6.

Intro

In this exercise we must determine which set of numbers are sufficient to determine the conditional probability vector $\vec{P}(H|e1, e2)$. As one can expect, the set of number will different wehn we assume that the events E1 and E2 are conditionally independent given H

Solution

a)

Using Bayes' rule:

$$P(H|e1, e2) = \frac{P(e1, e2|H)P(H)}{P(e1, e2)} \tag{1}$$

Therefore, we need $P(e1, e2)$, $P(H)$ and $P(e1, e2|H)$ to calculate the probability vector. This correspond to choice (ii).

b)

Knowing that $E1 \perp E2|H$ we can perform one more step on (1):

$$\begin{aligned} P(H|e1, e2) = \frac{P(e1, e2|H)P(H)}{P(e1, e2)} = \\ \frac{P(e1|H)P(e2|H)P(H)}{P(e1, e2)} \end{aligned} \tag{2}$$

Therefore, we need $P(e1, e2)$, $P(H)$, $P(e1|H)$ and $P(e2|H)$ to calculate the probability vector. This correspond to choice (i).

Conclusion

As we can see, in order to calculate the posterior there is a set of numbers that should be previously known. The set of numbers required can change, if we make more assumptions about the random variables. In this particular exercise, we saw in (b) that assuming $E1 \perp E2|H$ changed the set of numbers required for Bayes' calculation.