5.1 Basic Probability Concepts
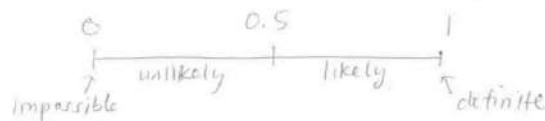
Probability: The likelihood or chance of something happening
→ must be between 0 and 1.
→ sum of all probabilities in an experiment is 1.

```
     0              0.5              1
     |---------------|---------------|
  ↑      unlikely         likely      ↑
impossible                          definite
```

Experimental Probability: The observed probability based on an experiment.
Experiment → a well-defined process from which observations are made.

trial : one round of an experiment.
outcome : a possible result from an experiment.

Example 1: Determine the experimental probability of a baseball player who makes 10 hits in 35 times at bat.

A = making a hit

$$P(A) = \frac{\text{\# of hits}}{\text{\# of attempts at bat}}$$

$$= \frac{10}{35}$$

$$= \frac{2}{7} \quad \text{or} \quad 28.6\% \quad \text{chance.}$$

Theoretical Probability: Based on possible outcomes, given that all outcomes are equally likely.

$$P(A) = \frac{n(A)}{n(S)} = \frac{\text{\# of ways an event can occur}}{\text{\# of possible outcomes}}$$

Complement: The probability that an event will _not_ occur

$$P(A') = 1 - P(A) \quad \text{(OR)} \quad P(A) + P(A') = 1$$

1

Example 2: Using a standard deck of 52 cards, what is the probability of:

a) Drawing an ace?

$= $ draw on Ace

$$P(A) = \frac{4}{52}$$
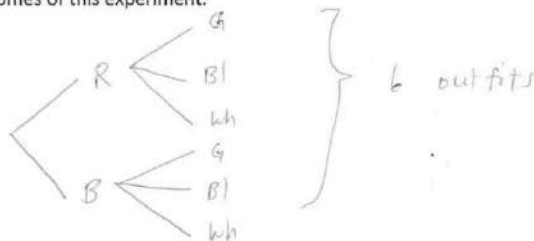$$= \frac{1}{13}$$
or 7.7%

b) Drawing anything but an ace?

$$P(A') = 1 - \frac{1}{13}$$
$$= \frac{12}{13}$$
or 92.3%

Example 3: Fiona has two shirts (red and blue), and three pairs of pants (green, black and white) that she can wear to work.

a) Suppose Fiona randomly picks a shirt and a pair of pants. Construct a tree diagram to identify the outcomes of this experiment.

R — G, Bl, wh
B — G, Bl, wh
} 6 outfits

b) Fiona does not like to wear blue and green together, nor does she like red and black together. What is the theoretical probability that she will pick a combination that she **does not** like?

A = does not like

$$P(A) = \frac{2}{6}$$
$$= \frac{1}{3}$$
or 33.3% chance of choosing an outfit she does not like.