

Name: _____

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CS 2102 - DMT1 - FALL 2020 — LUTHER TYCHONIEVICH
ADMINISTERED IN CLASS FRIDAY APRIL 10, 2020

QUIZ 10

PROBLEM 1 *Logic*

Use the following definitions for items 1–4 below:

- P : The set of programs
- T : The set of testing plans
- $B(p)$: Program p has a bug
- $B(p, t)$: Testing plan t reports program p has a bug

1. A *conservative* test plan never reports bugs unless bugs actually exist. A *complete* test plan always reports a bug if one exists. Write logic that means “some test plans are neither conservative nor complete.”

2. A *perfect* test plan reports bugs when they exist and only when they exist. A *universal* test plan works on all programs. Write logic that means “there’s no perfect universal test plan.”

3. Convert this logic to English, clearly enough we can tell if you got the quantifiers in the right order:

$$\forall t \in T . \exists p \in P . B(p) \leftrightarrow B(p, t)$$

4. Convert this logic to English, clearly enough we can tell if you got the quantifiers in the right order:

$$\exists t \in T . \forall p \in P . B(p) \leftrightarrow B(p, t)$$

PROBLEM 2 *Functions*

5. Give an example function $f : \mathbb{Q} \rightarrow \mathbb{Q}$ which is **total** and **injective** (one-to-one) but not **surjective** (not onto). You are welcome to describe it using pseudo-code, math, or any other unambiguous format we will understand.

6. Give an example function $f : \mathbb{Q} \rightarrow \mathbb{N}$ which is **total** and **surjective** (onto). You are welcome to describe it using pseudo-code, math, or any other unambiguous format we will understand.