Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY

VI SEMESTER B.TECH (MECHANICAL ENGG.) END SEMESTER EXAMINATIONS, APRIL/MAY 2017

SUBJECT: PROGRAM ELECTIVE IV, OPERATIONS RESEARCH [MME 4026] REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- ✤ Missing data may be suitably assumed.
- 1A. A company has two grades of inspectors, I & II to undertake quality inspection. At least 1,500 pieces must be inspected in an 8 hour day. Grade I inspector can check 20 pieces in an hour with an accuracy of 96%. Grade II inspector can check 14 pieces in an hour with an accuracy of 92%. Wages of grade I inspector is ₹100 per hour while those of grade II inspector is ₹80 per hour. Any error made by the by an inspector costs ₹60 to the company. If there are, in all, 10 grade I inspectors and 15 grade II inspectors in the company, formulate the LPP as to have the optimal assignment of inspectors that minimizes the daily inspection cost. Do not solve.

(5)

1B. A retailer deals in a perishable commodity. The daily demand and supply are available. The data for the past 500 days shows demand and supply as shown in table below.

Sup	ply	Demand		
Availability	No. of	Availability	No. of	
(kgs)	days	(kgs)	days	
10	40	10	50	
20	50	20	110	
30	190	30	200	
40	150	40	100	
50	70	50	40	

The retailer buys the commodity at ₹20 per kg and sells at ₹30 per kg. Any unsold commodity at the end of the day has no saleable value. Moreover, the

loss on any unsatisfied demand is ₹8 per kg. Given the following random numbers, simulate the sales, demand and profit for six days. The random numbers 31, 63, 15, 07, 43, 81 are pertaining to supply and the random numbers 18, 84, 79, 32, 75, 27 are pertaining to demand.

2A. Solve the following LPP:

Max. $Z = 2x_1 + 3x_2 + 4x_3$

s.t
$$3x_1 + x_2 + 4x_3 \le 600$$

 $2x_1 + 4x_2 + 2x_3 \ge 480$
 $2x_1 + 3x_2 + 3x_3 = 540$
 $x_1, x_2, x_3 \ge 0$

2B. Solve the game for the pay-off given below.

		Player B				
		b ₁	b ₂	b ₃		
A	a 1	7	1	7		
ayer	a ₂	9	-1	1		
Ъ	a ₃	5	7	6		

3A. A marketing manager wants to visit cities A,B,C and D. he does not want to visit any city twice before completing the tour of all the cities and wishes to return to his home city A. Profit earned in ₹ lakhs of going from one city to another as per the average of previous visits is given in table below. How should he plan his journey? Use suitable algorithm.

		To city				
		Α	В	С	D	
>	Α	-	3	8	5	
i cit	В	3	-	14	4	
rom	С	8	14	-	2	
ш	D	5	4	2	-	

3B. Write the dual of the LPP given below. Do not solve. Max $Z = 8x_1+10x_2+5x_3$

s.t., $x_1 - x_2 \le 4$ $2x_1 + 4x_2 \le 12$ $4x_1 - x_2 - x_3 = 15$ $x_1 + x_2 + x_3 \ge 7$ $x_1, x_3 \ge 0$ & x_2 is unrestricted in sign.

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(7)

(3)

4A. A departmental store wishes to purchase the following quantities of the outfits from the various designers.

Туре	Α	В	С	D	Е
Quantity	150	100	75	250	200

The designers have the different supply capacities as shown below:

Designers	W	Х	Y	Z
Quantity	300	250	150	200

The store estimates that its profit (in ₹ 000's) per outfit will vary with the designers as shown in the matrix below. How should orders be placed to attain maximum profit?

		Outfit						
		A B C D						
L	W	2.7	3.5	4.2	2.2	1.5		
gnei	X	3	3.2	4.5	1.7	1		
esi	Y	2.5	3.5	4.7	2	1.2		
	Z	3.2	2.7	4	2.5	1.7		

4B. The list of activities pertaining to a project is given below along with relevant details. The indirect cost is ₹300 per day. Find the minimum possible duration of the completion of the project and the associated cost.

Activity	Predecessor	Normal Cost (₹)	Crash Cost (₹)	Normal duration (days)	Crash duration (days)
A	-	3000	4000	5	4
В	A	1200	2000	6	2
С	A	1000	1800	4	3
D	A	1200	2000	5	3
E	B,C,D	1600	1600	3	3

(5)

(5)

5A. A fast food chain wants to build four stores. In the past the chain has used six different construction companies, and having been satisfied with each, has invited them to bid for each job. The final bids (in ₹ lakhs) are shown in the table below.

		Construction companies					
		1 2 3 4 5					6
	Α	85.3	90	87.5	82.4	89.1	91.3
res	В	78.9	84.5	99.4	80.4	89.3	88.4
Sto	С	82	31.3	28.5	66.5	80.4	109.7
	D	84.3	34.6	86.2	83.3	85	85.5

What assignment to the construction companies, by the stores will result in minimum expenditures, under the basis that no construction company will get (5) more than one bid?

5B. The precedence relations and other information of a project are given in table below. Draw the network and compute the duration floats of all the activities.

Activity	Predecessor	Time (days)
A	-	8
В	-	10
С	-	8
D	A	10
E	A	16
F	B,D	17
G	С	18
Н	С	14
I	F,G	9

(5)