Name:

Fall 2018 Math 245 Exam 1

Please read the following directions:
Please write legibly, with plenty of white space. Please print your name on the designated line, similarly to your quizzes (last name(s) in ALL CAPS). Writing your name incorrectly will cost you a point. Please fit your answers in the designated areas. To get credit, you must also show adequate work to justify your answers. If unsure, show the work. All problems are worth 5-10 points. The use of notes, calculators, or other materials on this exam is strictly prohibited. This exam will begin at 1:00 and will end at 1:50; pace yourself accordingly. Please remain quiet to ensure a good test environment for others. Good luck!

Problem	Min Score	Your Score	Max Score
1.	5		10
2.	5		10
3.	5		10
4.	5		10
5.	5		10
6.	5		10
7.	5		10
8.	5		10
9.	5		10
10.	5		10
Exam Total:	50		100
Quiz Ave:	50		100
Overall:	50		100

REMINDER: Use complete sentences.

Problem 1. Carefully define the following terms:

a. floor

b. divides

c. nand

d. Commutativity theorem (for propositions)

Problem 2. Carefully define the following terms:

a. Double Negation semantic theorem

b. Vacuous Proof theorem

c. converse

d. predicate

Problem 3. Calculate, and simplify, $\binom{100}{1} - \binom{100}{0}$.

Problem 4. Let $a, b \in \mathbb{Z}$, with $a \leq b$. Prove that $a + 1 \leq b + 2$, without using any theorems.

Problem 5. State the Conditional Interpretation Theorem, and prove it using a truth table.

Problem 6. Fix our domain to be $\mathbb{R}$. Simplify the proposition $\neg(\forall x\ \exists y\ \forall z,\ x \leq y < z)$ as much as possible (where nothing is negated).

Problem 7. Let $x \in \mathbb{R}$. Suppose that x is not odd. Prove that $\frac{x}{3}$ is not odd.

Problem 8. Without using truth tables, prove the Composition Theorem:

$$(p \to q) \land (p \to r) \vdash p \to (q \land r).$$

Problem 9. Simplify $\neg((p \to q) \land (\neg q))$ as much as possible (where only basic propositions are negated).

Problem 10. Fix our domain to be $\mathbb{R}$. Prove or disprove: $\forall x\ \exists y\ \forall z,\ x^2 \leq y^2 + z^2$.