GHANA COMMUNICATION TECHNOLOGY UNIVERSITY

CICS 461 ARTIFICIAL INTELLIGENCE

ASSIGNMENT

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Question 1

A consulting firm submitted a bid for a large consulting contract. The firm's management felt it had a 50-50 chance of landing the project. However, the agency to which the bid was submitted subsequently asked for additional information. Past experience indicates that that for 75% of successful bids and 40% of unsuccessful bids the agency asked for additional information.

a. What is the prior probability of the bid being successful (that is, prior to the request for additional information)?
b. What is the conditional probability of a request for additional information given that the bid will be ultimately successful?
c. Compute the posterior probability that the bid will be successful given a request for additional information.

Solution

Let **S** be the event of successful bid

Let **U** be the event of unsuccessful bid

Let **B** be the event of being asked for additional information

$$P(S) = \frac{50}{50 + 50} = \mathbf{0.5}$$

$$P(U) = \frac{50}{50 + 50} = \mathbf{0.5}$$

$$P(B \mid S) = \frac{75\%}{100\%} = \mathbf{0.75}$$

$$P(B \mid U) = \frac{40\%}{100\%} = \mathbf{0.40}$$

a. The prior probability of the bid being successful is $\mathbf{0.5}$
b. The conditional probability of a request for additional information given that the bid will be ultimately successful is $\mathbf{0.75}$

c. The posterior probability that the bid will be successful given a request for additional information is

$$P(S \mid B) = \frac{P(S \cap B)}{P(S \cap B) + P(U \cap B)}$$

$$= \frac{(0.5) * (0.75)}{((0.5) * (0.75)) + ((0.5) * (0.4))}$$

$$= \frac{0.375}{0.575} = \mathbf{0.652}$$

Question 2

All tractors made by a company are produced on one of three assembly lines, named Red, White, and Blue. The chances that a tractor will not start when it rolls off of a line are 6%, 11%, and 8% for lines Red, White, and Blue, respectively. 48% of the company's tractors are made on the Red line and 31% are made on the Blue line. What fraction of the company's tractors do not start when they roll off of an assembly line?

Solution

Let **R** be the event that the tractor was made by the red company

Let **W** be the event that the tractor was made by the white company

Let **B** be the event that the tractor was made by the blue company

Let **D** be the event that the tractor won't start

$P(R) = 0.48$

$P(W) = 0.21$

$P(B) = 0.31$

$P(D \mid R) = 0.06$

$P(D \mid W) = 0.11$

$P(D \mid B) = 0.08$

Now the fraction of the company's tractors that do not start when rolled off the assembly line is

$P(D) = ?$

In order to find the fraction of the company's tractors that do not start when rolled off the assembly line $P(R \cap D)$, $P(W \cap D)$, $P(B \cap D)$ must be determined.

Firstly, the probability of tractors not start when rolled off the red assembly line

$$P(R \cap D) = P(D \mid R)P(R)$$

But $P(D \mid R) = 0.06 \ and \ P(R) = 0.48$

$$P(R \cap D) = (0.06)(0.48) = \mathbf{0.0288}$$

Secondly, the probability of tractors not start when rolled off the red assembly line

$$P(W \cap D) = P(D \mid W)P(W)$$

But $P(D \mid W) = 0.11 \ and \ P(W) = 0.21$

$$P(W \cap D) = (0.11)(0.21) = \mathbf{0.0231}$$

Thirdly, the probability of tractors not start when rolled off the red assembly line

$$P(B \cap D) = P(D \mid B)P(B)$$

But $P(D \mid B) = 0.08 \ and \ P(B) = 0.31$

$$P(B \cap D) = (0.08)(0.31) = \mathbf{0.0248}$$

So therefore,

$$P(D) = P(D \mid R)P(R) + P(D \mid W)P(W) + P(D \mid B)P(B)$$

$$P(D) = 0.0288 + 0.0231 + 0.0248$$

$$P(D) = \mathbf{0.0767}$$

Approximately, $\mathbf{0.077}$

Bonus Question

The probability that a tractor came from the red company given that it was defective.

$$P(R \mid D) = \frac{P(R \cap D)}{P(D)}$$

But from the previous solution, $P(R \cap D)$ is **0.0288** and $P(D)$ is **0.0767**

So therefore,

$$P(R \mid D) = \frac{P(R \cap D)}{P(D)} = \frac{0.0288}{0.0767} = 0.37548891786$$

Approximately, **0.375**