Prep Work Template

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Chapter 0.4 Exercise 18

Presentation: Include here whether you'd be willing to present this one.

Question What can you deduce about the sets X and Y if you know,

a. there is an injective function $f : X \to Y$? Explain.

b. there is a surjective function $f : X \to Y$? Explain.

c. there is a bijective function $f : X \to Y$? Explain.

Solution Draft:

a. In the injective function $f : X \to Y$, no two elements in X map to the same element in Y.

b. In the surjective function$f : X \to Y$, every element in Y is assigned to at least one element of X

c. In the bijective function$f : X \to Y$, every element in X is assigned to exactly one element in Y.

Chapter 0.4 Exercise 19

Presentation: Include here whether you'd be willing to present this one.

Question Suppose $f : X \to Y$ is a function. Which of the following are possible? Explain.

a. f is injective but not surjective.

b. f is surjective but not injective.

c. $|X| = |Y|$ and f is injective but not surjective.

d. $|X| = |Y|$ and f is surjective but not injective.

e. $|X| = |Y|$, X and Y are finite, and f is injective but not surjective.

f. $|X| = |Y|$, X and Y are finite, and f is surjective but not injective.

Solution Draft:

a. When f is injective but not surjective, f is possible when $|X| \leq |Y|$.

b. When f is surjective but not injective, f is possible when $|X| \geq |Y|$.

c. When $|X| = |Y|$ and f is injective but not surjective, f is not possible as $|X| = |Y|$ means that it is bijunctive.

d. When $|X| = |Y|$ and f is surjective but not injective, f is not possible as $|X| = |Y|$ means that it is bijunctive.

e. When $|X| = |Y|$, X and Y are finite, and f is injective but not surjective, f is not possible as $|X| = |Y|$ means that it is bijunctive.

f. When $|X| = |Y|$, X and Y are finite, and f is surjective but not injective, f is not possible as $|X| = |Y|$ means that it is bijunctive.

Chapter 0.4 Exercise 23

Presentation: Include here whether you'd be willing to present this one.

Question In the game of Hearts, four players are each dealt 13 cards from a deck of 52. Is this a function? If so, what sets make up the domain and codomain, and is the function injective, surjective, bijective, or neither?

Solution Draft:

The domain of this function would be all the cards in the deck

The codomain would be the set of players' hands. In hearts, there are four players so the codomain is defined as a set of four elements, where each element is a player's hand.

Let's say the deck is $|D| = 52$ and the players' hands is $|C| = 52$

Injective Since $|D| = |C|$, the function is injective.

Surjective Since $|D| = |C|$, the function is surjective.

Bijective Since $|D| = |C|$ is both injective and surjective, the function is bijective.