CSE 235H Homework 07 Spring 2019

Due: Friday, March 1, 2019

Name 1 (Print) ______________________ **CSE Login** ______________

Name 2 (Print) ______________________ **CSE Login** ______________

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Problem A
Following the steps below:

1. State the propositions and their meaning in English.
2. Write each statement in propositional logic and number each statement.
3. Then, use the rules of inference to derive the conclusion from the premises clearly documenting each step.

Determine whether or not the following argument is valid:

1. She is a Math Major or a Computer Science Major.
2. If she does not know discrete math, she is not a Math Major.
3. If she knows discrete math, she is smart.
4. She is not a Computer Science Major.
5. Therefore, she is smart.

Problem B
Suppose you wish to prove a theorem of the form "if p then q".

1. If you give a direct proof, what do you assume and what do you prove?
2. If you give a proof by contraposition, what do you assume and what do you prove?
3. If you give a proof by contradiction, what do you assume and what do you prove?

Problem C
Give a proof by contradiction of the following:

"If n is an odd integer, then n^2 is odd".

Problem D
Prove that the following is true for all positive integers n:

n is even if and only if $3n^2 + 8$ is even.

Problem E
Give a proof by contraposition of the following:

if $3n + 5$ is even, then n is odd.

Problem F
Prove that the following three statements about positive integers n are equivalent:

1. n is even
2. $n^3 + 1$ is odd
3. $n^2 - 1$ is odd

Problem G
Using a proof by cases, prove that:
The equation $2x^2 + y^2 = 14$ has no positive integer solutions.

Problem H (2.3:10)
Let $f : \{a, b, c, d\} \to \{a, b, c, d\}$, for each of function f defined below

1. $f(a) = b$, $f(b) = a$, $f(c) = c$, $f(d) = d$.
2. $f(a) = b$, $f(b) = b$, $f(c) = d$, $f(d) = c$.
3. $f(a) = d$, $f(b) = a$, $f(c) = c$, $f(d) = d$.

Determine whether each f is

a. one-to-one (injective)
b. onto (surjective)
c. one-to-one correspondence (bijective)

Problem I (2.3.12)
Consider the following functions $f : \mathbb{Z} \to \mathbb{Z}$

- $f(n) = n - 1$.
- $f(n) = n^2 + 1$.
- $f(n) = n^3$.
- $f(n) = \lceil \frac{n}{2} \rceil$.

For *each* of the above functions, answer each of the following questions:

1. Determine whether each f is one-to-one (injective).
2. Determine whether each f is onto (surjective).

3. Determine whether each f is one-to-one correspondence (bijective).
4. Determine whether each f is invertible. If so, give f^{-1}.

Problem J
For functions $f(x) = x^2 + x$ and $g(x) = x - 2$ from $\mathbb{R}$ to $\mathbb{R}$, find:

1. $f \circ g$
2. $g \circ f$
3. $f \circ f$
4. $g \circ g$

Note: we have $range(f) = range(g) = domain(f) = domain(g)$.

Instructions Follow instructions *carefully*, failure to do so may result in points being deducted.

- The homework must be submitted on paper. Homework *neatly* formatted in LaTeXwill receive a 10 percent bonus. When formatting in LaTeX, submit both the .tex and .pdf files via handin, in addition to the hard copy. You will not receive the bonus points if you work with a partner (see below).
- Clearly label each problem and submit answers *in order*.
- Staple this cover page to the front of your assignment for easier grading.
- Late submissions *will not be accepted*.
- When you are asked to prove something, you must give a formal, rigorous, and complete a proof as possible. Each step in your proof must contain explanation that would allow us to understand what theorem/logic you have applied to arrive at that step.
- You are to work individually, and all work should be your own. Check partner policy below.
- The CSE academic dishonesty policy is in effect (see `http://cse.unl.edu/ugrad/resources/academic_integrity.php`).

Partner Policy You may work in pairs, but you must follow these guidelines:

1. You must work *all* problems *together*. You may not simply partition the work between you.
2. You must use LaTeXand you may divide the typing duties however you wish.
3. You may not discuss the problems with other groups or individuals.
4. Hand in only one hard copy with both author's names.