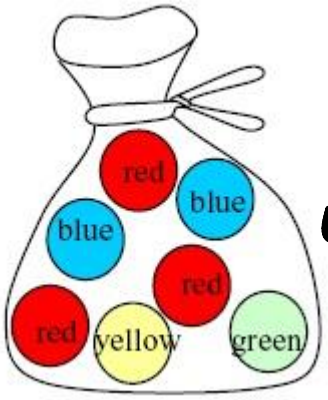
Key

Day 3 - Conditional probability and Probability Multiple Events

Conditional Probability

Let's say that I have a bag of marbles:



7 total

If I select a marble from the bag, what is

1) P(blue) = 2/7
2) P(yellow) = 1/7

What if I change the problem to…what is the probability of selecting a blue marble, if I already selected a red marble, or P(selecting a blue marble, if I already selected a red marble). This is conditional probability.

2/6 = 1/3

total goes down

Conditional probability **is the probability of an event occurring,** given **that another event has already occurred.**

In order to have conditional probability, the two event must be dependent.

Example 1: One of these students is chosen at random. Use the table below to calculate:

	Algebra 2	Not in Algebra 2
Freshman	5	405
Sophomore	220	310

1. P(Freshman, given that they are in Algebra 2) = 5/225 = 1/45 (total 225)
2. P(Algebra 2, given that they are a Sophomore) = 220/530 = 22/53 (total 530)
3. P(Sophomore, given that they are a Freshman) = 0

Example 2: Use the following table to answers the questions below

	In Bio	not in Bio	
Frosh	450	150	600
Soph	30	450	480
Junior	10	500	510
	490	1100	

total = 1590

If one student is chosen at random…

1) Find P(Frosh) = 600/1590 = 20/53
2) P(not a Frosh) = 990/1590 = 33/53
3) P(not Bio | Sophomore) = 450/480 = 15/16 (480)
4) P(Junior | Biology) = 10/490 = 1/49 (490)
5) P(Biology | not a Frosh) = 40/990 = 4/99 (990)
6) P(not Junior | Biology) 480/490 = 48/49 (490)

Probability of Multiple Events

Multiple events are either…

<u>Independent</u>: The first event *<u>does not</u>* affect the outcomes of the second event.

$$P(A) \bullet P(B)$$

<u>Dependent</u>: The first event *<u>does</u>* affect the outcomes of the second event.

$$P(A) \bullet P(B \text{ after } A) \quad or \quad P(A) \bullet P(B \text{ given } A) \quad or \quad P(A) \bullet P(B|A)$$

Examples:

1) At your barbeque, there is a cooler of soft drinks with 8 regular and 5 diet. You take out one can, and then decide you're not thirsty and put it back. Then, your friend comes over and takes out a can. Determine the probability that you BOTH chose a regular pop.

Independent or Dependent??

$P(Reg) \cdot P(Reg)$

$\frac{8}{13} \cdot \frac{8}{13} = \boxed{\frac{64}{169}}$

2) Let's change problem #1 a little bit…let's say that you are thirsty and keep the can of regular pop. Then, your friend comes over and takes out a can. Determine the probability that you BOTH chose a regular pop.

Independent or Dependent??

$P(Reg) \cdot P(R|R)$

$\frac{8}{13} \cdot \frac{7}{12} = \frac{56}{156} = \boxed{\frac{14}{39}}$

3) Congratulations! You were selected to be on a game show and you're doing well! You've made it to the bonus round where you'll be given the opportunity to win a new plasma T.V, a vacation to Australia, or a brand new Lamborghini! There are 15 chips in a bag, 6 say "T.V.", 3 say "vacation" and 1 says "car", and 5 that say "better luck next time". The host will draw two prizes ***<u>without</u>*** replacing any chips.

a. What is the probability that you win a vacation and then a car?

Independent or Dependent??

$P(vaca) \cdot P(car|vaca)$

$\frac{3}{15} \cdot \frac{1}{14} = \frac{3}{210} = \boxed{\frac{1}{70}}$

b. What is the probability that you win two T.V.'s?

Independent or Dependent?

$P(TV) \cdot P(TV|TV)$

$\frac{6}{15} \cdot \frac{5}{14} = \frac{30}{210} = \boxed{\frac{1}{7}}$

4) Three cards are drawn from a standard deck **without replacement**. What is the probability that you draw a diamond, a club, and then another diamond?

Independent or Dependent??

$\frac{13}{52} \cdot \frac{13}{51} \cdot \frac{12}{50} = \frac{2028}{132,600} = \boxed{\frac{13}{850}}$