Definitions

Probability: A measure of a desired outcome against all outcomes.

Random Experiment: An activity or process whose outcome cannot be predicted ahead of time.

Multi-Stage Experiment: An experiment with two or more events or trials, in which the outcome of each event or trial is record.

Outcome: The observed result of an event or trial.

Sample Space: A set of all possible outcomes for a random experiment.

Sample Size: The number of possible outcomes in a sample space.

Examples:

- Tossing one or more fair coins
- Rolling one or more fair six-sided dice
- Drawing one or more cards from a standard deck

Probability Application

Sometimes, we know in advance the probability of an event. For example, if we were to roll a die, we know ahead of time that any one of the six numbers has an equal chance of appearing face up, assuming we have a fair die. So, if we define our event as "a 5 appears," then the probability of that event is 1/6, or .17, or 17%. This is an example of a probability application because we know the exact makeup of the entire population. The probabilities describe the population (descriptive statistics).

Statistical Applications

Often we don't know the exact makeup of the population. We can't know ahead of time the likelihood of an event, so it has to be calculated by observation. We observe that a particular event occurs with a certain frequency over time. We can now calculate the probability by using the relative frequency formula: f/n. This is an example of a statistical application. We are using a sample to draw conclusions about what might happen with an unknown population (inferential statistics).

An example is free throws in basketball. There are two possible outcomes, the person either makes it or doesn't. However, the two outcomes are not equally likely. An experienced player will most likely make the shot, while an inexperienced player will not likely make the shot.

Mutually Exclusive Events

Events are mutually exclusive if they cannot occur at the same time.

Given the following events for a standard deck of cards:

A: Drawing a spade.
B: Drawing a heart.
C: Drawing a 5.

Events A and B are mutually exclusive because one card cannot be a spade and a heart.
Events A and C are not mutually exclusive because one card can be a 5 of spades.

Notation

The probability of an event is written as P(E).
For any event E, the probability of the event occurring is always from 0 to 1: $0 \le P(E) \le 1$.
$P(E) = 0$ means the event will not happen; $P(E) = 1$ means the event will happen.

Basic Probability Principle

The probability of an event occurring is the number of ways the event can occur divided by the size of the sample space.

$$P(E) = \frac{n(E)}{n(S)}$$