2020 B4TS1276P

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~~M~~ PNS Tut 2 solutions

1.) a) P (at most 1 purchase dryer) = 0.428 = P(A)
P(at least 2 purchases electric dryer) = = P(A)'

$P(A)' = 1 - P(A)$
$= 1 - 0.428$
$\boxed{P(A') = 0.572}$

b) P(all five gas) = 0.116
P(all five electric) = 0.005

P(both) = 0.121 = P(A)
P(at least 1) = P(A)'

$P(A)' = 1 - P(A)$
$= 1 - (0.121)$ $\boxed{P(A') = 0.879}$

3.) $P(A_1) = 0.12$ $P(A_2) = 0.07$ $P(A_3) = 0.05$
$P(A_1 \cup A_2) = 0.13$ $P(A_2 \cap A_3) = 0.14$
$P(A_1 \cup A_3) = 0.14$ $P(A_1 \cap A_2 \cap A_3) = 0.01$

a) P(not 1 defect) = $P(A_1)'$
$= 1 - P(A_1) = 1 - 0.12 = \boxed{0.88}$

b) $P(A_1 \cap A_2) = P(A_1) + P(A_2) - P(A_1 \cup A_2)$
$\Rightarrow 0.12 + 0.07 - 0.13$
$\boxed{P(A_1 \cap A_2 = 0.06}$

c) $\longrightarrow$

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c) P(Both type 1 and type 2 defects but not defect 3)

$\Rightarrow$ $P(A_1 \cap A_2 \cap A_3')$

Using Law of Probability

$P(A_1 \cap A_2) = P(A_1 \cap A_2 \cap A_3) + P(A_1 \cap A_2 \cap A_3')$

$P(A_1 \cap A_2 \cap A_3') = 0.06 - 0.01$

$\boxed{P(A_1 \cap A_2 \cap A_3') = 0.05}$

d) P(atmost 2 defects) = 1 - P(all 3 defects)

$\Rightarrow 1 - P(A_1 \cap A_2 \cap A_3)$

$\Rightarrow 1 - 0.01$

$\boxed{P(\text{atmost 2 def}) = 0.99}$

d) P(~~fix~~ not 3rd defect / 2 defects are there)

$\Rightarrow \dfrac{P(A_1 \cap A_2 \cap A_3')}{P(A_1 \cap A_2)} \Rightarrow \dfrac{0.05}{0.06} = \boxed{\dfrac{5}{6}}$

$\Rightarrow$

Q2)

		HOMEOWNER		
Auto	N	L	M	H
L	0.04	.06	.05	.03
M	.07	.10	.20	.10
H	.02	.03	.15	.15

a) P(medium auto & high homeowner) $\Rightarrow \boxed{0.10}$

b) P(low ~~auto~~ home) $\Rightarrow 0.06 + 0.10 + 0.03 = \boxed{0.19}$

P (low auto) = $0.04 + 0.06 + 0.05 + 0.03 \Rightarrow \boxed{0.18}$

c) P(same in auto & home) $\Rightarrow$ LL + MM + HH $\Rightarrow 0.06 + 0.20 + 0$

$\Rightarrow \boxed{0.41}$

P (both are diff. categories) $\Rightarrow$ ~~LM~~ + LH + ~~ML~~ + MH + ~~HL~~ + HM

$\Rightarrow$ ~~0.10 + 0.03 + 0.05 + 0.15 + 0~~

$\Rightarrow$ $\boxed{0.46}$ $1 - 0.41 = \boxed{0.59}$

P (at least one low) $\Rightarrow$ P (LN, LL, ML, ~~MH~~ LH, HL, LM)

$\Rightarrow \boxed{0.31}$

P (neither low) $\Rightarrow$ $1 - 0.31 = \boxed{0.69}$

classfellow

4.) P (type 2 defect | type 1 defect)

a) ⇒ $\frac{P(A_1 \cap A_2)}{P(A_1)} \Rightarrow \frac{0.06}{0.12} = \frac{6}{12} = \boxed{\frac{1}{2}}$

b) P(all 3 defect | type 1 defect)

$\frac{P(A_1 \cap A_2 \cap A_3)}{P(A_1)} = \frac{0.01}{0.12} = \boxed{\frac{1}{12}}$

c) P(atleast 1 defect | exactly 1 defect)

⇒ P(atleast 1 defect) = $P(A_1 \cup A_2 \cup A_3)$

$P(A_1 \cup A_2 \cup A_3) = P(A_1) + P(A_2) + P(A_3) - P(A_1 \cap A_2) - P(A_1 \cap A_3) - P(A_2 \cap A_3) + P(A_1 \cap A_2 \cap A_3)$

$P(A_1) = 0.12$ $P(A_2 \cap A_3) = 0.10$

$P(A_2) = 0.07$ $P(A_1 \cap A_3) = ?$

$P(A_3) = 0.05$ $P(A_1 \cap A_2 \cap A_3) = 0.01$

$P(A_1 \cap A_2) = 0.06$

$P(A_1 \cap A_3) = P(A_1) + P(A_3) - P(A_1 \cup A_3)$

$= 0.12 + 0.05 - 0.14$

$P(A_1 \cap A_3) \Rightarrow 0.03$

$P(A_1 \cup A_2 \cup A_3) = 0.12 + 0.07 + 0.05 - 0.06 - 0.10 - 0.03 + 0.01$

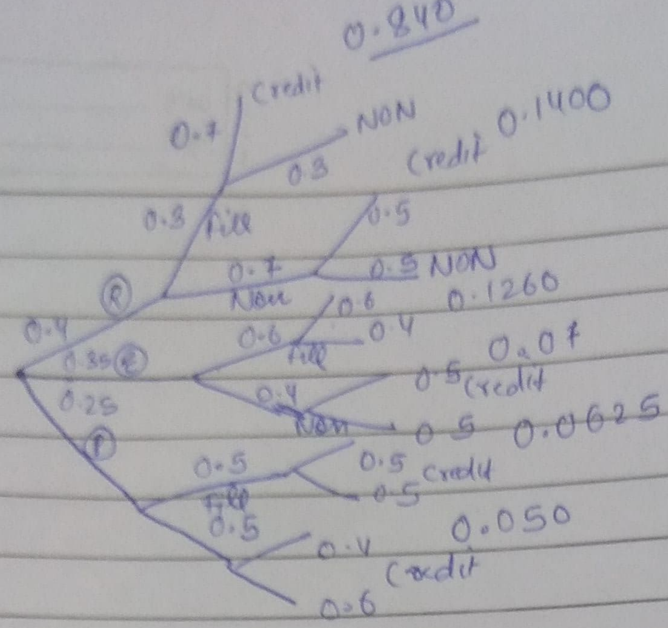
$\boxed{P(A \cup A_2 \cup A_3) \Rightarrow 0.06}$

$\frac{P(\text{atleast } 1)}{P(\text{exactly})} = \frac{0.06}{P(\text{exactly } 1)} \Rightarrow \frac{0.06}{0.11} = \boxed{\frac{6}{11}}$

$P(\text{exactly } 1) = P(A_1 \cup A_2 \cup A_3) - P(A_1 \cap A_2) - P(A_2 \cap A_3) - P(A_1 \cap A_3) + 2P(A_1 \cap A_2 \cap A_3)$

$\Rightarrow 0.06 - 0.06 - 0.10 - 0.03 + 0.02$

Q5)



1) Plus and fill up and credit card

→ (0.35) (0.6) (0.6)

→ $\boxed{0.126}$

2) Premium and non fill up & credit card

→ (0.25)(0.5) (0.4)

→ $\boxed{0.05}$

3) Premium & credit card

→ 0.0625 + 0.0500

→ $\boxed{0.1125}$

4) P(fill ∩ credit)

→ 0.0840 + 0.1260 + 0.0625

→ $\boxed{0.2725}$

5) Credit card

→ Add all → 0.0840 + 0.1400 + 0.1260 + 0.07 + 0.0625 + 0.05

→ $\boxed{0.5325}$

6) P(Premium | credit) = $\frac{P(\text{premium} \cap \text{credit})}{P(\text{credit})}$

→ $\frac{0.1125}{0.5325}$ → $\boxed{0.2113}$

(c) P(defective in exactly 3 tests). (P(A)).

$P(\text{defective}) = \frac{2}{7}$ $\quad$ $P(\text{good}) = \frac{5}{7}$.

Case. I $\quad$ 1st defective | 2nd good | 3rd defective.

$\frac{2}{7} \cdot \frac{5}{6} \cdot \frac{1}{5}$

Case II $\quad$ 1st good | 2nd defe. | 3rd defective

$\frac{5}{7} \cdot \frac{2}{6} \cdot \frac{1}{5}$

$$\text{Case I} + \text{Case II} = \frac{1}{21} + \frac{1}{21} = \boxed{\frac{2}{21} = P(A)}$$

(7) Urn → 10 white and 2 red.

a)

Let R_1 (1^{st} chip is red) Same with W_1, W_2, W_3.

R_2 (2^{nd} chip is red)

R_3 (3^{rd} chip is red)

$$P(R_3) = \Big(P(R_3 \mid R_2 W_1) . P(R_2 W_1) + P(R_3 \mid R_1 W_2)\, P(W_2 R_1)$$
$$+ P(R_3 \mid W_2 W_1)\, P(W_2 W_1) + P(R_3 \mid R_2 R_1)\, P(R_2 R_1)$$

$$\Rightarrow \frac{11}{20} \times \frac{12}{21} \times \frac{10}{22} + \frac{11}{20} \times \frac{10}{21} \times \frac{12}{22} + \frac{12}{20} \times \frac{10}{21} \times \frac{9}{22} + \frac{10}{20} \times \frac{1}{21}$$

$$\Rightarrow \frac{12}{22} = \frac{6}{11}$$

$$\boxed{P(R_3) = \frac{6}{11}}$$

$\boxed{\text{USING BAYES THEOREM}}$

b) P(1st 2 white | when 3rd is Red)

$$\Rightarrow P(WW|R) = \frac{P(R_3|W_2W_1)\,P(WW)}{P(R_3|W_2W_1)\,P(W_2W_1) + P(R_3|R_2R_1)\,P(R_2R_1) + P(R_3|R_2W_1)\,P(R_2W_1) + P(R_3|W_2R_1)\,P(W_2R_1)}$$

$$\Rightarrow \frac{\frac{54}{462}}{\frac{54}{462} + \frac{66}{462} + \frac{66}{462} + \frac{66}{462}}$$

$$\Rightarrow \frac{54}{252} \quad \frac{18}{84} \Rightarrow \frac{3}{14}$$

$$\boxed{P(1^{st}\ 2\ \text{white} \,|\, \text{when } 3^{rd}\ \text{red}) = \frac{3}{14}}$$

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8:) a) Probability of being stopped by 2 trains

$\Rightarrow (^4C_2)(0.1)^2(0.9)^2 + {^4C_3}(0.1)^3(0.9) + {^4C_4}(0.1)^4$

$\Rightarrow \boxed{0.0523}$

P(stopped by 1 or more on 2nd route)

$^2C_1(0.1)(0.9) + {^2C_2}(0.1)^2 = \boxed{0.19}$

So he should take the first route

b) P(took 4 cross route / late)

$\Rightarrow \dfrac{P(\text{late}/\text{4cross route})}{P(\text{Late})} \Rightarrow \dfrac{0.0523}{0.2423} \Rightarrow \boxed{0.2158}$