15-151 Math Foundations CS – EXCEL

Topic: **Post-Exam Reflection, Functions, Number Theory**
EXCEL Leader: Sam Yong
Email: myong@andrew.cmu.edu

Session Date: **Thu 27 Sep 2018**
Academic Development
Cyert Hall B5 | 412-268-6878

I. Definitions

a. There are three things to check when it comes to _____ of a function $f: X \to Y$, namely *totality, existence, uniqueness*:

   i. **Totality**: A value $f(x)$ should be _____ for _____ $\in X$

   ii. **Existence**: For _____ $\in X$, the specified value $f(x)$ should _____, and should be _____ of Y

   iii. **Uniqueness**: For each $x \in X$, the specified value $f(x)$ should refer to only one _____. That is, if $x = x' \in X$ then we should have _____.

b. Given functions $f: X \to Y$ and $g: Y \to Z$, their **composition** _____ is the function _____ defined by _____. Intuitively, _____ is the function resulting from first applying _____, and then applying _____, to the given input.

c. **Division Theorem**: Let $a, b \in \mathbb{Z}$ with $b \neq 0$. There exist _____ $q, r \in \mathbb{Z}$ such that _____ and _____. We say _____ is the **quotient** and _____ is the **remainder** of _____.

d. Let $a, b \in \mathbb{Z}$. We say b **divides** a, or that b is a **divisor** (or **factor**) of a, if there exists _____. To denote the fact that b divides a we write _____. For the negation, we write _____.

e. Let $u \in \mathbb{Z}$. We say u is a **unit** if _____.

II. Function Composition

Work in pairs! Each of you will create a linear function f, a quadratic function g, and an exotic function h (whatever you want). Make sure your functions are well-defined! Write your functions in part A below, and then given them to your partner to complete part B.

Part A:

f

g

h

Part B: Find the following functions! (Do they actually exist?)

- ✓ $f \circ g$
- ✓ $g \circ f$
- ✓ $g \circ h$
- ✓ $h \circ g$
- ✓ $f \circ h$
- ✓ $h \circ f$
- ✓ $f \circ g \circ h$

III. Numbers

i. What are numbers?
ii. What is division?
iii. Ciphers and Cryptography
iv. Complexity
v. Problem with Infinity

The following space is provided for you to draw.