

Functions don't have to be about numbers. They are just mappings between elements of sets.

Function: a relationship between two sets, translating an input element to an output.

The concept of functions is used throughout computer science. We need to understand exactly what a function is, and understand the different properties it could have.

Think of a function as a machine - we feed it some input, and we get some output in return.

We don't need to know what goes on inside the machine, all we care about is what output we get for different inputs.

What's important is that we can only get one output from a particular input.

For mathematical functions, we can graph them.

Functions are more general than those seen in maths, though:

- Given an ID number as input, a function returns the name of the student with that ID.
- Given the text of an email, a function "encrypt" returns an encrypted version of the text.

Let A and B be two non-empty sets. A *function* f from A to B specifies for each element of A exactly one element of B .

We write $f:A \rightarrow B$.

A is the domain and B is the codomain.

What properties must a function have?

Every element of the domain must be matched with exactly one element of the codomain, and not matched with anything else.

Can write them as:

$f: \mathbb{R} \rightarrow \mathbb{R}: x \mapsto 2x$ (maplet, basically \rightarrow with a bar at the tail)

Representing functions

In computer science we often represent functions as tables or matrices. Put the domain and codomain on the axes, specify the direction of f .

We can also use lookup tables.

Or an arrow diagram.

You can use a set of ordered pairs e.g. $\{ (\text{mallow}, \text{Cork}), \dots \}$

We'll use this representation most because it's easy to follow.

Standard function concepts

A function is linear if $f(x)$ can be written $f(x) = ax + b$ for fixed integers a and b .

polynomial if $f(x) = a_1x^n + a_2x^{(n-1)} + \dots + a_nx^0$

exponential if $f(x)$ contains a term a^x for some fixed integer a

Next lecture: properties of functions, combining functions