

Chapter 3

What are the chances? A Lesson in Probability

Where are we headed...

Make an assumption about a population. **I think the population looks like _____ or I think the population behaves a specific way.**

Collect data in a representative way.

Study the sample. If our population is the way we think it is then we expect our sample to look a certain way. If the sample is unexpected then we can calculate how likely it is that would observe such a sample.

If the probability is very small, we conclude the assumption about the way the population looks is wrong.

Probability is the measure of how likely an event is.

Vocabulary:

Experiment:

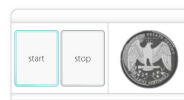
Sample Space:

Event:

The **Probability** of an event:

The **Probability** of the sample space:

Flip a coin:



Roll one die:



Spin the spinner:



Example:

Experiment - Have two children

Sample Space:

Events:

A = having two girls

B = having at least one boy

C = having exactly one boy

Probabilities of Events:

P(A) =

P(B) =

P(C) =

We can combine events...

Union

Intersection

Complement

Example:

Experiment: Pick ONE card.

Sample Space:

P(red)

P(face)

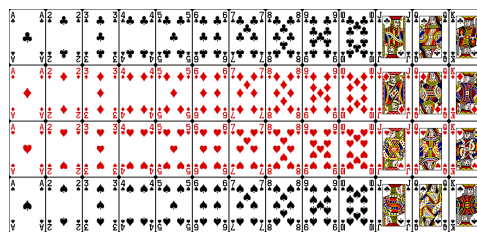
P(red and face)

P(black and number)

P(red and black)

P(not an Ace)

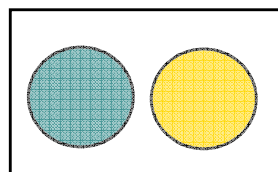
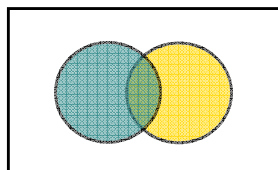
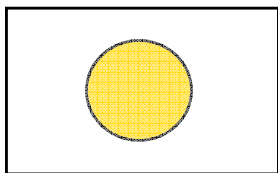
	face	number
red		
black		



Venn Diagrams help visualize probability situations.

We can create new events by combine other events.

Let A and B represent events.



Summary:

Complementary Events

$$P(A) + P(A^c) =$$

$$P(A^c) =$$

$$P(A) =$$

If A and B are mutually exclusive, then

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

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

If A and B can occur at the same time then $P(A \cap B) \neq 0$, so

Example: Suppose $P(A) = 0.5$ and $P(B) = 0.4$.

(1) If events A and B are mutually exclusive, then find $P(A \cup B)$.

(2) If the probability events A and B happen at the same time is 0.1, then find $P(A \cup B)$.

(3) Find the probability event B does not occur.

Example: A is the event a student is sick. B is the event a student misses class.

$P(A) = 0.35$, $P(B) = 0.25$, $P(A \cap B) = 0.1$ Draw Venn Diagrams

Find the probability a student is sick, misses class, or both.

Find the probability the student is neither sick nor misses class.

Find the probability the student is sick but does not miss class.

Example: Roll two dice.



Sample Space?

P(Prime or Even)

P(Greater than 3)

Example:

A die is constructed so that a 6 occurs twice as often as a 5, which occurs three times as often as a 1, 2, 3, or 4. Roll the die once.



List the Sample Space:

Find the probability of observing each outcome in the sample space:

P(observe a 5)

P(observe a number less than 5)

We will select a person at random.
Calculate the following probabilities.

	Physics	Math
Male	43	52
Female	39	49

$P(\text{male}) =$

$P(\text{math}) =$

$P(\text{male and math}) =$

$P(\text{male or math}) =$

$P(\text{male or female}) =$