

MATH 120 In-class Activity

Day 16

Question 1. Let $X = \{A, B, C, D, E, F\}$ and let $Y = \{1, 2, 3, 4, 5, 6\}$.

- (a) Use an arrow diagram to draw a function $f : X \rightarrow Y$ where f is **not injective**.

A B C D E F

1 2 3 4 5 6

Now explain why your answer is correct. If no such function is possible, explain why not.

- (b) Use an arrow diagram to draw a function $g : X \rightarrow Y$ where g is **surjective**.

A B C D E F

1 2 3 4 5 6

Now explain why your answer is correct. If no such function is possible, explain why not.

- (c) Must the function g also be a bijection? Why or why not?

Question 2.

Is it possible to find a **function** from the power set $\mathcal{P}(\{1, 2, 3\})$ to the set $\{0, 1, 2, 3, 4\}$?
Why or why not?

Is it possible to find a **bijection** from the power set $\mathcal{P}(\{1, 2, 3\})$ to the set $\{0, 1, 2, 3, 4\}$?
Why or why not?

Question 3. Let \mathcal{W} be the set of all words of any length on the alphabet $\{a, b\}$. Let $\ell : \mathcal{W} \rightarrow \mathbb{N}$ be the function that takes as input a word w and outputs $\ell(w)$, the number of letters in w . (In other words, $\ell(w)$ is the length of w .)

(a) Is ℓ injective? Explain why or why not.

(b) Is ℓ surjective? Explain why or why not.

(c) Is ℓ a bijection? Explain why or why not.

Question 4.

Let N be the set of all numbers that appear as a building number in an address in New York City. Let B be the set of all buildings in New York City.

(a) Give a well defined function from N to B **OR** from B to N that relates building numbers and buildings in a systematic way. Justify that your function is well defined.

(b) Is your function injective? Is your function surjective?

(c) Take an element e in your codomain. What is the pre-image of e ?