[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 1486 **F-7** **Your Roll No.....**

Unique Paper Code : 1091301

Name of the Paper : Operations Research

Name of the Course : **B.M.S.**

Semester : III

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Answer **any five** questions.
3. Attempt all parts of a question together.
4. Show your workings clearly on the answer sheet itself.
5. Use of Simple Calculator is allowed.

1. (a) Solve the following LPP graphically :

Maximize $Z = 15X_1 + 10X_2$

Subject to $4X_1 + 6X_2 \leq 360$

$3X_1 \leq 180$

$5X_2 \leq 200$

$X_1, X_2 \geq 0$ (6)

(b) Examine the Simplex Tableau given below (for an Objective function of Maximization type) :

		C_j	4	3	0	0	0	0
Profit per unit C_B	**Basis**	**Solution b_i**	X_1	X_2	S_1	S_2	S_3	S_4
3	X_2	200	0	1	1	0	-2	0
0	S_2	200	0	0	-1	1	1	0
4	X_1	400	1	0	0	0	1	0
0	S_4	500	0	0	-1	0	2	1

Comment whether the given solution is optimal or not. In case it is not, find the optimal solution and state the value of objective function.

(9)

2. A project consists of completing the wing assembly for an experimental aircraft. For this, seven major activities are involved. These activities have been labeled A through G in the following table, which also shows their estimated completion times (in weeks) and immediate predecessors.

Activity	Estimated Duration (weeks)			Immediate Predecessors
	Optimistic (a)	Most likely (m)	Pessimistic (b)	
A	1	2	3	-
B	2	3	4	-
C	4	5	6	A
D	8	9	10	B
E	2	5	8	C,D
F	4	5	6	B
G	1	2	3	E

(i) Draw the project network and find the critical path.

(ii) Find the expected duration and variance of the project.

(iii) What is the probability that the project will be completed 2 weeks earlier than the expected time ?

(15)

3. If the matrix elements represent the unit transportation times (in minutes), solve the following transportation problem using Vogel's Approximation method in order to minimize total transportation time :

	To				
From	**D_1**	**D_2**	**D_3**	**D_4**	**Availability**
O_1	10	0	20	11	**15**
O_2	1	7	9	20	**25**
O_3	12	14	16	18	**5**
Required	**12**	**8**	**15**	**10**	**45**

(15)

4. (a) The research department of Hindustan Lever has recommended to the marketing department to launch a shampoo of three different types. The marketing manager has to decide one of the types of shampoo to be launched under the following estimated payoffs for various levels of sales :

	Levels of Sales		
	High	**Moderate**	**Low**
Types of Shampoo			
Egg Shampoo	30	10	10
Clinic Shampoo	40	15	5
Deluxe Shampoo	55	20	3

What will be the marketing manager's decision under (i) Maximin (ii) Maximax and (iii) Laplace criteria respectively ? (6)

(b) The table given below shows the expected grade points for different subjects. Using Hungarian Assignment Method suggest how should a student choose the subjects in order to maximize the total expected grade points and what will be the maximum expected total points corresponding to such a choice.

Subjects / Semester	Analysis	Statistics	Set Theory	Algebra
I	4	5	6	7
II	5	5	7	7
III	7	6	7	9
IV	8	9	10	10

(9)

5. (a) A housewife buys three kinds of cereals: A, B and C. She never buys the same cereal on successive weeks. If she buys cereal A, then the next week she buys cereal B. However, if she buys either B or C, then the next week she is three times as likely to buy A as the other brand. Obtain the transition probability matrix and determine how often she would buy each of the cereals in the long run. (7)

(b) For the Payoff matrix is given below, solve the game and find the value of the game :

	Player B		
Player A	B_1	B_2	B_3
A_1	3	2	4
A_2	3	4	2
A_3	4	2	4

(8)

6. (a) Write the dual for the following LPP :

Minimize $Z = 10X_1 + 8X_2$

Subject to : $4X_1 + 2X_2 \leq 5$

$2X_1 + 2X_2 \geq 3$

$X_1, X_2 \geq 0$

(b) What is Integer Programming Problem ? How is it different from Linear Programming Problem ?

(c) Define total float and free float. State their applications. (5×3)

(200)