

Probability: Concepts and Fundamentals

Definitions:

An *event* is any collection of results or outcomes from a set of procedures or trials.

A *simple event* is an event that has been broken down into its most basic parts.

Sample space – the listing of all possible outcomes of a procedure or trial. For example the sample space for the genders of two children in two births would be {boy, boy; boy, girl; girl, boy; girl, girl}.

Compliment – The compliment of any event is all other possible outcomes that exclude that event. Notation: For Event A its compliment is \bar{A} .

Disjoint – Two events are disjoint if the possibility of one precludes the possibility of the other. If one occurs, the other cannot possibly occur.

Mathematical Definitions of Probability:

$$\text{Relative Frequency Approach - } P(A) = \frac{\text{number of time Event A occurred}}{\text{total number of events}}$$

$$\text{Classical Approach - } P(A) = \frac{\text{number of ways Event A can occur}}{\text{total number of simple events}}$$

Law of Large Numbers:

As a procedure is repeated over and over, the observed probability will approach the actual probability. For example, getting 10 tails in a 10 coin flips is an anomaly, but as we flip the coin more and more, the probability of our procedure will get closer and closer to 50% heads and 50% tails.

Unlikely vs. Unusual:

An event is unlikely if its chance of occurring is 5% or less [$P(x) \leq .05$] whereas an outcome is considered to be unusual if its results are extreme, either far above or below the expected value.

Independent vs. Dependent Events:

Two events are said to be *independent* of each other if the possibility of the first *does not* affect the possibility of the second. Conversely, two events are *dependent* if the probability of the first occurring *does* affect the probability of the second event occurring.

- **Sampling with replacement** means that events are **independent**.
- Conversely **sampling without replacement** means that events are **dependent**.