

CS 173, Fall 2014
Examlet 5, Part B

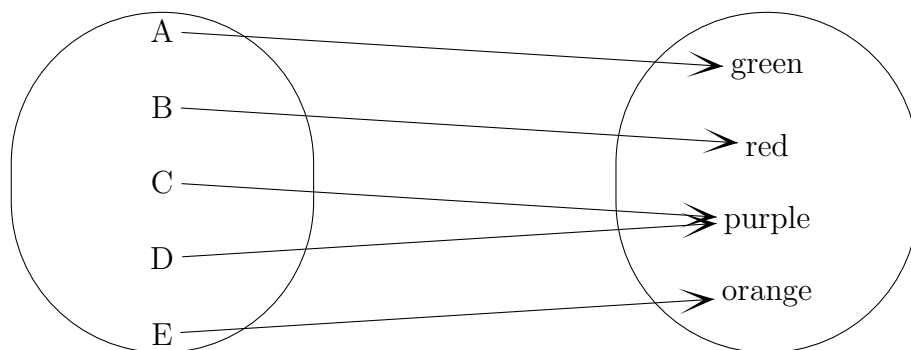
NETID:

FIRST:

LAST:

Discussion: Thursday 2 3 4 5 Friday 9 10 11 12 1 2

1. (5 points) Complete this picture to make an example of a function that is onto but not one-to-one, by adding elements to the domain and arrows showing how input values map to output values. The elements of the domain must be letters of the alphabet.



2. (10 points) Check the (single) box that best characterizes each item.

If a function from \mathbb{R} to \mathbb{R} is strictly increasing, it must be one-to-one.

true false

$g: \mathbb{Z} \rightarrow \mathbb{R}, g(x) = x - 0.314$

onto
 not a valid function

not onto

$f: \mathbb{N} \rightarrow \mathbb{R}, f(x) = x^2 + 2$

one-to-one
 not a valid function

not one-to-one

$f: \mathbb{Z} \rightarrow \mathbb{Z}, f(x) = x + 3$ if x is even,
 and $f(x) = x - 22$ if x is odd

onto
 not a valid function

not onto

$\exists y \in \mathbb{N}, \forall x \in \mathbb{N}, y \leq x$

true false

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1. (5 points) Suppose that $|A| = p$ and $|B| = q$. How many different functions are there from A to B ?

Solution: q^p

2. (10 points) Check the (single) box that best characterizes each item.

Suppose a graph with 12 vertices is colored with exactly 5 colors. By the pigeonhole principle, every color appears on at least two vertices.

true false

$$f : \mathbb{N} \rightarrow \mathbb{R}, f(x) = x^2 + 2$$

onto

not onto

not a valid function

$$g : \mathbb{Z} \rightarrow \mathbb{R}, g(x) = x + 2.137$$

one-to-one

not one-to-one

not a valid function

$$f : \mathbb{N}^2 \rightarrow \mathbb{Z}, f(p, q) = 2^p 3^q$$

one-to-one

not one-to-one

not a valid function

$$\exists y \in \mathbb{N}, \forall x \in \mathbb{Z}, x^2 = y$$

true

false

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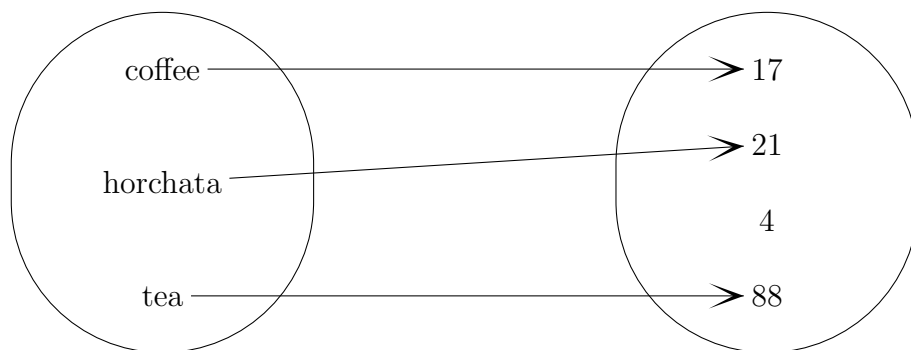
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1. (5 points) Complete this picture to make an example of a function that is one-to-one but not onto, by adding elements to the co-domain and arrows showing how input values map to output values. The elements of the co-domain must be integers.



2. (10 points) Check the (single) box that best characterizes each item.

If $f : \mathbb{Z} \rightarrow \mathbb{R}$ is a function such that $f(x) = 2x$ then the set of all even integers is

the domain of f the co-domain of f
 the image of f

$g : \mathbb{Z} \rightarrow \mathbb{Z}, g(x) = 7 - \lfloor \frac{x}{3} \rfloor$

onto not onto
 not a valid function

$f : \mathbb{N} \rightarrow \mathbb{N}, f(x) = 3 - x$

one-to-one not one-to-one
 not a valid function

$f : \mathbb{Z} \rightarrow \mathbb{Z}, f(x) = x + 3$ if x is even,
 and $f(x) = x - 22$ if x is odd

one-to-one not one-to-one
 not a valid function

$\exists y \in \mathbb{R}, \forall x \in \mathbb{R}, xy = 1$

true false

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1. (5 points) Suppose that $|A| = p$ and $|B| = q$, $p \leq q$. How many different one-to-one functions are there from A to B ?

Solution: $\frac{q!}{(q-p)!}$

2. (10 points) Check the (single) box that best characterizes each item.

A function is onto if and only if its image is the same as its co-domain.

true false

$f : \mathbb{Z} \rightarrow \mathbb{R}, f(x) = x$

one-to-one

not one-to-one

not a valid function

$g : \mathbb{Z} \rightarrow \mathbb{Z}, g(x) = 7 - \lfloor \frac{x}{3} \rfloor$

one-to-one

not one-to-one

not a valid function

$f : \mathbb{N}^2 \rightarrow \mathbb{Z}, f(p, q) = 2^p 3^q$

onto

not onto

not a valid function

$\exists y \in \mathbb{N}, \forall x \in \mathbb{N}, x = xy$

true

false