

8.4. Probability Trees and Bayes Formula

Monday, April 9, 2018

12:56 PM

E.g. Doctor is called to see a sick child.

In the neighbourhood:

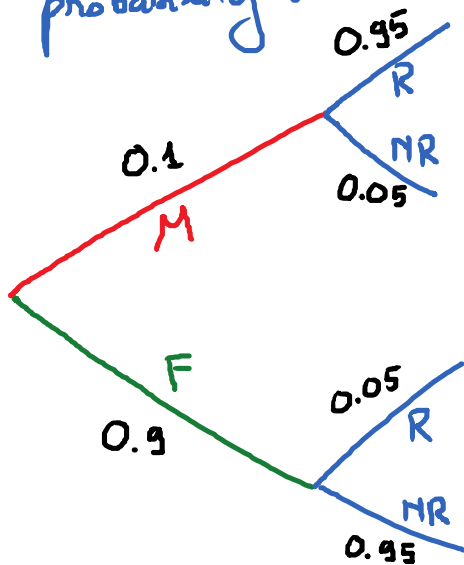
90% of all the sick children have the flu.

10% of all the sick children have measles.

95% of the children who have measles have a rash.

5% of the children who have the flu have a rash.

Q: If the doctor finds a rash, find the probability that the child has measles.



$$P(M|R) = ?$$

$$P(M|R) = \frac{P(M \cap R)}{P(R)}$$
$$= \frac{(0.1) \cdot (0.95)}{[(0.1) \cdot (0.95) + (0.9) \cdot (0.05)]}$$
$$= 0.679 \rightarrow 67.9\%$$

Ex. Companies A, B, C make aircraft emergency locator transmitter (ELT)

A makes 80% of all ELT

B makes 15% of all ELT

C makes 5% of all ELT.

A has a 4% rate of defect.

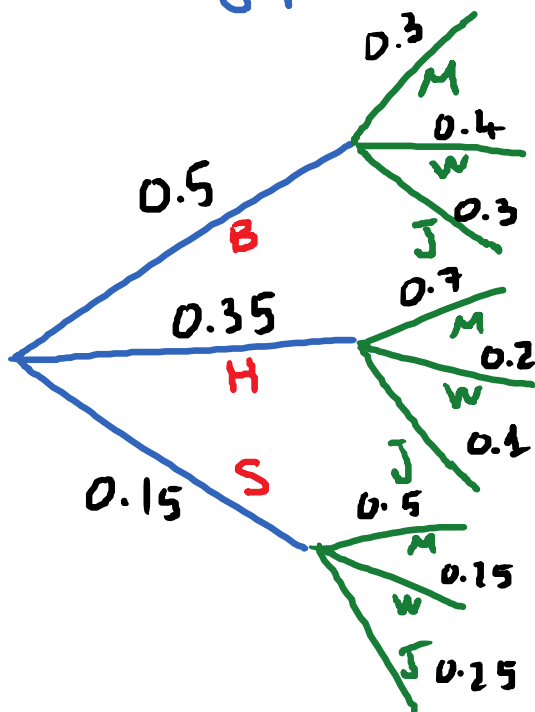
B has a 6% rate of defect

C has a 9% rate of defect.

Q: If a randomly selected E L T is defective, find the probability that it is made by company A?

→ Solve in class. Ans = 70.33%

Ex. Randomly pick a customer from a restaurant

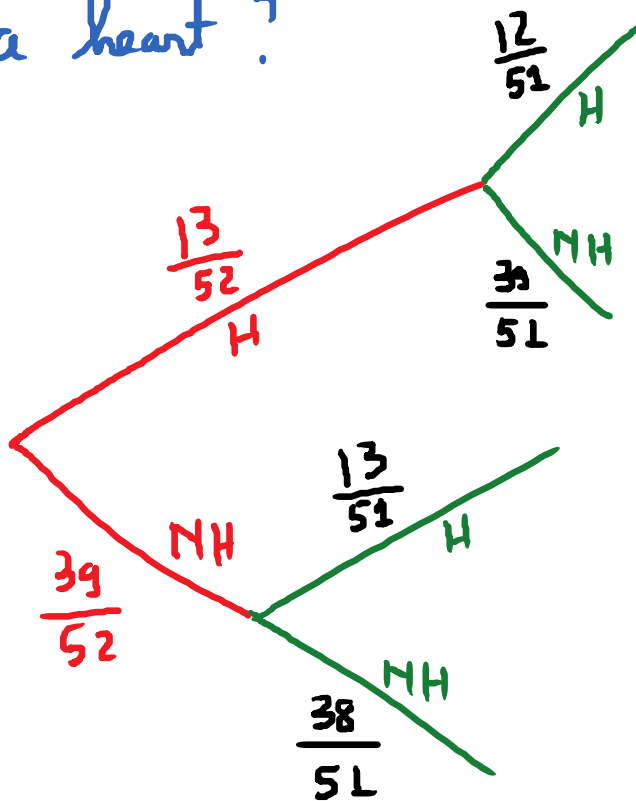


$$P(S|M)$$

$$= \frac{(0.15) \cdot (0.5)}{[(0.5) \cdot (0.3) + (0.35) \cdot (0.7) + (0.15) \cdot (0.5)]}$$

E.x. Draw a card from a standard 52 card deck, not replaced, and draw a second card.

Q: Find the probability that the second card is a heart?



$$P(H) = \frac{13}{52} \cdot \frac{12}{51} + \frac{39}{52} \cdot \frac{13}{51} = \frac{1}{4}$$

E.x. An insurance company divides its policy holders into low-risk and high risk classes. For the year, of those in the low-risk class 80% has no claims

15% has 1 claim and 5% has 2 claims. Of those in the high-risk class 50% has no claim, 30% has one claim and 20% has 2 claims. Of the policy holders, 60% were in the low-risk class, 40% in the high-risk class.

Q1: If a policy holder had no claim in the year, what is the probability that he/she is in the low-risk class.

Q2: If a policy holder had 2 claims in the year, what is the probability that he or she is in the high-risk class.