

Question 1

$$\Pr(\text{Hot} = N) = 13 + 10 + 7 + 9 / 80 = 48.75\%$$

$$\Pr(\text{Noisy} = N) = 5 + 8 + 7 + 9 / 80 = 36.25\%$$

$$\Pr(\text{Safe Door} = Y) = 16 + 5 + 13 + 7 / 80 = 51.25\%$$

A**i.**

$$\begin{aligned}\Pr(\text{Hot} = N, \text{Noisy} = N, \text{Safe Door} = Y) &= \Pr(\text{Hot} = N) * \Pr(\text{Noisy} = N) * \Pr(\text{Safe Door} = Y) \\ &= 0.4875 * 0.3625 * 0.5125 = 0.0905 \approx 9\%\end{aligned}$$

ii.

$$\Pr(\text{Hot} = N, \text{Safe Door} = N) = 0.4875 * 0.4875 \approx 0.2376 = 23.76\%$$

iii.

$$\begin{aligned}\Pr(\text{Hot} = Y \mid \text{Noisy} = N) &= \Pr(\text{Hot} = Y, \text{Noisy} = N) / \Pr(\text{Noisy} = N) \\ &= (1 - 0.4875) * 0.3625 / 0.3625 = 0.5125 = 51.25\%\end{aligned}$$

B. These properties are independent of each other because the above equation is simply equal to $\Pr(\text{Hot} = Y)$. This means that in all scenarios, Noisy is independent of Hot.

$$\begin{aligned}\text{C. } p(\text{Safe} = Y, \text{Noisy} = Y) &= p(\text{Safe} = Y) * p(\text{Noisy} = Y) \\ &= 0.5125 * (1 - 0.3625) \approx 0.3267 = 32.67\%\end{aligned}$$

$$\begin{aligned}\text{D. } p(\text{Safe} = Y, \text{Hot} = Y) &= p(\text{Safe} = Y) * p(\text{Hot} = Y) \\ &= .5125 * (1 - 0.4875) = 0.2626 = 26.26\%\end{aligned}$$

E. $p(\text{Noisy} = Y, \text{Hot} = N, \text{Safe} = Y) = p(\text{Noisy} = Y) * p(\text{Hot} = N) * p(\text{Safe} = Y) \approx 16\%$, therefore you should not open the door.