VPM's
DR VN BRIMS, Thane
Programme: MMS (2017-19)
Second Semester Examination April 2018

Subject	**Operations Research**		
Roll No.		**Marks**	**60 Marks**
Total No. of Questions	**7**	**Duration**	**3 Hours**
Total No. of printed pages	**3**	**Date**	**30.04.2018**

Note: Q1 is compulsory and solve any FOUR from the remaining SIX questions.

1. (Compulsory)

Three high precision products are manufactured by a Hi-Tech Machine ToolsCompany. All the products must undergo process through three machining centersA, B and C. The machine hours required per unit are,

Machine	**Product**		
	I	**II**	**III**
A	2	4	6
B	3	6	2
C	3	2	1

The available time per machine per week is:

Machine	**Hours per week**
A	150
B	100
C	120

It is estimated that profit per unit of the products are as follows:

Product	**Profit**
I	3
II	4
III	6

a) Formulate an LPP
b) Solve to find an optimal solution
c) How many units of each products should be produced at the optimal level?
d) Does machining center C have any time to spare? If so, how much?

2. Solve A) or B)

A) Solve the following LPP

Maximize $Z = 2X_1 + X_2$

Subject to

$4X_1 + 3X_2 \leq 12$

$4X_1 + X_2 \leq 8$

$4X_1 - X_2 \leq 8$

$X_1 , X_2 \geq 0$

B) Solve the following Transportation problem

	W1	**W2**	**W3**	**W4**	**Supplies**
F1	48	60	56	58	140
F2	45	55	53	60	260
F3	50	65	60	62	360
F4	52	64	55	61	220
Demand	200	320	250	210	

3. Solve A) or B)

A) A state has three power plants with generating capacities of 30, 40 and 25 millionKWH that supply electricity to three cities located in the same state. The demandrequirements (maximum) of the three cities are 35, 40 and 20 million KWH. The distribution cost (Rs. in thousand) per million unit for the three cities are given in the table below:

	City 1	City 2	City 3
Plant 1	60	75	45
Plant 2	35	35	40
Plant 3	55	50	45

(a) Formulate the problem as a transportation model.
(b) Determine an economical distribution plan.
(c) If the demand is estimated to increase by 15%, what is your revised plan?
B) Solve the following assignment problem

	I	II	III	IV	V
1	11	17	8	16	20
2	9	7	12	6	15
3	13	16	15	12	16
4	21	24	17	28	26
5	14	10	12	11	13

4. Solve A) or B)
A) A company has plants at locations A, B and C with the daily capacity to producechemicals to a maximum of 3000 kg, 1000 kg and 2000 kg respectively. The cost ofproduction (per kg) are Rs. 800 Rs. 900 and Rs. 7.50 respectively. Customer'srequirement of chemicals per day is as follows:

Customer	Volume needed	Price offered
1	2000	200
2	1000	215
3	2500	225
4	1000	200

Transportation cost (in rupees) per kg from plant locations to customer's place isgiven in table.

Customer	1	2	3	4
Plant A	5	7	10	12
Plant B	7	3	4	2
Plant C	4	6	3	9

Find the transportation schedule that minimizes the total transportation cost.
B) Mr. X quite often flies from town A to town B. He can use the airport bus which costs Rs 13 but if he takes it, there is a 0.08 chance that he will miss the flight. A hotel limousine costs Rs. 27 with a 0.96 chance of being on time for the flight. For Rs 50 he can use a taxi which will make 99 of 100 flights. If Mr X catches the flighton time, he will conclude a business transaction which will produce a profit of Rs
1,000; otherwise he will lose it. Which mode of transportation should Mr X use?
5. Solve A) or B)
A) For the PERT problem find the critical path and project duration. What is theprobability that the project will be completed in 25 days?

Activity	Predecessor	Time		
		Optimistic	Most Likely	Pessimistic
A	-	2	5	14
B	-	1	10	12
C	A	0	0	6
D	A	1	4	7
E	C	3	10	15
F	D	3	5	7
G	B	1	2	3
H	E,F	5	10	15
I	G	3	6	9

B) For the following game, find the Nash equilibrium.

		Player B	
		L	**R**
Player A	**U**	(3,9)	(1,8)
	D	(0,0)	(2,1)

6. Solve A) or B)

A) Explain prisoner's Dilemma with the help of the following payoff matrix

		Clyde	
		S	**C**
Bonnie	**S**	(-5,-5)	(-30,-1)
	C	(-1,-30)	(-10,-10)

B) Old hen can be bought for Rs 2 and young ones for Rs. 5. The old hen lay 3 eggs per week while the young ones lay 5 eggs per week, each egg being worth 30 paise. A hen costs Rs. 1 per week to feed. If a person has only Rs. 80 to spend on the hen, how many of each kind should he buy to get a profit of more than Rs. 6 per week, assuming he cannot keep more 20 hen at his house?

7. Solve A) or B)

A) A company has two options: either invest in a large plant (investment Rs 50 lacs) or a small plant (outlay 25 lacs). In the latter option, after year 1, depending on market response, it can expand by investing Rs. 30 lakhs further. Market survey puts the market response into two categories: good and bad. The chances of good response initially are 0.6 and bad 0.4. However, if the initial response is good, subsequent response will be good with probability of 0.9, and, if the initial response is bad, the subsequent response is likely to be bad with a probability 0.9. The estimated payoffs are given below:

	Small Plant		Large Plant	
	Good	**Bad**	**Good**	**Bad**
Initial Years	15	5	20	5
Subsequent Years	60	20	30	20

Advice the company on which investment should it make?

B) Solve the following transportation problem (suggested method VAM)

	Market A	**Market B**	**Market C**	**Supply**
Warehouse 1	5	4	6	65
Warehouse 2	7	4	7	42
Warehouse 3	8	6	7	43
Demand	70	30	50	