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## MANIPAL UNIVERSITY, MANIPAL

THIRD SEMESTER M.SC (APPLIED MATHEMATICS & COMPUTING) END SEMESTER EXAMINATION – NOVEMBER, 2016

SUB : OPTIMIZATION METHODS-I (MAT 701)

Time: 3 Hrs.

Max. Marks : 50

## Note: Answer any FIVE full questions.

1A A firm places an order for a particular product at the beginning of each month and receives them at the end of the month. The firm sells during the months from the stocks and it can sell any quantity. The following table shows the projected buying and selling prices for the next four months.

Month	Selling price(Rs) during the	Purchase price(Rs) in the beginning
	month	of the month
April		75
May	90	55
June	60	60
July	75	

As on April 1 the firm has no stokes and does not wish to have any stokes at the end of July. The firm has a warehouse which can hold a maximum of 150 units of the product. Formulate the problem mathematically to determine the best buy and sell so as to maximize the total profit.

- 1B. A company manufactures two products A & B. It is estimated that the sales of product A for the next month will not exceed 20 units , whereas the company has to supply a minimum of 10 units of product B. There are 100 hours of machining possible and both the products requiring 4 hours machining each. To assemble the parts, 4 and 6 labour hours are required for products A & B and a total of 180 hours of labour is available. The material available with the company is sufficient to produce 40 units of both parts with both parts requiring the same amount of material. If profits obtained in selling one unit of products A & B are Rs. 30 and Rs.40, find the best production 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 factories at A, B and C which supply warehouses at D,E,F and G. The factory capacities are 230, 280 and 180 respectively for regular production. If overtime production is utilized, the capacities can be increased to 300, 360 and 190 respectively. Increment limit overtime costs are Rs.5, Rs.4 and Rs.6 respectively. The current warehouse requirements are 165, 175, 205 and 165 respectively. Unit shipping costs ( in rupees) between the factories and the warehouses are

		warehouses					
		D	Е	F	G		
	А	6	7	8	10)		
Factories	В	4	3	7	6		
	С	3	22	2	11)		

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Determine the optimum distribution of the companies to minimize costs.

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 
$$Z = 7x_1 + 9x_2$$
  
Subject to  
$$-x_1 + 3x_2 \le 6,$$
$$7x_1 + x_2 \le 35$$
$$0 \le x_1, x_2 \le 7$$
, integers.

3B. A company has four zones open and 4 salesmen available for assignments. The estimated total annual sales in 4 zones are given below:

Territory	Ι	II	III	IV
Annual sales	126	105	84	63
(in Rs. 1000)				

The four salesmen also differ in their abilities. It is estimated that, working under the same conditions, their yearly sales would be proportionately as follows.

Salesmen	Р	Q	R	S
Proportion	7	5	5	4

Obtain the best assignment of salesmen to zones which maximizes the total sales. (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  

$$B_1 \quad B_2 \quad B_3 \quad B_4$$
  
Player 1  
 $A_1 \begin{bmatrix} 1 & 9 & 6 & 0 \\ 2 & 3 & 8 & 4 \\ -5 & -2 & 10 & -3 \\ A_4 & 7 & 4 & -2 & -5 \end{bmatrix}$ 

4B. A pro	ject has followin	g activities	precedence	relations and	time estimates
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Activity	Immediate	Duration ( in weeks)						
	predecessor	Optimistic	Most likely`	Pessimistic				
А	-	4	5	12				
В	-	2	9	10				
С	-	4	5	12				
D	В	8	10	12				
E	A,D	3	4	11				
F	В	3	4	5				
G	В	4	5	12				
Н	С	3	4.5	9				
Ι	С	1	3	11				
J	С	6	8	10				
K	E,F	1.5	2.5	6.5				
L	G,H,K	7	9	11				
М	E,F	2	5.5	6				
N	E,F	4	5	12				
0	I,L,M	1	3	11				

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

(4 + 6)

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

Player B  

$$B_1 \quad B_2 \quad B_3$$
  
 $A_1 \begin{bmatrix} 1 & -1 & 3 \\ 3 & 5 & -3 \\ A_3 \end{bmatrix} \begin{bmatrix} 3 & 5 & -3 \\ 6 & 2 & -2 \end{bmatrix}$ 

Activity	Α	В	С	D	E	F	G	Η	Ι	J	K	L	Μ	Ν	0	Р
Immediate				В	А,	В	В	С	С	С	E,F	G,H,	E,F	E,F	M,N	J
predecessor					D							Κ			,Ι	
Duration	2	3	4	5	4	9	7	8	9	10	10	7	11	12	13	15
( in days)																

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

Draw a network, find the critical path and duration of the project. Determine the free and total floats for all noncritical activities. If the duration of the activity 'F' be advanced by 3 days will it affect the duration of the project? If so by how many days.

(5 + 5)

6A. Given a LPP, Maximize Z = x+2y+zSubject to  $3x+y-z \le 10$  $-x+y+z \le 6$  $y+z \le 4$  $x,y,z \ge 0$ 

Solve the LPP by Simplex method and discuss the effect of change in availability of resources without change in the optimal value.

Activity	Time	(days)	Cos	t (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

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

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

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(6+4)