Name:

Fall 2016 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. 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 last at most 50 minutes; pace yourself accordingly. Please leave **only** at one of the designated times: 1:20pm, 1:40pm, or 1:50pm. At all other times please stay in your seat (emergencies excepted), to ensure a quiet 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

Problem 1. Carefully define the following terms:

a. irreducible

b. Division Algorithm theorem

c. (logical) equivalence

d. Conditional Interpretation semantic theorem

Problem 2. Carefully define the following terms:

a. converse

b. Disjunctive Syllogism semantic theorem

c. predicate

d. counterexample

Problem 3. Let $a \in \mathbb{Z}$. Suppose that a is odd. Prove that a^2 is odd.

Problem 4. Let $a, b, c \in \mathbb{Z}$. Suppose that $a|b$ and $b|c$. Prove that $a|c$.

Problem 5. Simplify $\neg((p \to q) \to ((\neg r) \vee p))$ as much as possible. (i.e. where only basic propositions are negated)

Problem 6. Simplify $\neg(\exists x \in \mathbb{R}\ \forall y \in \mathbb{R}\ \exists z \in \mathbb{R}, x \leq z < y^2)$ as much as possible. (i.e. where nothing is negated)

Problem 7. Prove or disprove: $\forall x \in \mathbb{R}, \lfloor x^2 \rfloor \geq x$.

Problem 8. Use semantic theorems to prove the modus tollens semantic theorem.

Problem 9. Use a truth table to prove that $p \leftrightarrow q \equiv (p \wedge q) \vee ((\neg p) \wedge (\neg q))$.

Problem 10. Use semantic theorems to prove that $p \leftrightarrow q \vdash (p \wedge q) \vee ((\neg p) \wedge (\neg q))$.