

Homework 2: Problem 5

William Svoboda (wsvoboda)

Collaborators: Epi Torres-Smith, Leslie Kim

Problem 5:

A:

We wish to find the probability that an engine that tests as functioning properly actually malfunctions. We are given that the probability that the software determines the engine has an issue given that the engine functions properly is 3%, so the probability that the software does not determine that the engine has an issue given that the engine functions properly is $100\% - 3\%$ or 97%. We are also given that the probability that the software determines the engine functions properly given that the engine malfunctions is 10%, so the probability that the software finds a malfunction given the same condition is $100\% - 90\%$ or 90%.

Using the formula for conditional probability and the knowledge that 95% of engines function properly, we have that

$$\begin{aligned}
 P(\text{malfunctions}|\text{tests properly}) &= \frac{P(\text{malfunctions} \cap \text{tests properly})}{P(\text{tests properly})} \\
 &= \frac{0.05 * 0.1}{0.05 * 0.1 + 0.95 * 0.97} \\
 &= \frac{0.05}{0.9265} \\
 &\approx 0.54\%
 \end{aligned}$$

B:

We wish to find the probability that an engine that tests as it malfunctions actually functions properly. Using the formula for conditional probability, we have that

$$\begin{aligned}
 P(\text{functioning}|\text{tests malfunctions}) &= \frac{P(\text{functioning} \cap \text{tests malfunctions})}{P(\text{tests malfunctions})} \\
 &= \frac{0.95 * 0.03}{0.95 * 0.03 + 0.05 * 0.9} \\
 &= \frac{0.0285}{0.0735} \\
 &\approx 38.78\%
 \end{aligned}$$