Homework 1
Lewis Collum (Section 01)
Updated: January 31, 2020

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- S: Event of sensor triggering
- D: Event of dangerous conditions
- D^C: Event of normal conditions
- $P(D) = 0.05$
- $P(D^C) = 0.95$
- $P(S|D) = 0.95$
- $P(S|D^C) = 0.05$

(a) $P(S|D^C) = \boxed{0.05}$
(b) $P(D|S^C)$

$$\begin{aligned} P(S) &= P(S \cap D) + P(S \cap D^C) \\ &= P(S|D)P(D) + P(S|D^C)P(D^C) \\ &= 0.95 \cdot 0.05 + 0.05 \cdot 0.95 \\ &= 0.095 \end{aligned}$$

$$P(S^C) = 1 - P(S) = 0.905$$

$$\begin{aligned} P(D|S^C) &= \frac{P(D)P(S^C|D)}{P(S^C)} \\ &= \frac{P(D)(1 - P(S|D))}{P(S^C)} \\ &= \frac{0.05(1 - 0.95)}{0.905} \\ &= \boxed{0.0028} \end{aligned}$$

(c)
An unidentified critical condition since this means that the sensor would not alarm in the case of a dangerous event.

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- R: Event of a woman wearing a ring
- N: Event of a woman wearing a necklace
- $P(R^C \cap N^C) = P((R \cup N)^C) = 0.4$
- $P(R) = 0.5$
- $P(N) = 0.2$

(a) $P(R \cup N) = 1 - P((R \cup N)^C) = \boxed{0.6}$
(b) $P(R \cap N) = P(R)P(N) = 0.5 \cdot 0.2 = \boxed{0.1}$
(c) $P(R|N) = \dfrac{P(R \cap N)}{P(N)} = \dfrac{0.1}{0.2} = \boxed{0.5}$
(d) $P(N|R) = \dfrac{P(N \cap R)}{P(R)} = \dfrac{0.1}{0.5} = \boxed{0.2}$
(e) Yes