Study Guide: 5.14 Probability

Standard: 5.14- The student will make predictions and determine the probability of an outcome by constructing a sample space.

What you need to know:

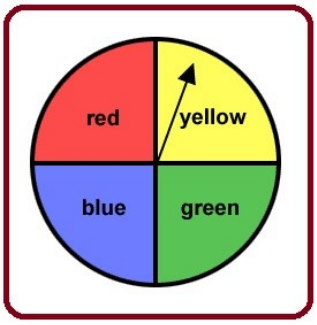
How to:

- Construct a sample space, using a tree diagram to identify all possible outcomes of a single event.
- Construct a sample space, using a list or chart to represent all possible outcomes of a single event.
- Predict and determine the probability of an outcome by constructing a sample space. The sample space will have a total of 24 or less possible outcomes.

Key concepts:

- The **probability** of an event occurring is represented by a **ratio** between 0 and 1. An event is **"impossible"** if it has a probability of **0** (e.g., the probability that the month of April will have 31 days). An event is **"certain"** if it has a probability of **1** (e.g., the probability that the sun will rise tomorrow morning).
- The more times an experiment is done, the closer the experimental probability comes to the theoretical probability (e.g., a coin lands heads up half of the time).

Key Vocabulary:



Probability: the ratio of the number of ways an event can occur to the total number of possible outcomes

Probability (red)= $\frac{\text{number of favorable outcomes (what we want to happen)}}{\text{number of possible outcomes (the possible results)}} = \frac{1}{4}$

Example: The probability of spinning yellow or blue is 2/4.

Outcome: A possible result in an experiment

Example: The possible outcomes are red, yellow, blue, and green

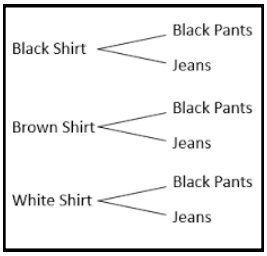
Experiment/trial: any procedure that can be infinitely repeated and has a well-defined set of possible outcomes

Example: Spinning the arrow

Event: a single result of an experiment

Example: I spin a red on my first spin. That is the event. The next spin I get blue. That is another event.

Tree diagram: A diagram used to organize outcomes of an experiment (it is called a tree diagram because it looks like branches)

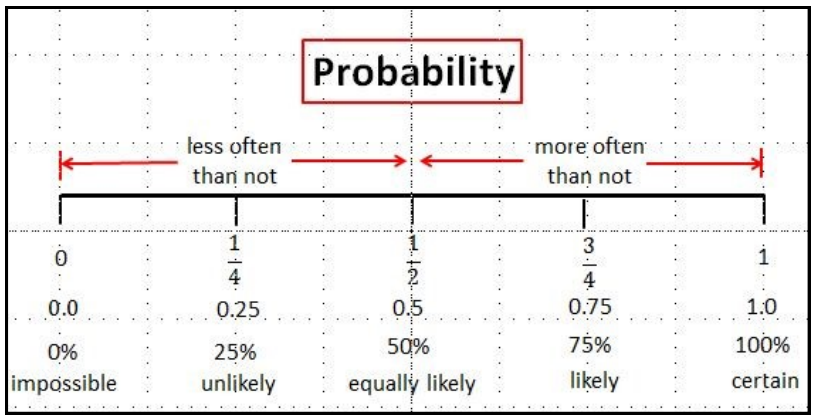


The outcomes in this tree diagram are: black shirt, black pants; black shirt, jeans; brown shirt, black pants; brown shirt, jeans; white shirt, black pants; white shirt, jeans

Fundamental Counting Principle: describes how to find the number of outcomes when there are multiple choices.

Example: How many different outfit combinations can you make from 3 shirts (black, brown, white) and 2 pants (black pants and jeans)? Take the number of choices of the shirts (3) and multiply it times the number of the pants (2): 3x2 = 6

Study Guide: 5.14 Probability



Likely: Probably will occur

Equally likely: Having the same chance of an outcome occurring, 1/2 (1 out of 2 chance it will happen)

Unlikely: Probably will not occur; only a small chance of happening, less than 1/2

Certain: An event that will always happen, 1 (1 out of 1 chance something will happen

Impossible: An event that will never happen

Sample space: The set of all possible outcomes; may be organized in a list, chart, or tree diagram.

Theoretical probability: A comparison of the number of favorable outcomes to the number of possible equally likely outcomes.

Experimental probability: The number of times the outcome occurs compared to the total number of trials.

Examples and Explanations

The possible **outcomes** of the spinner are GREEN, YELLOW, PURPLE, ORANGE, and RED. There are 5 possible outcomes. The probability of the spinner landing on a particular color can be expressed in words and as a fraction.

Event	Probability	
	Word	Fraction
Landing on GREEN, YELLOW, PURPLE, ORANGE, or RED.	Certain	1 or $\frac{5}{5}$
Landing on any color *except* GREEN	Likely	$\frac{4}{5}$
Landing on GREEN as related to landing on RED	Equally likely	$\frac{1}{5}$ and $\frac{1}{5}$
Landing on ORANGE	Unlikely	$\frac{1}{5}$
Landing on BROWN	Impossible	0

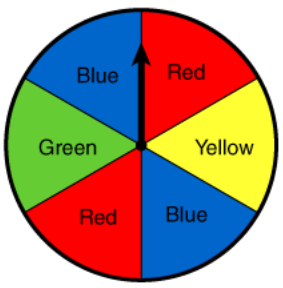
For the spinner on the right, the list of possible **outcomes** is: blue, red, yellow, and green. Even though there are two reds and two blues, you do not have to list them twice when listing the outcomes.

The probability of spinning a blue is 2/6 or 2:6.

The probability of spinning a red is 2/6 or 2:6.

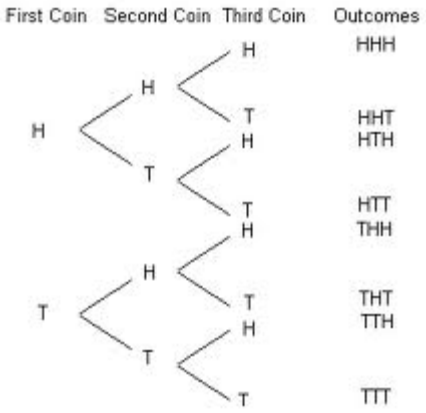
The probability of spinning a yellow is 1/6 or 1:6.

The probability of spinning a green is 1/6 or 1:6.



Study Guide: 5.14 Probability

All of the possible outcomes of an experiment are called the **sample space**. A **tree diagram** can be used to determine the sample space. Here is a tree diagram for an experiment involving flipping a coin three times. The tree diagram shows all of the possible outcomes.



There are 8 possible outcomes. This is the sample space. An **organized list or chart** can also show the sample space.

1st Roll	2nd Roll	3rd Roll
Heads	Heads	Heads
Heads	Heads	Tails
Heads	Tails	Heads
Heads	Tails	Tails
Tails	Tails	Tails
Tails	Tails	Heads
Tails	Heads	Tails
Tails	Heads	Heads

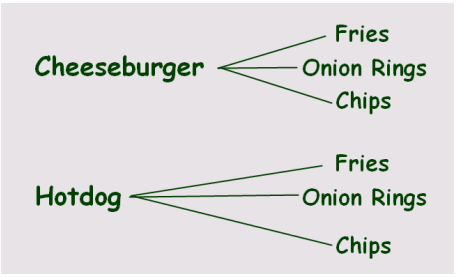
H, H, H
H, H, T
H, T, H
H, T, T
T, T, T
T, T, H
T, T, H
T, H, T
T, H, H

Example problem:

Chuck is opening a restaurant and has cheeseburgers and hot dogs on his menu. With those, patrons can choose either fries, onion rings, or chips as a side. How many of the outcomes include both a hot dog and chips?

Step 1: Use the fundamental counting principal to figure out how many total outcomes there will be. 2 sandwiches x 3 sides = 6 outcomes

Step 2: Create a tree diagram of all the possibilities.



Step 3: Figure out how many total possibilities there are (this is the sample space). Use this number as the denominator.

Possibilities (sample space):

Cheeseburger + Fries

Cheeseburger + Onion Rings

Cheeseburger + Chips

Hot dog + Fries

Hot dog + Onion Rings

Hotdog + Chips

So, there are a total of 6 choices.

Step 4: Check to see how many times the option occurs. There is only one option for hotdog and chips. Use this number as the numerator.

Step 5: Create your fraction and solve the problem.

The outcome of a hot dog with chips is 1/6.

Study Guide: 5.14 Probability

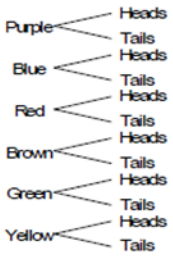
Organized List

Purple, Heads
Purple, Tails
Blue, Heads
Blue, Tails
Red, Heads
Red, Tails
Brown, Heads
Brown, Tails
Green, Heads
Green, Tails
Yellow, Heads,
Yellow, Tails

Heads	Tails
Purple	Purple
Blue	Blue
Red	Red
Brown	Brown
Green	Green
Yellow	Yellow

The spinner below is spun and a coin is tossed. How many possible outcomes are there?

Tree Diagram



Solution/Process

Multiplication
12 possible outcomes

Number of Spinner Outcomes		Number of Coin Outcomes		Total Possible Outcomes
6	x	2	=	12