X and Y to be manufactured to get maximum profit. Solve it by graphical method.

3. (a) Explain North-West Corner Rule for solving Transportation Problem. **4**

OR

Explain :

Degeneracy in Transportation Problem.

(b) Solve the following Transportation Problem by North-West Corner Rule. Also obtain the total transportation cost. **4**

		To				**Supply**
		(1)	(2)	(3)	(4)	
From	**A**	4	3	9	2	30
	B	7	6	8	9	30
Demand		18	16	14	12	60

OR

Obtain feasible solution of the following problem by matrix minima method :

From	To: A	B	C	Supply
P	5	6	7	6
Q	12	8	4	10
R	3	10	14	3
Demand	10	4	3	

(c) Obtain initial basic feasible solution of the following transportation problem by Vogel's method. Also find optimal solution. **6**

	A	B	C	Availability
I	6	8	4	14
II	4	9	8	12
III	1	2	6	5
Demand	6	10	15	

OR

Find the optimal solution for the given initial solution.

	D_1	D_2	D_3	D_4	**Supply**
S_1	10	7 $\boxed{12}$	9 $\boxed{1}$	8 $\boxed{9}$	22
S_2	9	13	6 $\boxed{15}$	11	15
S_3	9 $\boxed{7}$	11	12 $\boxed{1}$	10	8
Demand	7	12	17	9	45

4. (a) Define the following terms : **4**

(i) Optimistic time

(ii) Event

(iii) Dummy activity

(iv) Free Float

OR

Give the difference between PERT and CPM.

(b) Prepare a PERT diagram for the following project and determine critical path : **4**

Activity	1 – 2	1 – 3	1 – 4	2 – 3	2 – 5	3 – 5	4 – 5
Time (hours)	3	2	5	6	6	4	5

OR

Draw the network diagram for the data given below :

Activity	**Immediate Predecessor Activity**
A	–
B	A
C	A
D	B, C
E	C
F	D
G	E
H	F, G

(c) Find critical path for the following project and then find EST, EFT, LST, LFT and Float time for each activity. **6**

Activity	1 – 2	1 – 3	2 – 3	2 – 4	3 – 4	4 – 5	4 – 6	5 – 7	6 – 7
Time (hours)	10	5	6	4	6	5	3	2	3

OR

A project consists of 8 activities. Precedence relation and activity times are given. Draw the network and compute the critical path. Compute the free float for each activity.

Activity	**Immediate Predecessor**	**Activity time (weeks)**
P	–	12
Q	–	20
R	–	28
S	R	12
T	P, Q	28
U	T, S	12
V	S	8
W	U, V	8

5. (a) Explain : Minimax and Maximin principle used in the theory of games. **4**

OR

What is an unbalanced assignment problem ?

(b) Solve the following game and determine the value of game : **4**

$$\begin{bmatrix} 5 & 1 \\ 3 & 4 \end{bmatrix}$$

OR

Solve the following game (using dominance property) :

$$\begin{bmatrix} 9 & 8 & -7 \\ 3 & -6 & 4 \\ 6 & 7 & -7 \end{bmatrix}$$

(c) Solve the following assignment problem for minimum cost. **6**

		Job			
		1	2	3	4
Man	A	10	12	19	11
	B	5	10	7	8
	C	12	14	13	11
	D	8	15	11	9

OR

A company has four machines on which three jobs has to be done. 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 :

	Machines			
	W	**X**	**Y**	**Z**
A	18	24	28	32
B	8	13	17	19
C	10	15	19	22

What are the job assignments ? Which will minimize the cost ?