**Q.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?

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

**Solution :**

Let the blood type found at crime seen be X.

Probability that A is guilty **prior** to the new evidence P(A)=1−P(B)=0.5

Probability that blood type of X is found **given** A is guilty = Probability that A has the blood type P(X|A)=1

Probability that blood type of X is found **given** B is guilty = Probability that B has the blood type P(X|B)=0.1

Now it is known that blood type is X, and given exactly one of A or B is guilty,

P(A|X) = P(X|A)P(A)/P(X)

=P(X|A)P(A) /P(X|A)P(A)+P(X|B)P(B)=10/11

= 0.909091

We have P(x|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?

Let C be the event that B’s blood type matches, and condition on whether B is guilty. This gives P(C|x) = P(C|x,A)P(A|x) + P(C|x,B)P(B|x)

