Lecture 1 — Basics of Probability Theory

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- What is a Set?
  - A set is a collection of objects (elements) that make up the set
  - We usually use upper case letters to describe a set and lower-case letters to refer to the elements
  - A set can be defined using enumerations:

$$A = \{\text{Jane}, \text{Bill}, \cdots\}$$
$$B = \{1, 2, 3, \cdots\}$$

  - A set can also be defined using a description method
  - $A = \{x \mid x \text{ satisfies some property}\}$
  - For example:

$$A = \{\text{Students} \mid \text{Students who earned an 'A'}\}$$

  - A set can have a finite or infinite number of elements
  - Useful notations:
    - $x \in A \equiv$ element x is contained in A
    - $x \notin A \equiv$ element x is <u>not</u> contained in A
    - $C = \{\} = \emptyset$ — C is an empty or null set
    - $D = S$ — Universal set including all elements in a given category
    - $A \subset B$ — A is a subset of set B
    - Simple Set: A set with a single element
    - Set equality: $A = B$ only if $A \subset B$ and $B \subset A$
    - $A^C \equiv$ complement of set A, which includes all elements in a given category that are not in set A