CISC 2210 Discrete Structures - Noson S. Yanofsky

Student: Ruslan Pantaev

March 11, 2018

1.7

1.

Let $S = \{1, 2, 3, 4, 5\}$ and $T = \{a, b, c, d\}$. For each question below: if the answer is Yes, give an example, else explain briefly.

Figure 1 ▶

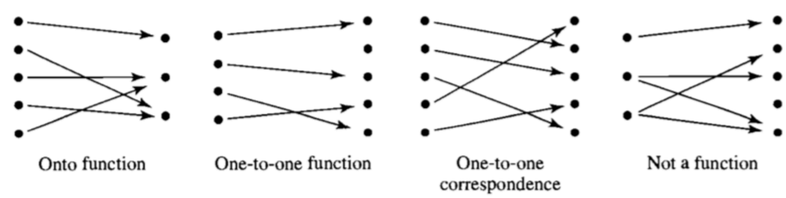


Figure 1: types of functions

onto: every element in codomain is accounted for
one-to-one: every element in domain has a unique spot in codomain
one-to-one correspondence: one-to-one between domain-codomain and codomain-domain

(a)

Are there any one-to-one functions from S into T?

No, this would be an onto function but doesn't meet the requirements for one-to-one.

(b)

Are there any one-to-one functions from T into S?

Yes. One element in S will be unused.

(c)

Are there any functions mapping S onto T?

Yes. Some two elements from S will map onto some single element in T.

(d)

Are there any functions mapping T onto S?

No, not enough elements in T to fill up codomain S. This could be a one-to-one however.

(e)

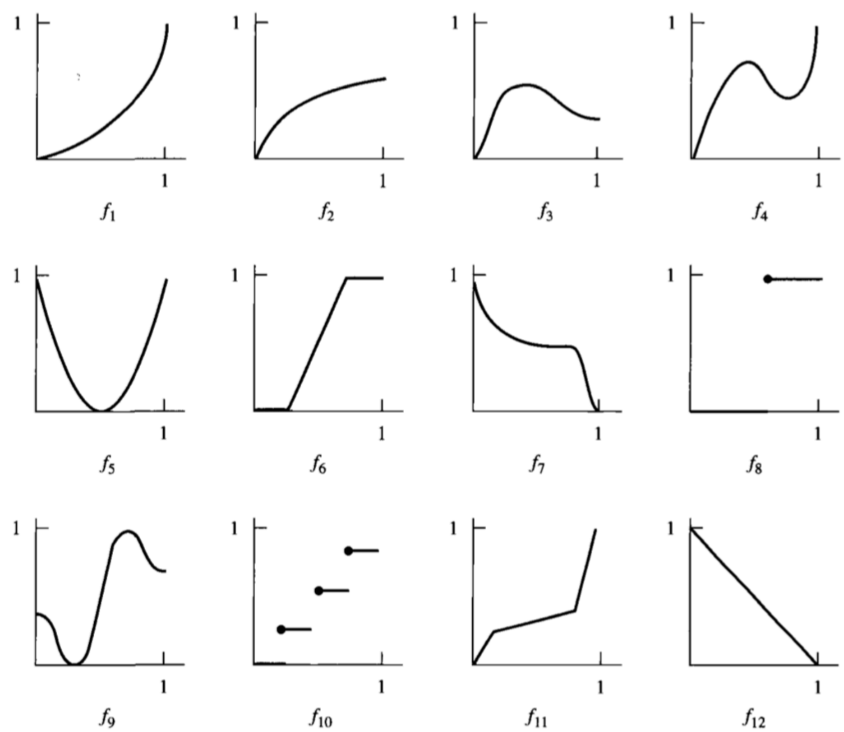
Are there any one-to-one correspondences between S and T?

No, S and T have different number of elements.

2.

The functions sketched in Figure 3 have domain and codomain both equal to $[0, 1]$

Figure 3 ▶



(TODO check with Professor about question 2)

(a)

Which of these functions are one-to-one?

f_1, f_2, f_{11} because x and y coordinates are not repeated on x and y axes.

(b)

Which of these functions map $[0, 1]$ onto $[0, 1]$?

Might be a bit of a trick question; the original statement tells us that all functions have domain and codomain mapped to $[0, 1]$.

(c)

Which of these functions are one-to-one correspondences?

f_{12} because the graph is symmetrical diagonally with no repeated points on x and y axes.

3.

The function $f(m, n) = 2^m 3^n$ is a one-to-one function from $\mathbb{N} \times \mathbb{N}$ into $\mathbb{N}$.

(a)

Calculate $f(m, n)$ for five different elements (m, n) in $\mathbb{N} \times \mathbb{N}$: