Set theory: an introduction

Set theory is a very useful branch of mathematics. In probability theory, we use the language of set theory.

A set is a collection of objects. Set theory gives us a way to describe these collections. Often, the objects in a set are numbers or sets of numbers. However, a set could represent collections of zebras and trees and hairballs.

Examples of sets:

A field is a set with special structure. This structure is provided by the addition (+) operator and multiplication operator (×) and their inverses (− and ÷).

Example of fields:

Set membership means an object belongs to a set. It is denoted: (element in set) ∈ (set).

Examples of set membership:

The union of sets is a set containing all the elements in the original sets (sets don't have repeating elements, though). The union of sets A and B is denoted $A \cup B$.

Example of set union:

The intersection of sets is a set containing the element common to all the original sets. The intersection of sets A and B is denoted $A \cap B$.

Example of set intersection:

If two sets have no elements in common, the intersection is the empty set $\varnothing = \{\}$, the unique set with no elements.

The set difference of two sets A and B is the set of elements in A that aren't also in B. It's denoted $A \setminus B$.

Example of set difference:

A subset of a set is a set, the elements of which are all contained in the original set. If B is a subset of A, we can express this relation by $B \subseteq A$.

Example of a subset:

It is true that $A \subseteq A$: a set is a subset of itself.

The complement of a subset of a set is a set of the elements of the original set that aren't in the subset.

Example of a complement: