DEF: Experiment ≡ process that generates data

EX: Flip a fair coin twice.

DEF: Observation ≡ recording of information

EX: We flip the coin two times and get Heads Tails (or HT).

DEF: Outcome ≡ result of a *hypothetical* experiment; an element or member or sample point of sample space.

EX: When we flip the coin twice, there are four possible outcomes: HH, HT, TH, TT.

DEF: Sample Space ≡ S ≡ the set of all possible outcomes of a statistical experiment

EX: When we flip the coin twice, S is the set of possible outcomes:

S = {HH, HT, TH, TT}

DEF: Event ≡ subset of sample space S

EX: When we flip the coin twice, we may define an event A to be "we get Heads on the first flip".

A = {HH, HT}

DEF: Probability (of event A) ≡ weight (of event A) ≡ likelihood of obtaining outcome in A as the result of a hypothetical experiment

EX: For event A defined above, $P(A) = 1/2$ (meaning we have a 50-50 chance of getting Heads on the first flip).

DEF: Complement (of event A) ≡ A' ≡ subset of all elements of sample space S that are not in A

EX: For event A defined above, A' = {TH, TT} since the outcomes that start with Tails are the possible outcomes that are not in A.

DEF: Intersection (of events A and B) ≡ $A \cap B$ ≡ event consisting of all elements of sample space S that are common to A and B

EX: Suppose we define another event B to be "the outcome has one Heads and one Tails".

B = {HT, TH}

For event A defined earlier,

$A \cap B$ = {HT} since HT is in both A and B

NOTE: In general, we can have multiple outcomes in the intersection.

DEF: Mutually exclusive (events B and C) ≡ disjoint (events B and C) ≡ B and C have no elements in common ≡ $B \cap C = \varnothing$ (empty set)

EX: If we define event C = {HH}, then B (from earlier) and C are mutually exclusive since they have no elements (i.e., outcomes) in common.

$B \cap C = \varnothing$

DEF: Union (of events A and B) ≡ $A \cup B$ ≡ event consisting of all elements of sample space S that are in either A or B or both

EX: For A and B defined above, the union of A and B has three elements:

$A \cup B$ = {HH, HT, TH}

NOTE: If an outcome is in both events A and B, it appears only once in the union.

DEF: Partition (A_1, A_2, A_3, ..., A_n of sample space S) ≡ events A_1, A_2, A_3, ..., A_n are mutually exclusive and the union of A_1, A_2, A_3, ..., A_n is S ≡ $A_i \cap A_j = \varnothing$ when $i \neq j$ and $A_1 \cup A_2 \cup A_3 \cup \ldots \cup A_n = S$

EX: If we define a new event, D = {TT}, then B, C, and D form a partition.

B = {HT, TH}

C = {HH}

D = {TT}

Each outcome in sample space, S, appears in B, C, or D once and only once.