

Exercise sheet 10 - Machine Intelligence I

10.3

a)

Representing the probabilities as a DAG, we see the following dependencies:

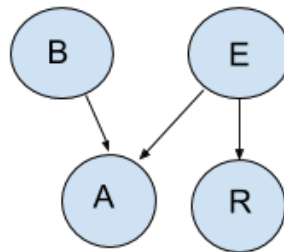


Figure 1: DAG illustrating probability dependencies

b)

Explaining away the probabilities given, we consider the case where you're alarm has gone off while there was a radio broadcast. What are the respective probabilities of a burglary having occurred?

The probability of a burglary not having occurred is:

$$\begin{aligned}
 P(B = f | A = t, E = t) &= \frac{P(E = t, A = t | B = f)P(B = f)}{P(A = t, E = t)} = \\
 &= \frac{P(A = t | E = t, B = f)P(B = f)P(E = t)}{P(A = t | E = t)P(E = t)} = \\
 &= \frac{P(A = t | B = f, E = t)P(B = f)}{P(A = t | B = t, E = t)P(B = t) + P(A = t | B = f, E = t)P(B = f)}
 \end{aligned}$$

The probability of a burglary having occurred is:

$$\begin{aligned}
 P(B = t|A = t, E = t) &= \frac{P(E = t, A = t|B = t)P(B = t)}{P(A = t, E = t)} = \\
 &= \frac{P(A = t|E = t, B = t)P(B = t)P(E = t)}{P(A = t|E = t)P(E = t)} = \\
 &= \frac{P(A = t|B = t, E = t)P(B = t)}{P(A = t|B = t, E = t)P(B = t) + P(A = t|B = f, E = t)P(B = f)}
 \end{aligned}$$