Homework 1

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Problem 1

Define.

$Cov =$ Getting COVID

$DF =$ Disease Free

$+ =$ Test positive

$- =$ Test negative

From the question, we learned

$Sensitivity = P(+|Cov)$

$Specificity = P(-|DF)$

a) $P(Cov) = 0.5\%$

b) $P(Cov) = 5\%$

We want $P(Cov|+)$ for bose cases.

$$\begin{aligned} P(Cov|+) &= \frac{P(+|Cov) \cdot P(Cov)}{P(+)} \\ &= \frac{P(+|Cov) \cdot P(Cov)}{P(+|Cov) \cdot P(Cov) + P(+|DF) \cdot P(DF)} \\ &= \frac{Sensitivity \cdot P(Cov)}{Sensitivity \cdot P(Cov) + (1 - Specificity) \cdot (1 - P(Cov))} \end{aligned}$$

For *a)*

$$P(Cov|+) = \frac{0.65 \times 0.005}{0.65 \times 0.005 + 0.01 \times 0.995} = \frac{65}{264} \approx 0.246 = 24.6\%$$

For *b)*

$$P(Cov|+) = \frac{0.65 \times 0.05}{0.65 \times 0.05 + 0.01 \times 0.95} = \frac{65}{84} \approx 0.774 = 77.4\%$$

Problem 2