Statistics:

<u>DEF</u> A <u>random experiment</u>

<u>DEF</u> The <u>Sample Space</u>

<u>EX</u>: Flipping a coin.

(a). A fair coin is flipped 4 times. If x denotes the number of heads flipped, then

$S =$

(b). A fair coin is flipped. If x denotes the number of flips until a Head is observed, then

$S =$

Set Theory Review

The ____________________ is the set of all objects considered.

The objects in a set are called ______________ of that set.

If all the elements in a set A are also in S then

A set containing no elements is called the ________________________ and denoted ________ .

The _________________ of a set A is the set of all elements in S that are not in A. It is denoted by _________ .

The _________________ of two sets A and B is the set that contains elements that are in both A and B.

It is denoted by ____________ .

The ____________ of A and B is the set that contains elements that are in either A or B.

It is denoted by ____________ .

Notation: $\bigcap_{k=1}^{n} A_k = A_1 \cap A_2 \cap \cdots \cap A_n$ $\bigcup_{k=1}^{n} A_k = A_1 \cup A_2 \cup \cdots \cup A_n$

Commutative Laws:
$$A \cup B = B \cup A$$
$$A \cap B = B \cap A$$

Associative Laws:
$$(A \cup B) \cup C = A \cup (B \cup C)$$
$$(A \cap B) \cap C = A \cap (B \cap C)$$

Distributive Laws:
$$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$$
$$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$$

De Morgan's Laws:
$$(A \cup B)' = A' \cap B'$$
$$(A \cap B)' = A' \cup B'$$

What does set theory have to do with random experiments?

The universal set is the set of all objects considered	$\Longleftrightarrow$	The ____________________ is the set of all possible outcomes
If $A \subset S$	$\Longleftrightarrow$	A is called an ___________ . (part of the possible outcomes)
$x \in A$	$\Longleftrightarrow$	If the outcome x of a random experiment is in A,

then _________________________ .

<u>Ex</u>: Roll a single 6-sided die.

(a). What is the sample space S?

(b). Event A: Roll an even number. Write A as a set.

(c). If you roll at 2, then _________________________ .

Some more set $\iff$ event connections/terminology:

DEF $A_1, A_2, \ldots, A_k$ are mutually exclusive **events** if

i.e. $A_1, A_2, \ldots, A_k$ are **sets**.

DEF $A_1, A_2, \ldots, A_k$ are exhaustive **events** if

But how does any of this help us with probabilities?
How do we define the probability of event A? (i.e., the chance of event A occurring?)

Suppose a random experiment is repeated n times (called n ___________).

DEF The Frequency of a specific outcome A is

DEF The Relative Frequency of a specific outcome A is

DEF The Probability of the specific outcome A is

Then if $P(A)$ denotes the probability of event A occurring, ______________

Def Probability is a function ,
denoted $P(A)$ with the following properties.

(c). If $A_1, A_2, A_3, \ldots$ are ____________________________ , then

$P(A_1 \cup A_2 \cup \cdots \cup A_k) = P(A_1) + P(A_2) + \cdots + P(A_k)$ for each positive integer k, and

$P(A_1 \cup A_2 \cup \cdots A_3 \cup \cdots) = P(A_1) + P(A_2) + P(A_3) + \cdots$ for an infinitely countable number of events.