

# Probability and Statistics: Lesson 1

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## 1 General Overview

### 1.1 Definitions

Experiment: procedure with undetermined outcomes

Sample Space: (S.S. or S) set of all possible outcomes

Set: a collection of things

Countable: can be put in one-to-one correspondence with the natural numbers (integers are countable)

Discrete: finite or countable

Continuous: uncountable (in opposition to discrete)

Universal Set: set of all possible outcomes equivalent to the sample space in a Probability experiment

### 1.2 Symbols

- $\in$ :  $x \in S$ :  $x$  is an element of  $S$
- $\notin$ :  $x \notin S$   $x$  is not an element of  $S$

### 1.3 Examples

- – Experiment: flip a coin  
– Sample Space:  $\{H, T\}$   
Sample Space is **finite**
- – Experiment: flip a coin until we get a tails  
– Sample Space:  $\{T, HT, HHT, HHHT, \dots\}$   
Sample Space is **infinite**, but **countable**
- – Experiment: pick a number in the interval  $[0, 1]$   
– Sample Space:  $[0, 1]$  or  $\{x \in \mathbb{R} \mid 0 \leq x \leq 1\}$   
Sample Space is **infinite**, and **not countable**

## 2 Events

### 2.1 Definitions

Subset: a set whose elements are all contained in another (super)set, additionally every set is a subset of itself and the empty set is a subset of every set

Event: a subset of the sample space

## 2.2 Symbols

- $\subseteq$ :  $A \subseteq B$ :  $A$  is a subset of  $B$
- $\subset$ :  $A \subset B$ :  $A$  is a proper subset of  $B$  (at least one element of  $B$  is not in  $A$ )
- $\emptyset$ : the empty set

## 2.3 Examples

- – Roll a six-sided die
  - $S = \{1, 2, 3, 4, 5, 6\}$   
Sample Space is **finite**
  - Events:
    - \* Event of rolling even numbers:  $A = \{2, 4, 6\}$
    - \* Event of rolling a “6”:  $B = \{6\}$
    - \* Event of rolling a prime number:  $C = \{2, 3, 5\}$
    - \* Event of rolling a number 7 or greater:  $D = \emptyset$