

# CSE 390Z: Mathematics for Computation Workshop

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## Practice 311 Midterm 2

Name: \_\_\_\_\_

UW ID: \_\_\_\_\_

### Instructions:

- This is a **simulated practice midterm**. You will **not** be graded on your performance on this exam.
- Nevertheless, please treat this as if it is a real exam. That means that you may not discuss with your neighbors, reference outside material, or use your devices during the next 50 minute period.
- If you get stuck on a problem, consider moving on and coming back later. In the actual exam, there will likely be opportunity for partial credit.
- There are 3 problems on this exam, totaling 60 points.

### 1. Predicate Translation [20 points]

Let the domain of discourse be people. Translate the following statements to predicate logic, using the following predicates:

$\text{Student}(x) := x$  is a student

$\text{Professor}(x) := x$  is a professor

$\text{EnrolledInClass}(x, y) := x$  is enrolled a class taught by  $y$

You may also use  $=$  and  $\neq$  as predicates.

(a) (5 points) Every professor has at least one student enrolled in their class.

(b) (5 points) There's a student who is enrolled in two different professors' classes.

(c) (5 points) There's a professor who is enrolled in another professor's class.

(d) (5 points) All students are enrolled in some class, taught by some professor. (May not be the same professor for everyone).

**2. Set Proof** [20 points]

Suppose that for sets  $A, B, C$ , the facts  $A \subseteq B$  and  $B \subseteq C$  are given. Write an English proof to show that  $B \times A \subseteq C \times C$ .

**3. Induction** [20 points]

Prove by induction on  $n$  that for all integers  $n \geq 0$  the inequality  $(3 + \pi)^n \geq 3^n + n\pi 3^{n-1}$  is true.