2.1 Probability

What is probability?

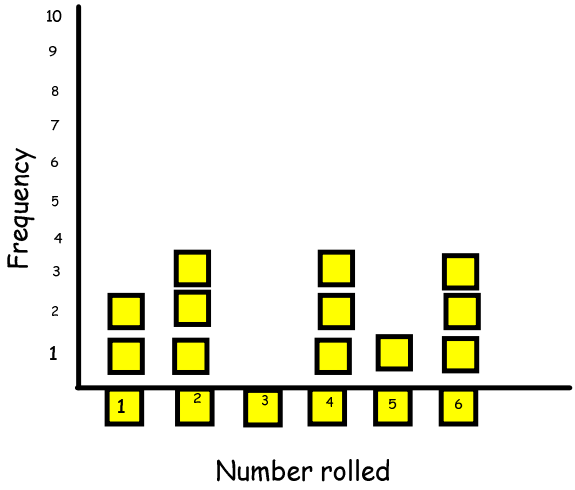
Measure of the likelihood that a specific event will occur.

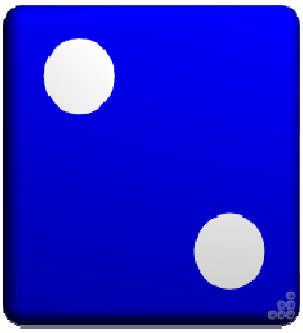
Outcome: A possible result of an experiment

Trial: One round of a probability experiment

Ex 1:

Let's roll a die 12 times and record the results on a graph





Dice Link

a) How many times was a 4 rolled? 3

b) What was the "Experimental Probability" of rolling a 4? $\frac{3}{12} = \frac{1}{4}$

c) What was the "Experimental Probability" of NOT rolling a 4? $\frac{9}{12} = \frac{3}{4}$

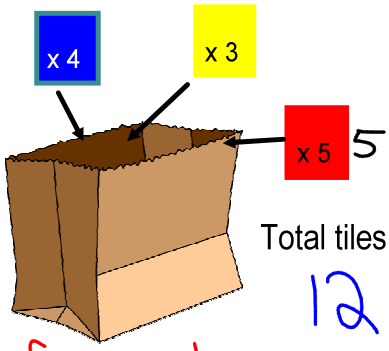
d) How many times would you expect each number to be rolled in our experiment? Explain

$\frac{1}{6}$ ∴ 2 times out of 12 rolls

we call this: "Theoretical Probability"

Ex 2

There are 4 blue, 3 yellow and 5 red tiles in a bag.



1. What are the possible outcomes?

blue, red, or yellow

2. If we pull one tile what colour do you think it will be? Why?

Red, because they are the most frequent

3. What is Theoretical Probability of each outcome?

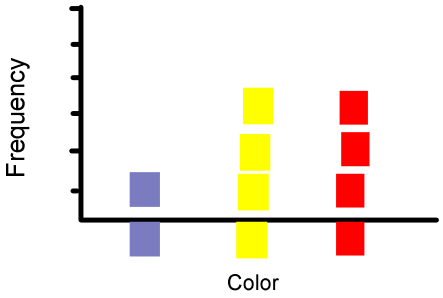
R: $\frac{5}{12}$ B: $\frac{4}{12}$ Y: $\frac{3}{12}$

4. Let's try... (Be sure to return the tiles after each draw)

a) What are the results from our actual experiment?

'Experimental Probability'

yellow: 3 red: 3 blue: 1



Trial #	Color
1	
2	
3	
4	
5	
6	
7	

b) How does this compare to the theoretical probability?

Definitely different!

c) When would experimental match theoretical probability?

If we did it a LOT!

Experimental Probability:

- the probability that a certain outcome will occur, as determined through an experiment
- can be from a real-life experiment or a simulated experiment
- always a value between 0 and 1 (WHY???)

$$\text{Experimental Probability} = \frac{\text{\# of successful trials}}{\text{total \# of trials}}$$

Theoretical Probability:

- the probability that a certain outcome will occur, as determined through measurement or calculation
- calculated value of what "should" happen (in theory!!)
- always a value between 0 and 1
- conditions must remain the same for the outcome to be "*equally likely*"
  i.e. you can't remove a few cards from the deck or weight the die

$$\text{Theoretical Probability} = \frac{\text{\# of successful outcomes}}{\text{total \# of possible outcomes}}$$

Ex 3

What is the theoretical probability of:

- tossing a head with a coin — P(a head) = $\frac{1}{2}$ 
- rolling a 4 with on a standard die — P(a 4) = $\frac{1}{6}$ 

Ex 4

How many cards in a deck? 52

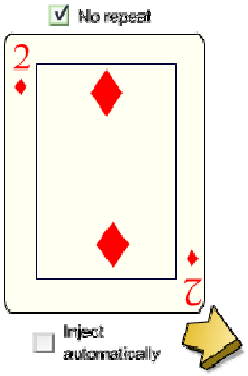
What is the probability of each event:

1. a heart

$P_{(HEART)} = \frac{13}{52}$

2. a jack

$P_{(JACK)} = \frac{4}{52}$



3. a heart, a club, or a jack P(Heart,club,or jack)= $\frac{13+13+2}{52}$

13 13 2more

$= \frac{28}{52}$

$= \frac{7}{13}$

Be careful not to count the jacks twice, two are already included in the hearts and clubs

4. a black diamond P(black diamond) $= \frac{0}{52}$

$= 0\%$

5. a heart, a club, a spade or a diamond

P(a heart, a club, a spade or diamond) $= \frac{52}{52}$

$= 1$

$= 100\%$

Discuss the following:

Does

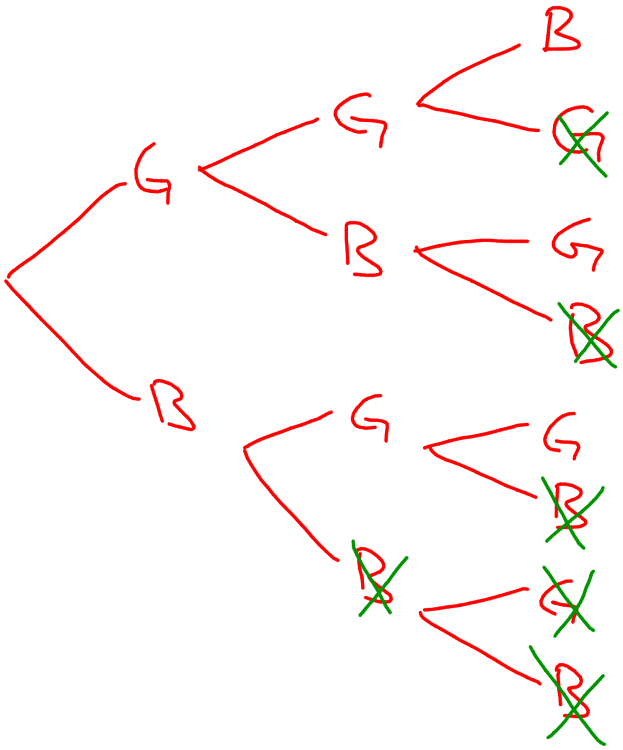
Experimental Probability

ever equal

Theoretical Probability?

Before we continue we need to know how to draw tree diagrams

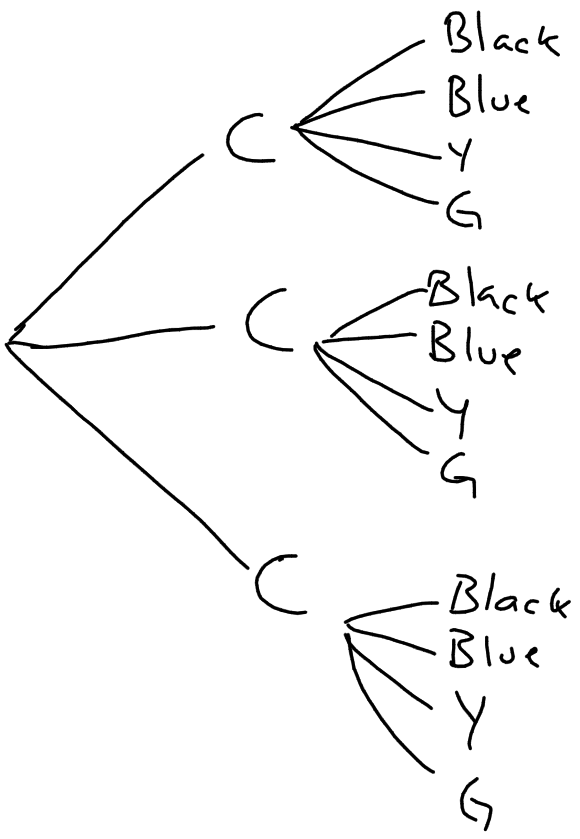
Determine the theoretical probability for having two girls and one boy in any family with 3 children. You may have the children in any order. Draw a tree diagram to represent this situation.



3 possible ways to get this arrangement

Example

You are at a carnival. One of the carnival games asks you to pick a cup and then pick a ball beneath the cup. There are 3 cups and 4 balls beneath each cup. How many choices are possible?



∴ 12 possible choices

Example: Coin Toss Experiment

Toss a coin 2 times and record the # of heads.

Repeat this trial 10 times. What is the probability of 2 heads?

Experimental:

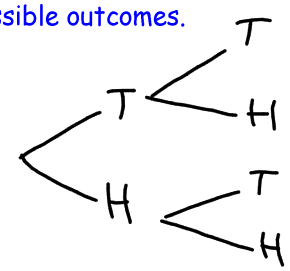
trial	# heads	
1	0	T
2	0	T
3	0	T
4	1	H
5	1	T
6	2	H
7	2	T
8	3	H
9	3	T
10	3	T

What is the experimental probability of getting 3 heads?

$\frac{3}{10}$

Theoretical:

Draw a tree diagram to show the possible outcome of 2 tosses. Then write out all the possible outcomes.



What is the theoretical probability of getting 2 heads?

$\frac{1}{4}$

What is the theoretical probability of getting a head and a tail?

$\frac{2}{4} = \frac{1}{2}$

Homework:

pg 66 # 1,2,4,6,7

pg 73 - 75 # 1-4,6-9,13

pg 82-84 #1,3,4,6,11,13