CS 173, Spring 2016
Examlet 5, Part B

NETID:

FIRST:

LAST:

Discussion: Monday 9 10 11 12 1 2 3 4 5

1. (5 points) How many different 13-letter strings beginning with ma can be made be rearranging the characters in the word ``massachusetts''? Show your work.

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

The composition of two onto functions is onto.

true ☐ false ☐

$f : \mathbb{Z} \to \mathbb{Z}$,
$f(x) = x + 4$ (x even),
$f(x) = x - 21$ (x odd)

onto ☐ not onto ☐ not a function ☐

$g : \mathbb{Z} \to \mathbb{Z}$,
$g(x) = \lfloor x \rfloor$

one-to-one ☐ not one-to-one ☐ not a function ☐

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

one-to-one ☐ not one-to-one ☐ not a function ☐

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

true ☐ false ☐

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1. (5 points) 8 presidential candidates (including Bernie and Hilary) need to line up for a photo. The new editor would like Bernie and Hilary to stand next to each other. How many different ways can we arrange the eight people?

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

The composition of two one-to-one functions is one-to-one.

true ☐   false ☐

$f : \mathbb{N}^2 \to \mathbb{N}$,
$f(p, q) = pq$

one-to-one ☐   not one-to-one ☐   not a function ☐

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

one-to-one ☐   not one-to-one ☐   not a function ☐

$g : \mathbb{R} \to \mathbb{Z}$,
$g(x) = \lfloor x \rfloor$

one-to-one ☐   not one-to-one ☐   not a function ☐

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

true ☐   false ☐

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Discussion: **Monday** **9** **10** **11** **12** **1** **2** **3** **4** **5**

1. (5 points) 15 men and 15 women showed up to this week's meeting of the UIUC Swing Dance Society. How many different ways can we form all of them into pairs, each pair containing one man and one woman?

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

If a function is onto, then each value in the co-domain has exactly one pre-image.

true ☐   false ☐

$f : \mathbb{Z} \to \mathbb{Z}$,
$f(x) = x + 4$ (x even),
$f(x) = x - 22$ (x odd)

onto ☐   not onto ☐   not a function ☐

$g : \mathbb{N} \to \mathbb{Z}$,
$g(x) = x^2$

one-to-one ☐   not one-to-one ☐   not a function ☐

$g : \mathbb{Z}^2 \to \mathbb{Z}^2$,
$g(x, y) = (y, 3x)$

one-to-one ☐   not one-to-one ☐   not a function ☐

$\forall x \in \mathbb{Z},\ \exists y \in \mathbb{Z},\ x \neq y$ and $x + y = 0$

true ☐   false ☐

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1. (5 points) How many different 12-letter strings can be made be rearranging the characters in the word ``apalachicola''? Show your work.

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

If $f : \mathbb{Z} \to \mathbb{R}$ is a function such that
$f(x) = 2x$ then the integers is the _____
of f.

domain ☐ co-domain ☐

image ☐

$g : \mathbb{N} \to \mathbb{Z}$,
$g(x) = x^2$

one-to-one ☐   not one-to-one ☐   not a function ☐

$g : \mathbb{Z} \to \mathbb{R}$,
$g(x) = \lfloor x \rfloor$

onto ☐   not onto ☐   not a function ☐

$g : \mathbb{R}^2 \to \mathbb{R}^2$,
$g(x, y) = (y, 3x)$

one-to-one ☐   not one-to-one ☐   not a function ☐

$\exists t \in \mathbb{Z}^+, \ \forall p \in \mathbb{Z}^+, \ \gcd(p, t) = 1$ true ☐   false ☐

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1. (5 points) To make exam grading anonymous and therefore hopefully more fair, each of the 200 students in CS 241 has been assigned a unique 3-character exam code. The character set is $\{\alpha, \beta, \gamma, \delta\}$. Use the Pigeonhole Principle to explain what's wrong with this plan.

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

$g : \mathbb{Z} \to \mathbb{Z}$,
$g(x) = x + 2.137$ one-to-one ☐   not one-to-one ☐   not a function ☐

Suppose a graph with 12 vertices is colored with
exactly 5 colors. By the pigeonhole principle, there is   true ☐   false ☐
a color that appear on at least two vertices.

$g : \mathbb{Z} \to \mathbb{Z}$,
$g(x) = \lfloor x \rfloor$ onto ☐   not onto ☐   not a function ☐

$f : \mathbb{Z} \to \mathbb{Z}$,
$f(x) = x + 4$ (x even),   one-to-one ☐   not one-to-one ☐   not a function ☐
$f(x) = x - 21$ (x odd)

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

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1. (5 points) 10 men and 15 women showed up to this week's meeting of the UIUC Swing Dance Society. How many different ways can we form as many as possible into pairs, where each pair consists of one man and one woman?

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

If $f : A \to B$ is one-to-one, then $|A| \geq |B|$ ☐ $|A| \leq |B|$ ☐ $|A| = |B|$ ☐

$g : \mathbb{N} \to \mathbb{Z}$,
$g(x) = |x|$ one-to-one ☐   not one-to-one ☐   not a function ☐

$f : \mathbb{N}^2 \to \mathbb{R}, \ f(p, q) = pq$ onto ☐   not onto ☐   not a function ☐

Suppose a graph with 12 vertices is colored with exactly 5 colors. By the pigeonhole principle, there are two vertices with the same color.   true ☐   false ☐

$\exists t \in \mathbb{N}, \ \forall p \in \mathbb{Z}^+, \ \gcd(p, t) = p$ true ☐   false ☐