Sharpen your pencil DRILL-1,2

Let's find the probability of getting a black or even (assume 0 and 00 are not even).

1. What's the probability of getting a black?

$$P(\text{Getting Black}) = \frac{18}{38} = 0.474$$

2. What's the probability of getting an even number?

$$P(\text{Even Number}) = \frac{18}{38} = 0.474$$

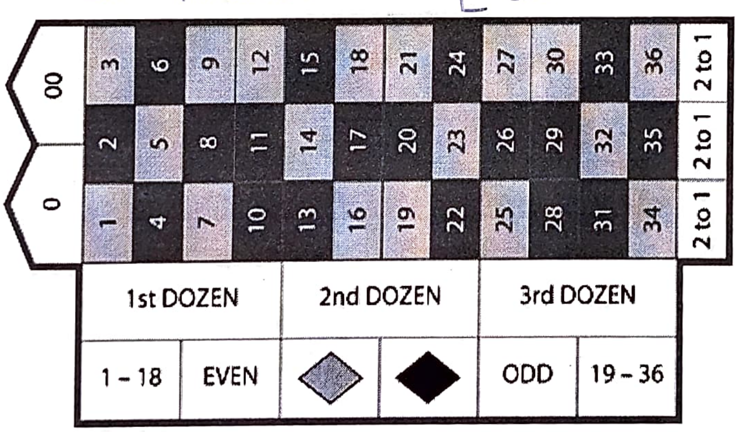
3. What do you get if you add these two probabilities together?

$$\text{Adding Probabilites} = 0.947 \left[\frac{18}{38} + \frac{18}{38}\right]$$

4. Finally, use your roulette board to count all the holes that are either black or even, then divide by the total number of holes. What do you get?

$$P\left(\frac{\text{Black or Even}}{\text{Total Number of Holes}}\right) = \frac{26}{38} = 0.684$$

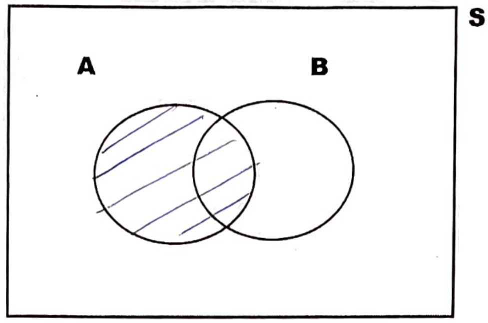
$$\left[\frac{18}{38} + \frac{18}{36} - \frac{10}{38} = \frac{26}{38}\right]$$



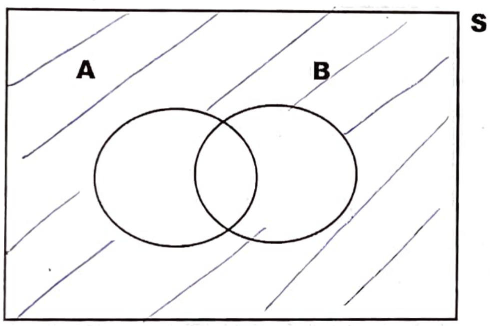
DRILL-3

BE the probability

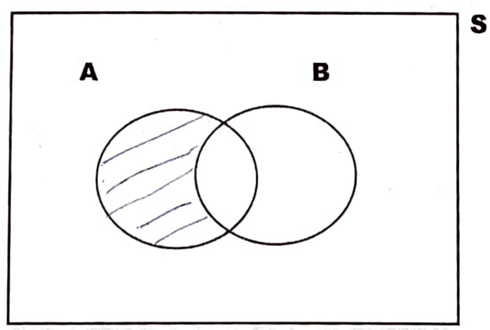
Your job is to play like you're the probability and shade in the area that represents each of the following probabilities on the Venn diagrams.



$P(A \cap B) + P(A \cap B')$



$P(A' \cap B')$



$P(A \cup B) - P(B)$

DRILL-4

Exercise

50 sports enthusiasts at the Head First Health Club are asked whether they play baseball, football, or basketball. 10 only play baseball. 12 only play football. 18 only play basketball. 6 play baseball and basketball but not football. 4 play football and basketball but not baseball.

Draw a Venn diagram for this probability space. How many enthusiasts play baseball in total? How many play basketball? How many play football?

Are any sports' rosters mutually exclusive? Which sports are exhaustive (fill up the possibility space)?

B – Baseball

K – Basketball

Total = 50

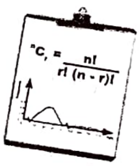
$n\,P(B) = 10$

$n\,P(F) = 12$

$n\,P(K) = 18$

$n\,(B \cap K) = 6$

$n\,(F \cap K) = 4$



Vital Statistics

A or B

To find the probability of getting event A or B, use

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$\cup$ means OR

$\cap$ means AND

$n(\text{Basketball}) = 18 + 6 = 28$

$n(\text{Football}) = 12 + 4 = 16$

$n(\text{Baseball}) = 10 + 6 = 16$

$P(\text{Baseball} \cap \text{Football}) = 0$

$\therefore$ Basketball and Football are mutually exclusive.

$P(\text{Baseball} \cup \text{Football} \cup \text{Basketball}) = 1$

So, the events for baseball, football and basketball are exhaustive.

DRILL-6

Exercise

We haven't quite finished with Duncan's Donuts! Now that you've completed the probability tree, you need to use it to work out some probabilities.

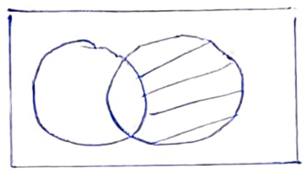
$P(D) = 3/4 \quad P(C \cup D) = 1/3 \quad P(D \cap C) = 9/20$

1. P(Donuts')

$$P(D') = 1 - P(D)$$
$$= 1 - \frac{3}{4}$$
$$= 1/4$$

2. P(Donuts' ∩ Coffee)

$$\frac{1}{3} \times \frac{1}{4} = \frac{1}{12}$$



3. P(Coffee' | Donuts)

$$P(C' | D) = \frac{2}{5}$$

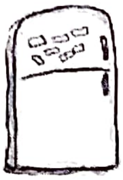
4. P(Coffee) ← Hint: How many ways are there of getting coffee? (You can get coffee with or without donuts.)

$$P(C) = P(D' \cap C) + P(D \cap C)$$
$$= \frac{1}{12} + \frac{9}{20} = \frac{8}{15}$$

Hint: maybe some of your other answers can help you.

5. P(Donuts | Coffee)

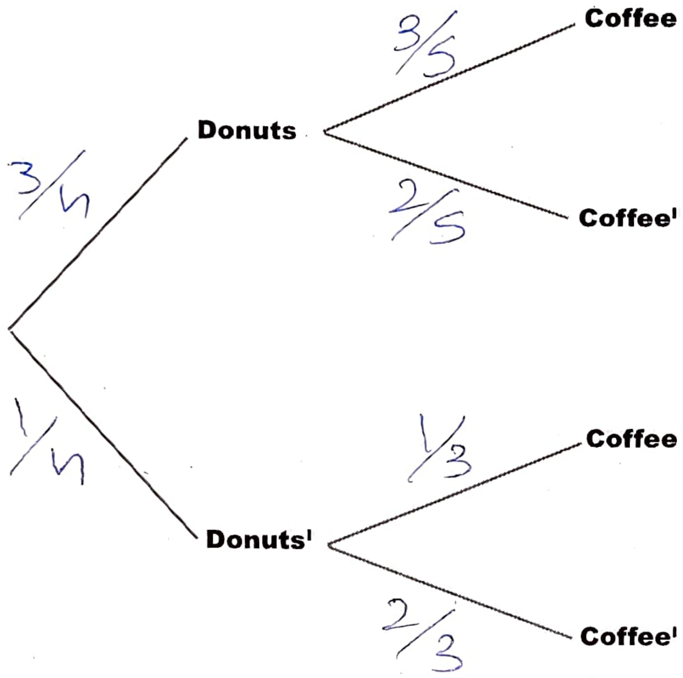
$$P(D|C) = \frac{9/20}{8/15} = \frac{27}{32}$$

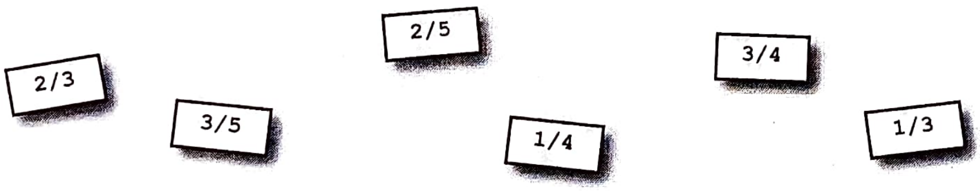


Probability Magnets

Duncan's Donuts are looking into the probabilities of their customers buying donuts *and* coffee. They drew up a probability tree to show the probabilities, but in a sudden gust of wind, they all fell off. Your task is to pin the probabilities back on the tree. Here are some clues to help you.

$P(\text{Donuts}) = 3/4$ $P(\text{Coffee} \mid \text{Donuts}') = 1/3$ $P(\text{Donuts} \cap \text{Coffee}) = 9/20$





Long Exercise

DRILL-7, 8

The Manic Mango games company is testing two brand-new games. They've asked a group of volunteers to choose the game they most want to play, and then tell them how satisfied they were with game play afterwards.

80 percent of the volunteers chose Game 1, and 20 percent chose Game 2. Out of the Game 1 players, 60 percent enjoyed the game and 40 percent didn't. For Game 2, 70 percent of the players enjoyed the game and 30 percent didn't.

Your first task is to fill in the probability tree for this scenario.

P(Game 1) = .80

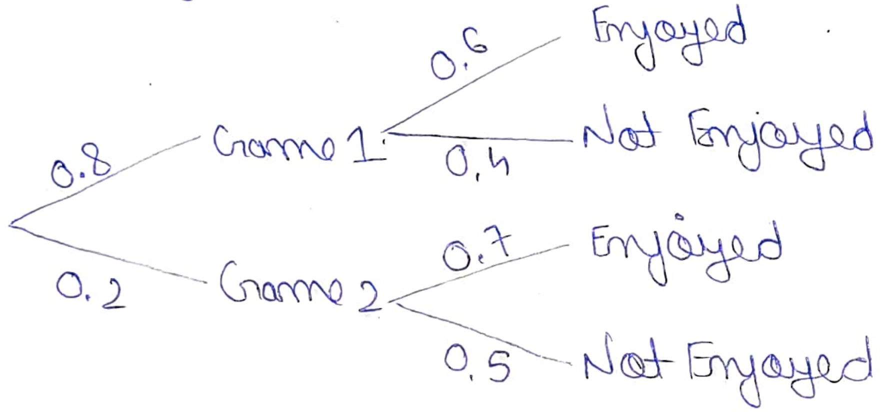
P(Game 2) = .20

Game 1

P(Enjoy) = .60 P(Enjoy) = .70

P(Didn't Enjoy) = .40 P(Didn't Enjoy) = .30

Tree Diagram:



Manic Mango selects one of the volunteers at random to ask if she enjoyed playing the game, and she says she did. Given that the volunteer enjoyed playing the game, what's the probability that she played game 2? Use Bayes' Theorem.

Hint: What's the probability of someone choosing game 2 and being satisfied? What's the probability of someone being satisfied overall? Once you've found these, you can use Bayes Theorem to obtain the right answer.

P (Game2 / Enjoyed)

$$\rightarrow P(G2/E) = \frac{P(G2).P(E|G2)}{P(G_2).P(E|G_2) + P(G_1).P(E|G_1)}$$

$$= \frac{0.2 \times 0.7}{(0.2 \times 0.7) + (0.8 \times 0.6)}$$

$$= \frac{0.14}{0.14 + 0.48}$$

$$= \frac{0.14}{0.62} = 0.226$$

DRILL-9

Five Minute Mystery

The Case of the Two Classes

The Head First Health Club prides itself on its ability to find a class for everyone. As a result, it is extremely popular with both young and old.

The Health Club is wondering how best to market its new yoga class, and the Head of Marketing wonders if someone who goes swimming is more likely to go to a yoga class. "Maybe we could offer some sort of discount to the swimmers to get them to try out yoga."

The CEO disagrees. "I think you're wrong," he says. "I think that people who go swimming and people who go to yoga are independent. I don't think people who go swimming are any more likely to do yoga than anyone else."

They ask a group of 96 people whether they go to the swimming or yoga classes. Out of these 96 people, 32 go to yoga and 72 go swimming. 24 people are exceptionally eager and go to both.

So who's right? Are the yoga and swimming classes dependent or independent?

$$P(\text{Yoga}) = \frac{32}{96} = \frac{1}{3}$$

$$P(\text{Swim}) = \frac{72}{96} = \frac{3}{4}$$

$$P(Y \cap S) = \frac{24}{96} = \frac{1}{4}$$

$$P(Y) \times P(S) = \frac{1}{3} \times \frac{3}{4} = \frac{1}{4}$$

$$= P(Y \cap S)$$

We can say that the classes are indepen-
-dent.