Probability

Basics

Definition

The most routine task of statistics is to find the probability that an event, or a series of events, will occur.

- Ex: Find probability for rolling an even-number from a six-sided die?
  - Since any roll will result in EITHER an even or an odd number.
  - Probability of rolling even: p(even) = 1/2

Events vs. Sample Space

- A Sample Space could be thought of as a list of all possible outcomes that an event could take.
- An Event could be thought of as the probability of a subset of the event space occuring.

Events vs. Sample Space

- Ex: Six sided-die:
  - Sample Space = {1,2,3,4,5,6} or ALL possible outcomes.
    - A ‘7’ or ‘0’ would not be a part of THIS sample space.
  - Event = p(1), p(even) = {2,4,6}, or probability that a subset of the event space occurs
    - Subset could be a single instance like rolling a 1
    - Or a subset could refer to a larger subset like the set of ALL even numbers in the set, odds, primes, etc...

Types of Events

- Simple vs. Compound
- Certain Vs. Impossible
- Equally Likely
- Complementary
- Mutually Exclusive

Simple vs. Compound

- Simple
  - Event that has only 1 representative in sample space
  - Ex: rolling a 3 from a six sided die. Only 1 way for that to happen! {3}
- Compound
  - Event that has more than 1 representative in sample space
  - Ex: rolling an even from a six sided die. There are 3 ways for that to happen! {2,4,6}

Certain Vs. Impossible

- Certain
  - Events that are certain, mostly trivial
  - Ex: Rolling a 1-6 from a 6 sided die.
- Impossible
  - Complementary to Certain Events, also mostly trivial
  - Ex: Rolling a 7 from a 6-sided die.

Equally Likely

- Equally Likely
  - Events that are equally likely, i.e 50% chance, binary
  - Ex: Rolling an even OR an odd from 6 sided die
  - Ex: Coin toss

Complementary

- Complementary
  - Events that complement another. Tend to be independent of each other.
  - Ex: Probability of rolling a 2 is complementary to rolling anything BUT a 2.
  - C = 1 - P

Mutually Exclusive

- Mutually Exclusive
  - Two SIMPLE events that cannot possibly coincide with each other
  - Ex: Rolling a 4 AND a prime from a 6 sided die
  - What are some more examples of mutually exclusive events?