

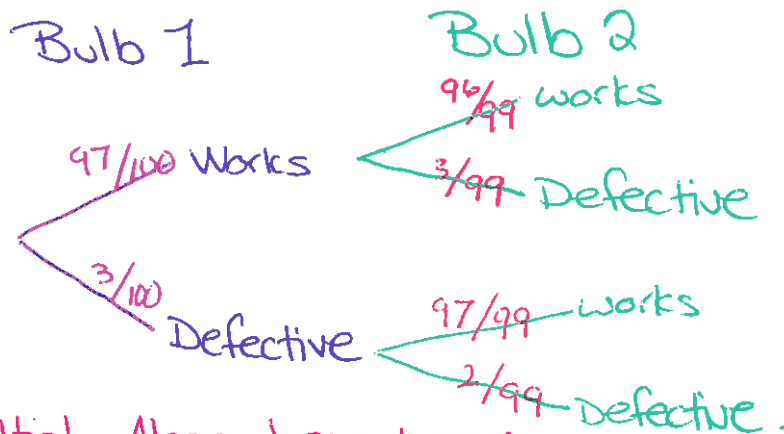
5.5 – Conditional Probability

Example 1: A light bulb manufacturer produces light bulbs such that 3% of the bulbs are defective. In a box of 100 bulbs from this company:

a) What is the probability of selecting a defective bulb?

3% means 3 out of 100 so out of box of 100, 3 will be defective. $P(\text{selecting defective}) = \frac{3}{100} = \boxed{3\%}$

b) Two bulbs are selected. What is the probability that they are both defective?



* Multiply Along branches *

$$P(\text{Both Defective}) = \frac{3}{100} \times \frac{2}{99} = \frac{6}{9900} = \boxed{\frac{1}{1650}}$$

Notation: $P(B|A)$ = Probability that B will happen given that A has already occurred.

For example from the previous question:

$$P(\text{2nd bulb defective} | \text{1st bulb defective}) = \frac{2}{99}$$

Example 2: According to a survey, 91% of Canadians own a cellphone. Of these people, 42% have a smartphone. Determine, to the nearest percent, the probability that any Canadian you met during the month in which the survey was conducted would have a smartphone.

Save writing: C = Cellphone, S = Smartphone

$$P(C) = 91\%$$

$$P(S|C) = 42\%$$

"Probability smartphone given cellphone"

From Formula Sheet: $P(A \cap B) = P(A) \times P(B|A)$

$$P(C \cap S) = P(C) \times P(S|C)$$

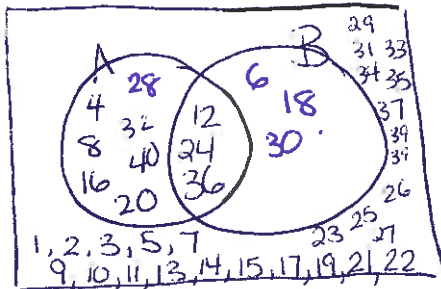
$$P(C \cap S) = 0.91 \times 0.42$$

$$= 0.38$$

$$\boxed{38\%}$$

Example 3: Nathan asks Riel to choose a number between 1 and 40 and then say one fact about the number. Riel says that the number he chose is a multiple of 4. Determine the probability that the number is also a multiple of 6, using:

a) a Venn Diagram



A = Multiple of 4 B = Multiple of 6

We know Riel's # is in A

→ 10 items in A

→ 3 of which are also in B

$$P(B|A) = \frac{3}{10}$$

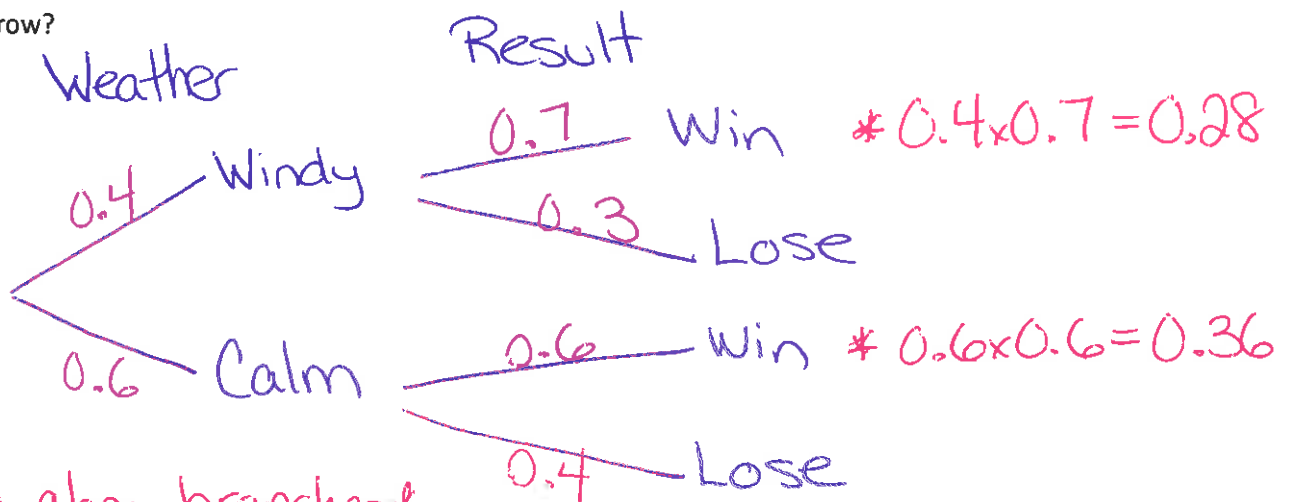
b) a formula

$$P(A \cap B) = P(A) \times P(B|A)$$

$$P(B|A) = \frac{P(A \cap B)}{P(A)}$$

$$P(B|A) = \frac{3/40}{10/40} = \frac{3}{40} \div \frac{10}{40} = \frac{3}{40} \times \frac{40}{10} = \frac{3}{10}$$

Example 4: Hillary is the coach of a junior ultimate team. Based on the team's record, it has a 60% chance of winning on calm days and a 70% chance of winning on windy days. Tomorrow, there is a 40% chance of high winds. There are no ties in ultimate. What is the probability that Hillary's team will win tomorrow?



* Multiply along branches *

$$P(\text{win}) = 0.28 + 0.36 = 0.64 = 64\%$$

* Add up all favourable outcomes *