What is probability?

- Probability- the ratio that measures the chances of an event occurring
  - Success: a desired outcome
  - Failure: any other outcome

Probability of Successes and Failures

- If an event can succeed in s ways and fail in f ways, then the probabilities of success, P(S), and failure, P(F), are as follows:

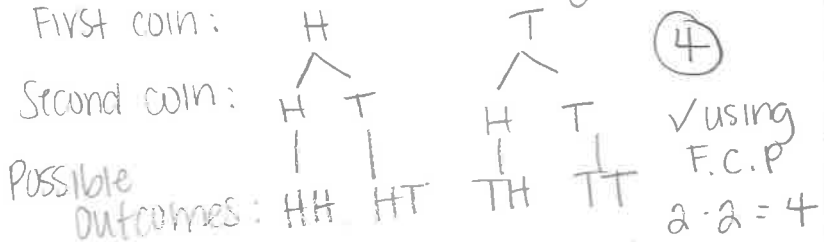
$$P(S) = \frac{s}{s+f} \qquad P(F) = \frac{f}{s+f}$$

Note: The probability of an event occurring is always between 0 and 1. The closer the probability of an event is to 1, the more likely the event is to occur. The closer to 0, the less likely.

Example 1:

- When two coins are tossed, what is the probability that both are tails?

make a tree diagram



Probability Both Tails: 1/4

Can write in decimals or percents too

Example 2: Probability with Combinations

Monica has a collection of 32 CDs- 18 pop and 14 rap. As she is leaving for a trip, she randomly chooses 6 CDs to take with her. What is the probability that she selects 3 pop and 3 rap?

1) Determine how many 6 CD selections meet the conditions
2) Use the Fundamental Counting Principle to find the number of successes
3) Find the total number of possible 6 CD selections (s+f)
4) Determine the probability.

C(18,3) C(14,3)

$\frac{18!}{15!3!} \cdot \frac{14!}{11!3!} = 297,024$

C(32,6)

$\frac{32!}{26!6!} = 906,192$

$\frac{297,024}{906,192} \approx 0.3277$

or 33%

Odds

- Odds- the ratio of the number of successes to the number of failures
- Odds of success = s:f
- Odds of failure = f:s

Example 3: According to the US National Center for Health Statistics the chances of a male born in 1990 living to be at least 65 years of age are about 3 in 4. For females, the chances are about 17 in 20.

- What are the odds of a male living to be at least 65?

# of failures: 1
# of successes = 3

3:1 odds

- What are the odds of a female living to be at least 65?

# of failures: 3
# of successes: 17

17:3 odds

Theoretical vs. Experimental Probability

- Theoretical probability: determined using mathematical methods and assumptions about the fairness of coins, dice, etc.
- Experimental probability: determined by performing experiments and observing the outcomes.

Determine whether each example is theoretical or experimental, then find the probability.

- Two dice are rolled. What is the probability that the sum will be 12?

theoretical, 1/36

- A baseball player has 126 hits in 410 at-bats this season. What is the probability that he gets a hit in his next at-bat?

experimental, about .307 or ≈31%

- A hand of 2 cards is dealt from a standard deck of cards. What is the probability that both cards are clubs?

theoretical, 1/17

P(club card 1) = 13/52
P(club card 2) = 12/51

$\frac{13 \cdot 12}{52 \cdot 51} = \frac{156}{2652} = \frac{1}{17}$