GHANA COMMUNICATION TECHNOLOGY UNIVERSITY



CICS 461 ARTIFICIAL INTELLIGENCE

ASSIGNMENT

NAME	BOUARO RICHARD ABEAKU
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CAMPUS	TAKORADI
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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 **0**. **5**
- b. The conditional probability of a request for additional information given that the bid will be ultimately successful is **0**. **75**
- c. The posterior probability that the bid will be successful given a request for additional information is

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

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

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

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

$$P(R) = 0.48$$

$$P(W) = 0.21$$

$$P(B) = 0.31$$

$$P(D | R) = 0.06$$

$$P(D | W) = 0.11$$

$$P(D | B) = 0.08$$

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,

$$P(D) = P(D | R)P(R) + P(D | W)P(W) + P(D | B)P(B)$$

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

$$P(D) = 0.0767$$

Approximately, 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