CSE 390Z: Mathematics for Computation Workshop

Practice 311 Midterm

Name: _____

UW ID: _____

Instructions:

- This is a **simulated practice midterm**. You will be graded on your effort, not correctness, on this exam.
- Nevertheless, please treat this as if it is a real exam. That means that you should not discuss with your neighbors or use your devices during the next hour.
- If you find yourself needing to look concepts up in your notes or lecture materials, feel free to do so. Consider taking note of this so you can include it on your note sheet for the real exam, where you will not be able to have unlimited access to your notes.
- 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 4 problems on this exam, totaling 64 points.

1. Predicate Translation [20 points]

Let the domain of discourse be novels, comic books, movies, and TV shows. Assume the following predicates have been defined:

Novel(x) := x is a novel
Comic(x) := x is a comic book
Movie(x) := x is a movie
Show(x) := x is a TV show
Adaptation(x, y) := x is an adaptation of y

For parts (a) - (c), translate the English sentences to predicate logic.

(a) (4 points) A novel cannot be adapted into both a movie and a TV show.

(b) (4 points) Every movie is an adaptation of a novel or a comic book.

(c) (4 points) Every novel has been adapted into exactly one movie.

(d) (4 points) Translate the following statement to English:
$\exists x \exists y \exists z (\text{Novel}(x) \wedge \text{Movie}(y) \wedge \text{Movie}(z) \wedge (y \neq z) \wedge \text{Adaptation}(y, x) \wedge \text{Adaptation}(z, x))$

(e) (4 points) What is the negation of the statement from part (d), in English?
You do not need to show work for this part.

2. Sets [12 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. Number Theory [12 points]

Recall this definition of even: $\text{Even}(x) := \exists y(x = 2y)$. Write an English proof using **proof by contradiction** to show that for all integers a, b, if $4 \mid (a^2 + b^2)$, then a and b are not both odd.

4. Induction [20 points]

Prove by induction that $(1+\pi)^n > 1 + n\pi$ for all integers $n \geq 2$.