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ASSIGNMENT NO. 1

Decision Theory

Q1. Payoff Table :

	Estimated Sales (In units)		
Types of shampoo	15000	10000	5000
Egg shampoo	30	10	10
Clinic shampoo	40	15	5
Deluxe shampoo	55	20	3

(i) Maxmin principle

	Estimated Sales (In Units)			Minimum
Types of shampoo	15000	10000	5000	Pay-off
Egg shampoo	30	10	10	10
Clinic shampoo	40	15	5	5
Deluxe shampoo	55	20	3	3

Max (10,5,3) = 10. Since the maxmin pay-off is 10 units, the marketing manager has to choose Egg shampoo by Maxmin rule.

(ii) Minimax principle

	Estimated Sales (In Units)			Maxmimum
Types of shampoo	15000	10000	5000	Pay-off
Egg shampoo	30	10	10	30
Clinic shampoo	40	15	5	40
Deluxe shampoo	55	20	3	55

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Min (30, 40, 55) = 30. Since the minimum payoff is 30 units, the marketing manager has to choose Egg shampoo by minimax rule.

(iii) Laplace principle

Types of shampoo	Estimated Sales (In Units) 15000	15000	5000	Average Payoff
Egg shampoo	30	10	10	16.67
Clinic shampoo	40	15	5	20
Deluxe shampoo	55	20	3	26

Max (16.67, 20, 26) = 26. Since the maximum payoff is 26 units, the marketing manager has to choose Deluxe shampoo by Laplace rule.

(iv) Hurwicz principle

∴ Weighted average = α x (max in row) + (1-α) x (min in row)

Consider α = 0.75

Types of shampoo	Estimated Sales (In Units) 15000	15000	5000	Weighted Average
Egg shampoo	30	10	10	25
Clinic shampoo	40	15	5	31.25
Deluxe shampoo	55	20	3	42

Max (25, 31.25, 42) = 42. Since the maximum payoff is 42 units, the marketing manager has to chose Deluxe shampoo by Hurwicz rule.

(v) Regret Table principle

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	Estimated sales (in Unit)		
Types of shampoo	15000	10000	5000
Egg shampoo	25	10	0
Clinic shampoo	15	5	5
Deluxe shampoo	0	0	7

Q2. Payoffs Table :

	Estimated conditional Profit (Rs.)		
Rainfall	Crop A	Crop B	Crop C
High	8000	3500	3600
Medium	4500	4500	5000
Low	2000	5000	4000

(i) Maxmin principle

	Estimated conditional Profit (Rs.)		
Rainfall	Crop A	Crop B	Crop C
High	8000	3500	5000
Medium	4500	4500	5000
Low	2500	3500	4000
Minimum payoff	2500	3500	4000

Max (2500, 3500, 4000) = 4000. Since the maximum payoff is 4000 Rs, the farmer should plant Crop C using Maxmin rule.

(ii) Laplace principle

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Estimated (conditional) Profit (Rs.)

Rainfall	Crop A	Crop B	Crop C
High	8000	3500	5000
Medium	4500	4500	5000
Low	2000	5000	4000
Average Payoff	4833.33	4333.33	4666.67

Max (4833.33, 4333.33, 4666.67) = 4833.33. since the maximum payoff is 4833.33 Rs, the farmer should plant the crop A using laplace rule.

Fuzzy set and Relations.

Q1. $A = \{(1,0.1), (2,0.5), (3,0.6), (4,1.0), (5,0.7), (6,0.2)\}$

$B = \{(1,1), (2,0.8), (3,0.4), (4,0.1)\}$

Union : comfortable house for a 4 person family or small

$A \cup B = \{(1, \max(0.1,1)), (2, \max(0.5,0.8)), (3, \max(0.6,0.4)),$
$(4, \max(0.1,1)), (5, \max(0.7,0)), (6, \max(0.2,0))\}$

$= \{(1,1), (2,0.8), (3,0.6), (4,1), (5,0.7), (6,0.2)\}$

Intersection : comfortable house for a person family and small

$A \cap B = \{(1, \min(0.1,1)), (2, \min(0.5,0.8)), (3, \min(0.6,0.4)),$
$(4, \min(0.1,1)), (5, \min(0.7,0)), (6, \min(0.2,0))\}$

$= \{(1,0.1), (2,0.5), (3,0.4), (4,0.1), (5,0), (6,0)\}$

Q2. $A = B = \{1,2,3,4\}$

Relation $R \Rightarrow R = \{(a,b) \mid b = a+1, a,b \in A,B\}$

$\therefore R = \{(1,2), (2,3), (3,4)\}$

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Relation matrix = M_R =

	1	2	3	4
1	0	1	0	0
2	0	0	1	0
3	0	0	0	1
4	0	0	0	0

B3.

$R =$

	D_1	D_2	D_3	D_4
P_1	0.6	0.6	0.9	0.8
P_2	0.1	0.2	0.9	0.8
P_3	0.9	0.3	0.4	0.8
P_4	0.9	0.8	0.4	0.2

$T =$

	S_1	S_2	S_3	S_4
D_1	0.1	0.2	0.7	0.9
D_2	1	1	0.4	0.6
D_3	0	0	0.5	0.7
D_4	0.9	1	0.8	0.2

(i) Max min composition

$\therefore U(P,S) = \max_d (\min \{ R(P,d), T(d,S) \})$

U	S_1	S_2	S_3	S_4
P_1	0.8	0.8	0.8	0.9
P_2	0.8	0.8	0.8	0.9
P_3	0.8	0.8	0.8	0.9
P_4	0.8	0.8	0.7	0.9

(ii) Max product composition

$\therefore U(P,S) = \max_d (R(P,d), T(d,S))$

U	S_1	S_2	S_3	S_4
P_1	0.72	0.8	0.64	0.81
P_2	0.72	0.8	0.64	0.81
P_3	0.72	0.8	0.64	0.81
P_4	0.8	0.8	0.63	0.81

Q4. $A = \{ 1/2 + 0.65/4 + 0.5/6 + 0.35/8 + 0/10 \}$

$B = \{ 0/2 + 0.35/4 + 0.5/6 + 0.65/8 + 1/10 \}$

(i) $A \cup B = \max \{ A(x), B(x) \}$

$= \{ 1/2 + 0.65/4 + 0.5/6 + 0.65/8 + 1/10 \}$

(ii) $A \cap B = \min \{ A(x), B(x) \}$

$= \{ 0/2 + 0.35/4 + 0.5/6 + 0.35/8 + 0/10 \}$

(iii) $\bar{A} = 1 - A(x)$

$= \{ 0/2 + 0.35/4 + 0.5/6 + 0.65/8 + 1/10 \}$

(iv) $\bar{B} = 1 - B(x)$

$= \{ 1/2 + 0.65/4 + 0.5/6 + 0.35/8 + 0/10 \}$

(v) $\bar{A} \cap \bar{B} = \min \{ \bar{A}(x), \bar{B}(x) \}$

$= \{ 0/2 + 0.35/4 + 0.5/6 + 0.35/8 + 0/10 \}$

(vi) $\bar{A} \cup \bar{B} = \max \{ \bar{A}(x), \bar{B}(x) \}$

$= \{ 1/2 + 0.65/4 + 0.5/6 + 0.65/8 + 1/10 \}$

(vii) $\overline{A \cup B} = \bar{A} \cap \bar{B}$ (De Morgan's Law)

$= \{ 0/2 + 0.35/4 + 0.5/6 + 0.35/8 + 0/10 \}$

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