Probability

Probability- How likely an event is to occur. Can be written as a fraction, decimal, or percent.

- Always on or between 0 and 1

0 — Impossible

1 — certain

Example: What is P(green)?

¼, .25, or 25%

Outcomes- all choices that may occur.

Fraction form of probability:

$$\frac{\text{Chance of specific outcome}}{\text{total \# of outcomes}}$$

Sample Space → a list of all possible outcomes

In a deck of cards, you have:

Clubs (Black): 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King, and Ace (13 cards)

Spades (Black): 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King, and Ace (13 cards)

Diamonds (Red): 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King, and Ace (13 cards)

Hearts (Red): 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King, and Ace (13 cards)

Each suit has 13 cards, and there are 4 suits. Therefore each deck of cards has 52 cards total.

(2)

the more trials, the closer the experimental and theoretical will be*

Experimental	Theoretical
What actualy happens	What should happen
Experimental Probability: $\frac{\text{favorable outcome}}{\text{number of trials conducted}}$	**Theoretical Probability:** $\frac{\text{favorable outcomes}}{\text{total possible outcomes}}$
What does happen?	***What should happen?***
Example: You toss a die 10 times. You record the number. You want to find the experimental probability of getting a 3. If a 3 occurred 6 times, the probability is $\frac{6}{10} = \frac{3}{5}$	**Example:** There are 6 numbers on a die. You want to find the theoretical probability of getting a 3. Probability of rolling a 3 = $\frac{1}{6}$ When you toss a die, you should get a 3 one sixth of the time.

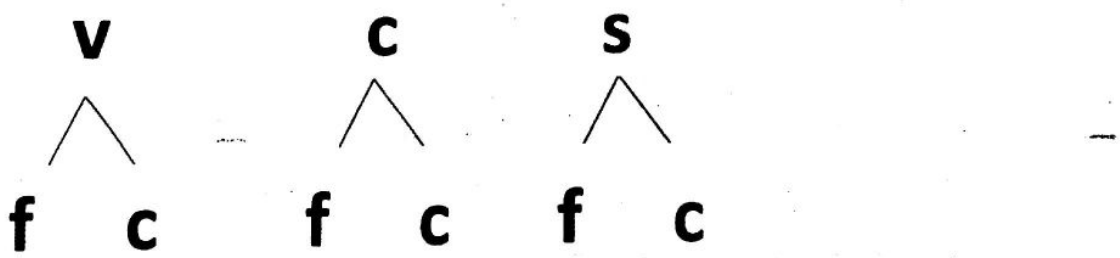
Probability

Tree Diagrams- a way to illustrate the possible outcomes of a given event

Ex. Given 3 flavors of icecream and 2 toppings, what are all of the possible combinations of one icecream and one topping?

Icecream: vanilla (v)
chocolate (c)
strawberry (s)

Toppings: fudge (f)
cherries (c)

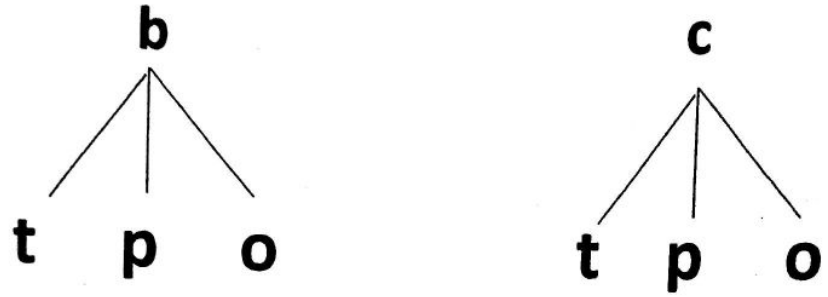


How many total outcomes? 6

Sample Space- list of all the possible outcomes

S= { vf, vc, cf, cc, sf, sc}

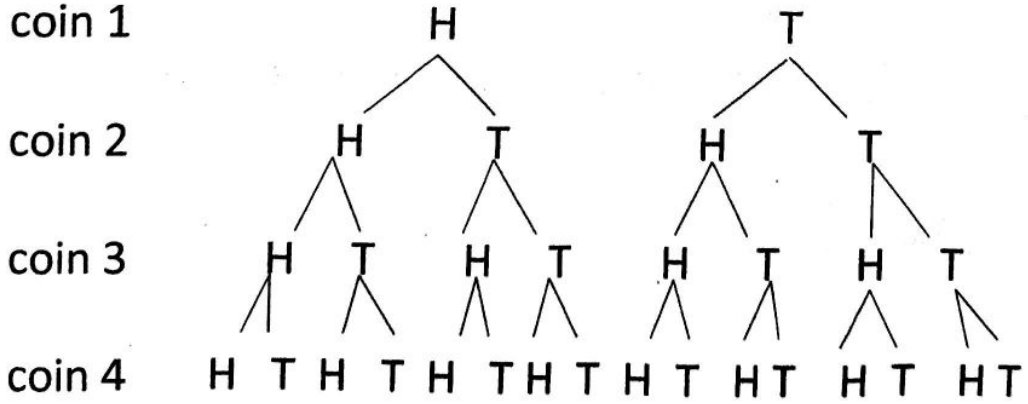
Ex. 2 main dishes (beef or chicken) and 3 veggies (tomatoes, peas, or okra)



What is the sample space?
S={bt, bp, bo, ct, cp, co}
How many total outcomes are there? 6

<u>Fundamental Counting Principle-</u> the number of options in event A X the number of options in event B = the total number of outcomes
(# Event A X # Event B = Total # Outcomes)

Ex. Flip four coins:



How many outcomes? 16

go back to p. 4

(cont from p. 6)

Go to p. 5 1st!

SO...when 4 coins are flipped,

Coin 1- 2 possible outcomes H,T
Coin 2- 2 possible outcomes H,T
Coin 3- 2 possible outcomes H,T
Coin 4- 2 possible outcomes H,T

Therefore...2x2x2x2=16

Ex. Company IDs require 4 numbers. The digits 0, 1, 2, 3, 4 are used. How many possible IDs (outcomes) can be made?

Event A		Event B		Event C		Event D		
5	x	5	x	5	x	5	=	625 IDs

Compound Probability Notes

Key word: And

Ex: Find the probability of:
p (Heads and green)

- 2 ways to find the probability of a compound event: (and)
  - *Create the sample space & find the number of favorable outcomes* (Make a tree diagram):

H < B — HB
  G — HG
T < B — TB
  G — TG

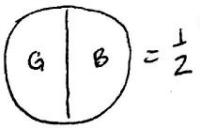
  - *Find the probability of each individual event and multiply them together →*

Or

Getting Heads:

(H) (T) = $\frac{1}{2}$

Getting Green or Blue



= $\frac{1}{2}$

p(Heads and green)

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

Key

Sum of two dice (number cubes)

This table shows the results when you roll two dice and add the numbers:

Die #2 ↓

Die #1 →

	2	3	4	5	6	7
	3	4	5	6	7	8
	4	5	6	7	8	9
	5	6	7	8	9	10
	6	7	8	9	10	11
	7	8	9	10	11	12

The table shows that when you roll 3 and 2, the sum is 5; read across from 3 to the 2 column. When you roll 5 and 6 the sum is 11; read across from 5 to the 6 column.

* There are 36 outcomes when you roll 2 dice.

P(sum is 4) = $\frac{3}{36} = \frac{1}{12}$

P(sum = 12) = $\frac{1}{36}$

P(sum is 3) = $\frac{2}{36} = \frac{1}{18}$

P(sum is 8) = $\frac{5}{36}$

P(sum is 11) = $\frac{2}{36} = \frac{1}{18}$

P(sum is 5) = $\frac{4}{36} = \frac{1}{9}$

P(sum is 10) = $\frac{3}{36}$

P(sum is 2) = $\frac{1}{36}$

P(sum is 6) = $\frac{5}{36}$

P(sum is 9) = $\frac{4}{36} = \frac{1}{9}$

P(sum is 7) = $\frac{6}{36} = \frac{1}{6}$

* 7 has the greatest (most likely) probability of being rolled when you roll 2 dice together.