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Exercise sheet 10 - Machine Intelligence I

10.3

a)

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

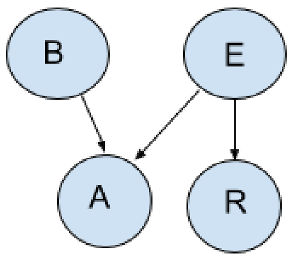

Figure 1: DAG illustrating probability dependencies

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 occured?
The probability of a burglary not having occured is:

$$P(B=f|A=t,E=t) = \frac{P(E=t,A=t|B=f)P(B=f)}{P(A=t,E=t)} =$$

$$= \frac{P(A=t|E=t,B=f)P(B=f)P(E=t)}{P(A=t|E=t)P(E=t)} =$$

$$= \frac{P(A=t|B=f,E=t)P(B=f)}{P(A=t|B=t,E=t)P(B=t)+P(A=t|B=f,E=t)P(B=f)} = \frac{0.41*0.99}{0.98*0.01+0.41+0.99}$$

The probability of a burglary having occured is:

$$P(B=t|A=t,E=t)=\frac{P(E=t,A=t|B=t)P(B=t)}{P(A=t,E=t)}=$$

$$=\frac{P(A=t|E=t,B=t)P(B=t)P(E=t)}{P(A=t|E=t)P(E=t)}=$$

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

$$\frac{0.98*0.01}{0.98*0.01+0.41*0.99}=0.02357...$$

We see that if there was a radio broadcast while the alarm went off, a burglary probably hasn't occured. This seems to indicate that keeping the radio on reduces the risk for burglaries, but this is a faulty assumtion to make, since the two probabilities are independent.