

AP Statistics  
Chapter 5:  
Probability  
Day 2  
HW: p. 309-310, #39, 41, 43, 45, 47

Sample Space  
Any process that results in an observation or an outcome is an **experiment**.  
An experiment may have more than one possible outcome.  
A set of all possible outcomes of an experiment is known as a **sample space**.  
○ Denoted using the letter S.

Sample Space  
○ Tossing a coin will result in one of two possible outcomes, heads or tails. The sample space is:  
 $S = \{\text{Heads, Tails}\}$   
○ Throwing a die will result in one of six possible outcomes. The sample space is:  
 $S = \{1, 2, 3, 4, 5, 6\}$

Example  
Let's say we toss two coins.  
How many possible outcomes do we have?  
4  
Toss 1 Toss 2  
H ← T  
T ← H  
What is the sample space?  
 $S = \{HH, HT, TH, TT\}$

## Sample Space

The outcomes listed in a sample space are never repeated, and no outcome is left out.

Two events are said to be **equally likely** if one does not occur more often than the other.

- Tossing a coin
- Throwing a die

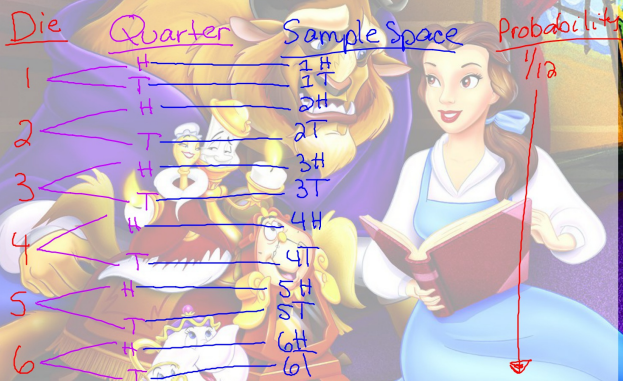
## Tree Diagram

A **tree diagram** representation is useful in determining the sample space for an experiment.

Let's take a look at an experiment in which a die and quarter are tossed together.

- How many possible outcomes are there?  
12
- What is the sample space?  
see next slide

## Tree Diagram



## Events

It is common practice to use capital letters to indicate **events**.

A = Getting an even number when a die is thrown = {2, 4, 6}

B = Getting two heads when two coins are tossed simultaneously = {H, H}



## Events

The probability of an event is generally denoted by a capital P followed by the name of the event in parenthesis.

$$P(\text{An event}) = \frac{\text{Number of outcomes that lead to the event}}{\text{Total number of possible outcomes}}$$

$$P(A) =$$

$$P(B) =$$

## Events

A = Getting an even number when a die is thrown = {2, 4, 6}

B = Getting two heads when two coins are tossed simultaneously = {H, H}

$$P(A) = \frac{3}{6} = \frac{1}{2}$$

$$P(B) = \frac{1}{4}$$

## Basic Probability Rules and Terms

**Rule 1:** For any event A, the probability of A is always greater than or equal to 0 and less than or equal to 1.

$$0 \leq P(A) \leq 1$$

**Rule 2:** The sum of the probabilities for all possible outcomes in a sample space is always 1.

## Basic Probability Rules and Terms

If an event can never occur, its probability is 0. This is known as an **impossible event**.

If an event must occur every time, its probability is 1. This is known as a **sure event**.

## Odds

The **odds in favor of an event** is a ratio of the probability of the occurrence of an event to the probability of the nonoccurrence of that event.

$$\text{Odds in a favor of an event} = \frac{P(\text{Event A occurs})}{P(\text{Event A does not occur})}$$

## Example

When tossing a die, what are the odds in favor of getting the number 2?

$$\frac{1}{6} : \frac{5}{6}$$

$\rightarrow 1 : 5$  or  $\frac{1}{5}$  or  $1 : 5$

$$\frac{1}{6} : \frac{5}{6} = \frac{1}{5}$$