Bit ID - 2022AA05030
Name - Divey Anand
Section - A
Subject - 81-22 - AIML CZC 418
Introduction to Statistical Methods

Q1

Given Probability of Brand A tried people = $\frac{15}{100}$

Percentage of People tried Brand B = $\frac{20}{100}$

Percentage of People tried Brand C = 30% = $\frac{30}{100}$

Percentage of People tried Brand D = 35% ≈ $\frac{35}{100}$

After trial period,

% of people satisfied with Brand A = 99%

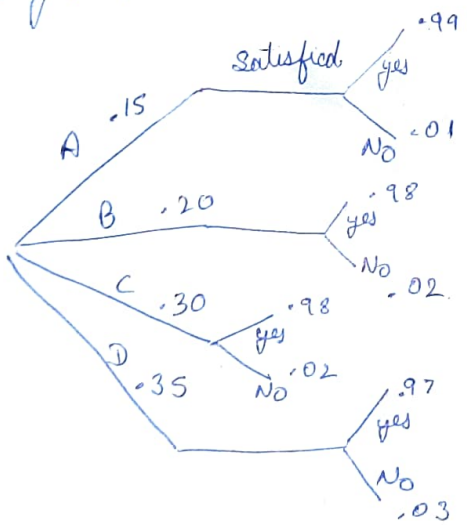
% of people satisfied with Brand B = 98%

% of people satisfied with Brand C = 98%

% of people satisfied with Brand D = 97%.

Solution

As per given, decision tree will be



Brand	P(B)	P(S'∩B)	P(B)×P(S'∩B)
A	0.15	0.01	0.0015
B	0.2	0.02	0.004
C	0.3	0.02	0.006
D	0.35	0.03	0.0105
			0.022

Probability (Person is not satisfied and he is from group D) =

$$\frac{P(\text{Brand D}) \times P(\text{Brand D \& not satisfied})}{\Sigma P(\text{Total not satisfied}) \times P(\text{Brand})}$$

$$= \frac{0.35 \times 0.03}{0.022} = 0.4772$$ Answer

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Q.2 Given,

3 Apple 4 Mango

Bag 1

4 Apple 3 Orange

Bag 2

Die < 1 or 3
2, 4, 5, 6

P(1 or 3) = Probability of getting 1 or 3 = $\frac{2}{6}$

P(2 or 4 or 5 or 6) = Probability of getting 2, 4, 5, 6 = $\frac{4}{6}$

Solution

Total Probability of getting apple from Bag 1, if die is 1 or 3

$= \frac{2}{6_3} \times \frac{3}{7} = \frac{3}{21}$

Total Probability of getting apple from Bag 2 if die is not 1 or 3

$= \frac{4}{6_2} \times \frac{4}{7} = \frac{8}{21}$

Net probability of getting apple is

$= \frac{8}{21} + \frac{3}{21} = \frac{11}{21}$ Answer

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Q3 Given $f(x) = \begin{cases} 0 & x \le 0 \\ k x e^{-4x} & x > 0 \end{cases}$

To find (1) k
(2) probabilities b/w 2 & 4
(3) greater than 1/4

Solution

$$\int_{-\infty}^{0} 0 + \int_{0}^{\infty} k x e^{-4x} dx = 1$$

$$k \int_{0}^{\infty} x e^{-4x} dx = 1$$

Using Integration by parts

$$k \left[\frac{-x e^{-4x}}{4} - \int -\frac{e^{-4x}}{4} dx \right]_0^{\infty} = 1$$

$$k \left[\frac{-x e^{-4x}}{4} - \frac{e^{-4x}}{16} \right]_0^{\infty} = 1$$

$$k \left[\frac{-4x e^{-4x} - e^{-4x}}{16} \right]_0^{\infty} = 1$$

$$k \left[\frac{-(1+4x) e^{-4x}}{16} \right]_0^{\infty} = 1$$

$$k \left[\left[\frac{-(1+4\infty) e^{-4\infty}}{16} \right] - \left[\frac{-(1+4\times 0) e^{-0}}{16} \right] \right] = 1$$

$$k \left[0 + \frac{1}{16} \right] = 1$$

$$\boxed{k = 16}$$ Answer

Formula used:
$e^0 = 1$
$e^{-\infty} = \frac{1}{e^{\infty}} = \frac{1}{\infty} = 0$

a) $$\int_2^4 16 x e^{-4x} dx = 16 \left[\frac{-(1+4x) e^{-4x}}{16} \right]_2^4 = 16 \left[\frac{-17 e^{-16}}{16} + \frac{(9) e^{-8}}{16} \right]$$

$$= 16 \left[\frac{-17 e^{-16} + 9 e^{-8}}{16} \right]$$

$$= 0.00301$$ Answer

b) $$\int_{1/4}^{\infty} 16 x e^{-4x} dx = 16 \left[\frac{-(1+4x) e^{-4x}}{16} \right]_{1/4}^{\infty} = 16 \left[0 + \frac{(1+1) e^{-1}}{16} \right]$$

$$= 2 \times 0.3678$$

$$= 0.73575$$ Answer

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Q-4 Given

Probability (Rahul speaking Truth) = 0.75 = $\frac{75}{100} = \frac{3}{4}$

Probability (Sanjay speaking Truth) = 0.70 = $\frac{7}{10}$

$P(\bar{R}) = 1 - \frac{3}{4} = \frac{1}{4}$ (Rahul not speaking Truth)

$P(\bar{S}) = 1 - \frac{7}{10} = \frac{3}{10}$ (Sanjay not speaking Truth)

Probability (Blue) = $\frac{1}{6}$

Probability (different color) = $\frac{5}{6}$

Solution

Let x be the event that [redacted] ball is drawn & both assert it is [redacted] blue

$P(X) = \frac{1}{6} \times \frac{3}{4} \times \frac{7}{10} = \frac{7}{80}$

Let Y be the event that non-white ball is drawn & both assert it is blue

$\frac{1}{4} \times \frac{1}{5} = \frac{1}{20}$

if a non-blue is taken, prob. that A say it is [redacted] blue $= \frac{1}{4} \times \frac{1}{5} = \frac{1}{20}$

if non-blue is taken prob B is saying it is blue $= \frac{3}{10} \times \frac{1}{5} = \frac{3}{50}$

Now total $P(Y) = \frac{5}{6} \times \frac{1}{20} \times \frac{3}{50} = \frac{1}{400}$

Hence Required prob. $= \dfrac{\frac{7}{80}}{\frac{7}{80} + \frac{1}{400}}$

$= \frac{35}{36}$ Answer

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Q.5

Given

Probability (stolen) = $P(S) = \frac{5}{10} = \frac{1}{2}$

Probability (Not stolen) = $P(\bar{S}) = \frac{5}{10} = \frac{1}{2}$

Solution

P(Yellow car, Domestic, Sports) = ?

	Color	
stolen	Red	Yellow
Yes	3/5	2/5
No	2/5	3/5

Type	
Sports	Suv
4/5	1/5
2/5	3/5

Origin	
Domestic	International
2/5	3/5
3/5	2/5

P(stolen = Yes / Color = Yellow / Type = Sports / Origin = Domestic)

$= \frac{2}{5} \times \frac{4}{5} \times \frac{2}{5} \times \frac{1}{2} = 0.064$

Answer.