

### Assignment 8:

1. A crime is committed by one of two suspects, A and B. Initially, there is equal evidence against both of them. In further investigation at the crime scene, it is found that the guilty party had a blood type found in 10% of the population. Suspect A does match this blood type, whereas the blood type of Suspect B is unknown.

(a) Given this new information, what is the probability that A is the guilty party?

(a) Let  $M$  be the event that  $A$ 's blood type matches the guilty party's and for brevity, write  $A$  for " $A$  is guilty" and  $B$  for " $B$  is guilty". By Bayes' Rule,

$$P(A|M) = \frac{P(M|A)P(A)}{P(M|A)P(A) + P(M|B)P(B)} = \frac{1/2}{1/2 + (1/10)(1/2)} = \frac{10}{11}.$$

(We have  $P(M|B) = 1/10$  since, given that  $B$  is guilty, the probability that  $A$ 's blood type matches the guilty party's is the same probability as for the general population.)

(b) Given this new information, what is the probability that B's blood type matches that found at the crime scene?

(b) Let  $C$  be the event that  $B$ 's blood type matches, and condition on whether  $B$  is guilty. This gives

$$P(C|M) = P(C|M, A)P(A|M) + P(C|M, B)P(B|M) = \frac{1}{10} \cdot \frac{10}{11} + \frac{1}{11} = \frac{2}{11}.$$