Reg. No										

MANIPAL UNIVERSITY, MANIPAL

THIRD SEMESTER M.SC (APPLIED MATHEMATICS & COMPUTING)
MAKEUP EXAMINATION –December , 2015

SUB : OPTIMIZATION METHODS-I (MAT 701)

(REVISED CREDIT SYSTEM)

Time: 3 Hrs. **Max. Marks : 50**

Note : a) Answer any FIVE full questions. b) All questions carry equal marks.

1A . Every shift resident doctors in a government hospital work five consecutive days and have two consecutive days off. Their five days of work can start on any day of the week and the schedule rotates indefinitely. The hospital requires the following minimum number of doctors working

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
35	55	60	50	60	50	45

No more than 40 doctors can start their five working days on the same day. Formulate the problem mathematically to minimize the number of doctors employed by the hospital.

1B. A firm makes two products X and Y and has a total production capacity of 9 tons per day, X and Y requiring the same production capacity. The firm has a permanent contact to supply at least 2 tons of X and at least 3 tons of Y per day. Each ton of X requires 20 machine hours and that of Y requires 50 machine hours of production time. Daily maximum possible machine hours available is 360. If profit of Rs.8 and Rs.120 are made in selling each ton of products X and Y, determine the optimal production schedule using graphical method.

1C. Derive the condition for the optimality of a solution of a LPP in the standard form using simplex method. (3+4+3)

2A. A company has three production shops and five warehouses. The cost of production of one unit of material in each shops are given below:

Shops	A	B	C
Cost of production(In Rs.)	14	16	15

The unit transportation cost of material from shops to warehouses are given below

		warehouses					
		I	II	III	IV	V	Supply
Shops	A	6	4	4	7	5	100
	B	5	6	7	4	8	125
	C	3	4	6	3	4	175
Demand		60	80	85	105	70	

Find the optimal quantity to be supplied from each shop to different warehouses which will minimize the total cost. Use VAM to find the initial basic solution.

2B. Solve the following LPP by dual simplex method

Minimize $z = 2x_1 + x_2$

Subject to $x_1 + x_2 = 4$

$2x_1 - x_2 \geq 3$

$x_1, x_2 \geq 0$ (5+5)

3A. Use branch and bound method to solve the following LPP

Maximize $z = 7x_1 + 9x_2$

Subject to $-x_1 + 3x_2 \leq 6$

$7x_1 + x_2 \leq 35,$

$0 \leq x_1, x_2 \leq 7$ and integers.

3B. The captain of Cricket team has to allot five middle batting positions to five batsman. The average runs scored by each batsman at these positions are as follows

		Batting Positions				
		I	II	III	IV	V
Batsmen	A	40	40	35	25	50
	B	42	30	16	25	27
	C	50	48	40	60	50
	D	20	19	20	18	25
	E	58	60	59	55	53

(i) find the best assignment of the batsmen to positions.

(ii) if another batsman F with the following average runs in following positions as given below

Batting Position :	I	II	III	IV	V
Average runs :	45	52	38	50	49

is to be added to the team. Should he be included to play in the team? If so, who will be replaced by him?

(6 + 4)

4A. Reduce the game defined by the following pay off matrix into a 2 X 2 game and then solve it

		Player II			
		B_1	B_2	B_3	B_4
Player 1	A_1	1	9	6	0
	A_2	2	3	8	4
	A_3	–5	–2	10	–3
	A_4	7	4	–2	–5

4B. A project has following activities precedence relations and time estimates

		Duration (in weeks)		
Activity	Immediate predecessor	Optimistic	Most likely`	Pessimistic
A	-	4	5	12
B	-	2	9	10
C	B	4	5	12
D	A,C	8	10	12
E	B	4	6	8
F	D,E	3	4	5
G	D,E	4	5	12
H	D,E	2	3	4
I	G	3	4	5
J	F,I	6	8	10
K	G	4	5	6
L	H	7	9	11
M	J,K,L	6	7	8

Draw a network, find the critical path . What should be the due date to have 0.90 probability of completion? Given, $\phi^{-1}(0.90) = 1.28.$

(4 + 6)

5A. Formulate the game defined by the following pay off matrix into a LPP and solve it by simplex method

		Player B		
		B_1	B_2	B_3
Player A	A_1	9	1	4
	A_2	0	6	3
	A_3	5	2	8

5B. A Project has following activities, precedence relations and time estimates

Activity	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Immediate predecessor	---	--	---	B	A, D	B	B	C	C	C	E,F	G,H, K	E,F	E, F	M,N,I	J
Duration (in days)	2	3	4	5	4	9	7	8	9	10	10	7	11	12	13	15

Draw a network, find the critical path and duration of the project. Determine the free and total floats for all noncritical activities. If so by how many days.

(5 + 5)

6A. Given a LPP, Maximize $z = 3x + 5y$

Subject to $3x + 2y \leq 18$

$x \leq 4$

$y \leq 6$

$x,y \geq 0$

Solve the LPP by Simplex method and discuss the effect of change in coefficient of objective function and availability of resources.

6B. . A project has following activities, time and cost estimates.

Activity	Time (days)		Cost (Rs.)	
	Normal	Crash	Normal	Crash
(1, 2)	6	2	4000	12000
(1,3)	8	3	3000	6000
(2, 4)	7	4	2800	4000
(3, 4)	12	8	9000	11,000
(4, 6)	3	1	10000	13,000
(5,6)	5	2	4900	7000
(3, 5)	7	3	1800	5000
(5,7)	11	5	6600	12000
(6,7)	10	6	4000	8400

The indirect cost of the project is Rs.2000 per day. Draw a network and find the optimal duration which minimizes the total cost.

(6+4)

****