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subject: DSA 5400

1. We have determined that the probability that we encounter a green light at a particular traffic light is 0.32, a yellow light is 0.05, and red light is 0.63.

(a) what is the probability you find the light red on both Monday and Tuesday?

(b) What is the probability you don't encounter a red light until wednesday?

Solution :-

Given data

probability of getting green light is $P(G) = 0.32$

probability of getting yellow light is $P(Y) = 0.05$

probability of getting red light is $P(R) = 0.63$.

probability

(a) Probability of red light on both Monday and Tuesday.

Probability of getting red light on Monday $P(R_1)$

Probability of getting red light on Tuesday $P(R_2)$

⇒ Getting red light on Monday is not ~~dependent~~ dependent of getting red light on Tuesday, we are using multiplication rule

Probability of finding red light on both Monday and Tuesday

$= P(R_1) \times P(R_2)$

$= 0.63 \times 0.63$

$= 0.3969$

→ Probability of finding be light red both monday and Tuesdays is $\boxed{0.3969}$

(b) What is the probability you don't encounter a red light until wednesday?

Probability of red light $P(R) = 0.63$

Probability of not red light $1 - P(R)$

$= 1 - 0.63$

$= 0.37$

Probability of not red on Monday $= P(NRM)$

Probability of not red on Tuesday $= P(NRT)$

Probability of red light on wednesday $= P(RW)$

$= P(NRM) \times P(NRT) \times P(RW)$

$= (0.37) \times (0.37) \times (0.63)$

$= 0.086247$

The probability of not encountering a red light until wednesday is $\boxed{0.862470}$

2Q] A recent safety found that in 77% of all accidents the driver was wearing a seat belt. Accident reports indicated that 92% of those drivers escaped serious injury, but only 63% of the non-belted drivers were so fortunate. What is the probability that a driver who was seriously injured wasn't wearing a seat belt?

Sol: Probability of wearing seat belt $P(S) = 0.77$.

probability of not wearing seat belt $P(N) = 0.27$

Probability of safe, wearing seat belt $P\left(\frac{A}{S}\right) = 0.92$

probability of injured, seat belt $P\left(\frac{A}{S}\right)' = 0.08$

Probability of safe, no seat belt is $P\left(\frac{B}{N}\right) = 0.63$

probability of injured, no seat belt $P\left(\frac{B}{N}\right)' = 0.37$

$$P(A) + P(A)' = 1$$

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

The probability of injured not wearing seat belt is

$$P\left(\frac{N}{B}\right)' = \frac{P\left(\frac{B}{N}\right)' P(N)}{P(B')}$$

$$\boxed{P\left(\frac{N.S}{\text{Injury}}\right) = \frac{P\left(\frac{\text{Injury}}{NS}\right) P(NS)}{P(\text{injury})}}$$

$$P(B)' = P(S)\,P\left(\frac{A}{S}\right)' + P(N)\,P\left(\frac{B}{N}\right)'$$

$$= (0.77)(0.08) + (0.23)(0.37)$$

$$= 0.0616 + 0.851$$

$$= 0.1467$$

$$\boxed{P(B)' = 0.1467}$$

$$P\left(\frac{N}{B}\right)' = \frac{(0.37)(0.23)}{0.1467} = \frac{0.851}{0.1467}$$

$$= 0.580$$

The probability of injured not wearing seat belt is $\boxed{0.580}$

3Q] Customers are used to evaluate preliminary product designs. In the past, 90% of highly successful products received good reviews, 60% of moderately successful products received good reviews, and 10% successfull products received good reviews. In addition, 40% of poor products received good reviews. In addition, 40% of products have been highly successful, 35% have been moderately successful, and 25% have been poor products.

Sol:- ① Probability of highly successful $P(A) = 0.4$

Probability of moderately successful $P(B) = 0.35$

Probability of least successful $P(C) = 0.25$

② Probability of highly success with good reviews

$$P\left(\frac{R}{A}\right) = 0.9$$

Probability of moderately success with good reviews

$$P\left(\frac{R}{B}\right) = 0.6$$

Probability of least success with good reviews

$$P\left(\frac{R}{C}\right) = 0.1$$

(a) whis is Probability that a product attains a good review?

Probability that gets good reviews

$$P(R) = P(A)\,P\left(\frac{R}{A}\right) + P(B)\,P\left(\frac{R}{B}\right) + P(C)\,P\left(\frac{R}{C}\right)$$

$$= 0.4 \times 0.9 + 0.35 \times 0.6 + 0.25 \times 0.1$$

$$= 0.36 + 0.21 + 0.025$$

$$P(R) = 0.595$$

∴ Probability gets good reviews is $\boxed{0.595}$

(b) If a new design attains a good review, what is the probability that it will be a highly successful product?

probability of new design will highly successful

$$P\left(\frac{A}{R}\right) = \frac{P\left(\frac{R}{A}\right) \cdot P(A)}{P(R)}$$

$$= \frac{0.9 \times 0.4}{0.595}$$

$$= \frac{0.36}{0.595}$$

$$P\left(\frac{A}{R}\right) = 0.60504$$

∴ The Probability of New design will highly successful is $\boxed{0.60504}$

4Q] Police report that 78% of drivers are given a breath test, 36% a blood test, and 22% both test.

sol: Probability of Breath test $\Rightarrow P(B_r) = 0.78$

Probability of Blood test $\Rightarrow P(B_L) = 0.36$

probability of both tests $\Rightarrow P(B_r \cap B_L) = 0.22$

(a) What is the probability that a suspect is given a test?

probability of suspect given a test

$$P(B_r \cup B_L) = P(B_r) + P(B_L) - P(B_r \cap B_L)$$

$$= 0.78 + 0.36 - 0.22$$

$$= 0.92$$

$\boxed{\therefore \text{The probability of suspect given a test is } 0.92}$

(b) What is the probability that a suspect gets blood test or a breath test but NOT both?

Probability of suspect gets a blood test or breath test but NOT both is $P(B_r \cup B_L) - P(B_r \cap B_L)$

$$= 0.92 - 0.22$$

$$= 0.70$$

$\boxed{\therefore \text{The probability of suspect gets blood test or breath test but NOT both is } 0.70}$

(c) What is the probability that suspect gets neither test?

Probability that suspect gets neither test is

$P(B_r \cup B_L) + P(B_r \cup B_L)' = 1$ $\boxed{\because P(A \cup B) + P(A \cup B)' = 1}$

The probability of suspect given test $P(B_r \cup B_L) = 0.92$

$\Rightarrow P(B_r \cup B_L)' = 1 - P(B_r \cup B_L)$

$= 1 - 0.92$

$= 0.08$

$\boxed{\therefore \text{The probability of suspect gets neither test is } 0.08}$