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MANIPAL UNIVERSITY, MANIPAL

THIRD SEMESTER M.SC (APPLIED MATHEMATICS & COMPUTING)

MAKEUP EXAMINATION – DECEMBER, 2016

SUBJECT : OPTIMIZATION METHODS-I (MAT 701)

Time: 3 Hrs.

Max. Marks : 50

Note :	Answer any	FIVE full	questions.
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1A A transport company has offices in five localities A, B, C, D and E. On a day at offices A & B 6 and 8 spare trucks are available where as in the offices C, D and E require 4, 7 and 3 trucks respectively. The distances in kms between the five localities are given below

$$\begin{array}{c} \text{To} \\ \text{C} \quad \text{D} \quad \text{E} \\ \text{From} \quad \begin{array}{c} \text{A} \begin{bmatrix} 3 & 7 & 5 \\ 2 & 3 & 9 \end{bmatrix} \end{array}$$

How should the trucks from A and B be sent to C, D and E so that a total of minimum distance is covered. Formulate mathematically.

- 1B. A person has Rs. 1,00,000/= to invest in two stock portfolios with maximum investment allowed in either portfolio set at Rs. 75,000. The first portfolio has an average of 10% return where as the second has 20% return. In terms of risk factors, the first portfolio has a risk rating of 4 and second has 9 (in the scale of 10). The person will not accept an average rate of return below 12% or a risk factor above 6. Use graphical method to determine the amount to be invested in different portfolios so as to maximize the return.
- 1C. Derive the condition for the feasibility of a solution of a LPP in the standard form using simplex method.

(3+4+3)

2A. A particular product is manufactured in factories A, B, C & D and are sold at centres 1,2,3. The relevant data are given below :

Factory	Cost / unit	Capacities
	In Rs.	
А	12	100
В	15	20
С	11	60
D	13	80

Sales	Sale	Demand
Centre	Price/Unit	
1	15	120
2	14	140
3	16	60

Find the optimal sales distribution. Use VAM to obtain the initial basic solution.

- 2B. A retired person wants to invest up to an amount of Rs.30,000 in fixed Income securities. His broker recommends investing in two bonds. Bond A yielding 7% and Bond B yielding 10%. After some consideration, he decides to invest at most Rs.12,000 in bond B and atleast Rs.6000 in bond A
 - . He also wants to amount invested in bond A to be at least equal to the amount invested in bond B. How should broker recommend if the investor wants to maximize his return on investment? Solve by penalty cost method.

(5+5)

3A. Solve the following LPP by branch and bound method Maximize $Z = 4x_1 + 3x_2$ Subject to : $5x_1 + 3x_2 \ge 30$ $x_1 \le 4, x_2 \le 6$

- $x_1, x_2 \ge 0$ 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							
		Ι	II	III	IV	V		
	А	40	40	35	25	50		
	В	42	30	16	25	27		
Batsmen	С	50	48	40	60	50		
	D	20	19	20	18	25		
	Е	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 :	Ι	II	III	IV	V
Average runs :	45	52	38	50	49
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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 payoff matrix into a 2 X 2 game and solve by analytical method.

Player B

$$B_1 \quad B_2 \quad B_3 \quad B_4$$

Player A
 $A_1 \begin{bmatrix} 3 & 2 & 4 & 0 \\ 3 & 4 & 2 & 4 \\ A_3 & 4 & 2 & 4 \\ 4 & 2 & 4 & 0 \\ 0 & 4 & 0 & 8 \end{bmatrix}$

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

Activity	Immediate	Duration (in weeks)						
	predecessor	Optimistic	Most likely`	Pessimistic				
А	-	2	3	4				
В	-	3	4	11				
С	-	2	5	8				
D	A,B	1.5	3.5	8.5				
Е	B,C	5	7	9				
F	A,B	2	5.5	6				
G	С	1.5	2.5	6.5				
Н	D,E,F	3	4	11				
Ι	D	4	6	8				
J	G	3	4.5	9				
K	G	5	6	7				
L	H,J	1	3	11				
М	K	4	5	6				
Ν	I,L	6	7	8				

Draw a network, find the critical path and expected duration of the project. In how many weeks the project will be completed with the probability of 0.95? Given $\phi^{-1}(0.95) = 1.645$.

(4 + 6)

5A. Solve the game defined by the following pay off matrix by simplex method

PlayerB $B_1 \quad B_2 \quad B_3$ $A_1 \begin{bmatrix} 3 & 4 & -2 \\ -3 & 0 & 1 \\ A_3 \begin{bmatrix} -1 & -4 & 2 \end{bmatrix}$

Activity	A	В	C	D	E	F	G	Η	Ι	J	K	L	М
Immediate predecessors	-	А	В	A	D	Е	-	G	J, H	-	А	G, K	I,L
Durations (days)	6	4	7	2	4	10	2	10	6	13	9	3	5

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

Draw a network, find the critical path. Determine the total and free floats for all non-critical activities.

(5 + 5)

6A. Given a LPP, Subject to $3x + 2y \le 18$ $x \le 4, y \le 6$ $x,y \ge 0$

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	Preceeding	Time (in	n weeks)	Cost (Rs.)		
	Activities	Normal	Crash	Norma	Crash	
А	-	3	2	18000	19000	
В	-	8	6	600	1000	
С	В	6	4	10000	12000	
D	В	5	2	4000	10000	
E	А	13	10	3000	9000	
F	А	4	4	15000	15000	
G	F	2	1	1200	1400	
Н	C,E,G	6	4	3500	4500	
Ι	F	2	1	7000	8000	

Draw a network and find the critical path. If a dead line of 19weeks is imposed for completion, what activities will be crashed? What is the total cost after crashing?

(6+4)
