

# COMPUTER SCIENCE 20, SPRING 2014

## Module #12 (Relations and Functions)

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### Executive Summary

1. A *binary relation* describes relationships from one set  $A$ , called the *domain*, to another set  $B$ , called the *codomain* through a subset of  $A \times B$  called the *relation graph*. This is often depicted as a diagram with arrows from elements of the *domain* to elements of the *codomain*.
  - A *function* is a special case of a relation in which each member of the domain has at most one arrow coming out of it. Most of the time when we see functions, they can be described in a concise way, such as  $f(x) = x^2$ .
  - A relation is *surjective* when every item in the codomain has at least one arrow coming in – that is, every element in the codomain is covered.
  - A relation is *total* when every item in the domain has at least one arrow coming out of it – that is, every element in the domain participates in the relation.
  - A relation is *injective* when every element of the codomain has at most one arrow coming in – that is, if you start with an element in the codomain that has an arrow, there’s no ambiguity where in the domain it came from.
  - A relation is *bijective* when every element of the domain has exactly one arrow pointing out, and every element of the codomain has exactly one arrow pointing in.

### Check in question

1. Indicate which of the following pairs of sets has a surjective function from the first set in the pair to the second.
  - (a)  $(\{1, 2, 3\}, \{a, b\})$
  - (b)  $(\{1, a, b\}, \{2, 3, 4, 5\})$
  - (c)  $(\{1\}, \{\})$