Functions

CSE015 Lab 7, 2024 Fall

Jieke (Jacky) Wang
jwang450@ucmerced.edu
EECS, School of Engineering
UC Merced

TOC

Slides is posted on Canvas:Files. If you find any typos or have any concerns, please contact me ASAP!

Concepts

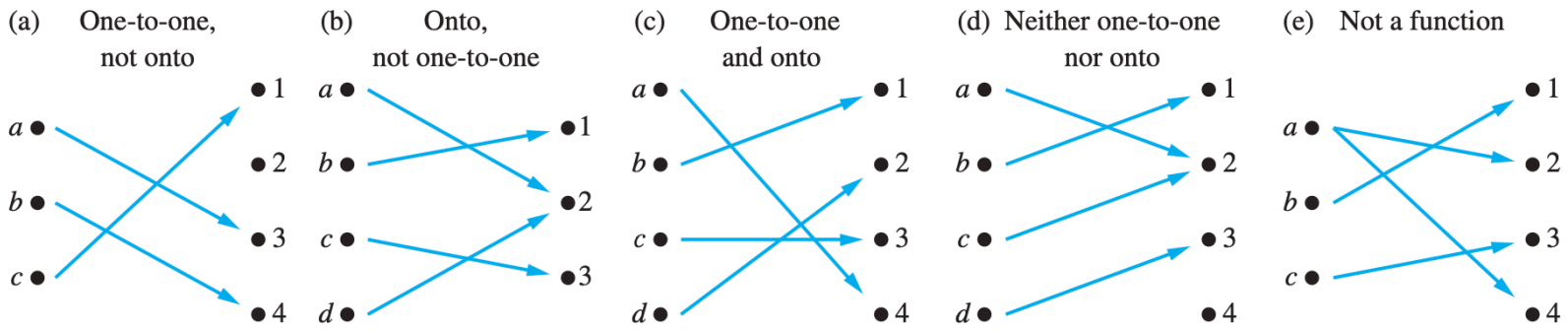
- **Definitions**: function, domain, codomain, range, image, preimage; injective / one-to-one, surjective / onto, bijective; inverse, composite, graph;
- 2.3 Figure 5, page 153.
- 2.3 blue box, page 153.

Function

To show a function $f : A \to B$ is well-defined, we need to check all of the following

1. $\forall a \in A : f(a)$ is defined on B.
2. $\forall a \in A : f(a)$ corresponds to exactly one value.

Injective & Surjective



Suppose that $f : A \to B$.

To show that f is injective Show that if $f(x) = f(y)$ for arbitrary $x, y \in A$, then $x = y$.

To show that f is not injective Find particular elements $x, y \in A$ such that $x \neq y$ and $f(x) = f(y)$.

To show that f is surjective Consider an arbitrary element $y \in B$ and find an element $x \in A$ such that $f(x) = y$.

To show that f is not surjective Find a particular $y \in B$ such that $f(x) \neq y$ for all $x \in A$.

Exercise

- Give an example of a function $f : \mathbb{R} \to \mathbb{R}$ that is injective but not surjective.
- Give an example of a function $f : \mathbb{R} \to \mathbb{R}$ that is surjective but not injective.
- Give an example of a function $f : \mathbb{R} \to \mathbb{R}$ that is neither injective nor surjective.
- Give an example of a function $f : \mathbb{R} \to \mathbb{R}$ that is bijective.
- A function $f : \mathbb{R} \to \mathbb{R}$ is continuous, strictly increasing, and unbounded. Is f injective, surjective, or bijective?

Exercise

- 1, 2, 12, 15, 21, 22, 32.
- 14 is in homework 3.