CSE 390Z: Mathematics for Computation Workshop

Practice 311 Midterm

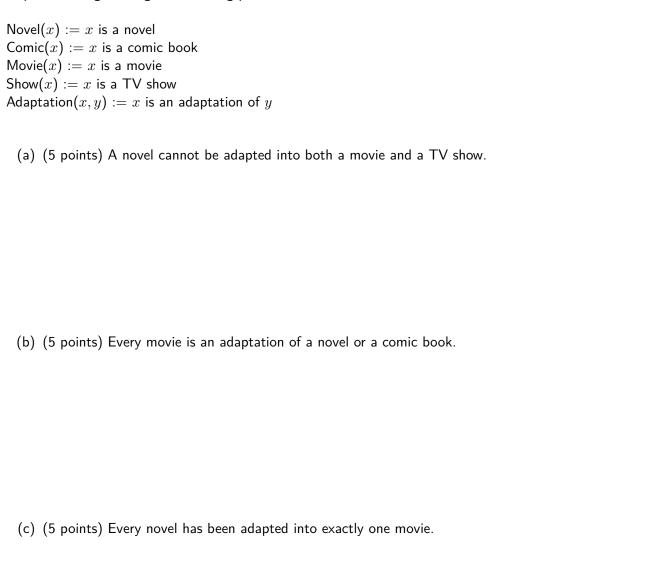
Name:			
UW ID:			

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 60 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 5 problems on this exam, totaling 80 points.

1. Predicate Translation [15 points]

Let the domain of discourse be novels, comic books, movies, and TV shows. Translate the following statements to predicate logic, using the following predicates:



2. Boolean Algebra [15 points]

Let f be the boolean function defined as f(x, y, z) = (x + y)' + (zy)

(a) (5 points) Fill in the following table with the values of f(x, y, z) in the last column. Feel free to use the blank columns while doing your work.

x	y	z		f(x,y,z)
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

(b) (5 points) Write f(x, y, z) as a Boolean algebra expression in the canonical sum-of-products form in terms of the three input bits x, y, and z.

(c) (5 points) Write f(x, y, z) as a Boolean algebra expression in the canonical product-of-sums form in terms of the three input bits x, y, and z.

3. Formal Proof with Divides [10 points]

Prove the following statement using a formal proof:

For all integers a,b,c, if $a^2\mid b$ and $b^3\mid c$, then $a^6\mid c$.

4. English Proof with Mod [20 points]

Write an English proof to show that for all integers n, $n^2 \equiv_4 0$ or $n^2 \equiv_4 1$.

Hint: You'll need to break this proof into cases based on the following definitions:

$$Even(x) := \exists k(x = 2k)$$

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$$\exists k(x = 2k)$$

Odd(x):= $\exists k(x = 2k + 1)$

5. Induction [20 points] Prove by induction that $(1+\pi)^n>1+n\pi$ for all integers $n\geq 2$.