Math 108—Outline for Exam 1

Sections: 1.1–1.7, 2.1,2.2 (but not the Cartesian product)

1 Language

One thing that I hope you all take away from this course is a fluency in the language of logic and set theory. To that end, you are expected to be able to recite the definitions for the following terms as well as the statements of the following theorems. Keep in mind that you are also expected to have a "working understanding" of **everything** that we have covered.

Terms

- a (mathematical) *proposition*
- what is means for two propositional forms to be *equivalent*
- the *converse* and *contrapositive* of an implication $P \implies Q$
- what it means to say that a set A is a *subset* of a set B
- what it means to say that two sets A and B are *disjoint*
- the *complement* and the *power set* of a set A
- the *union*, *intersection*, *difference*, and ~~*product* (or *Cartesian product*) of sets A and B~~

Theorems

- **De Morgan's Laws**: if P and Q are propositions, then
$$\sim (P \wedge Q) \equiv (\sim P) \vee (\sim Q) \quad \text{and} \quad \sim (P \vee Q) \equiv (\sim P) \wedge (\sim Q).$$
- **Negating Quantifiers**: If $P(x)$ is an open sentence, then
$$\sim (\exists x P(x)) \equiv \forall x (\sim P(x)) \quad \text{and} \quad \sim (\forall x P(x)) \equiv \exists x (\sim P(x)).$$

2 Problems to Practice

1. Translating to and from symbolic logic [**see Homework and Groupwork**]
2. Proving two propositional forms are equivalent with a truth table [**see Writing Assignments**]
3. Using set-builder notation [**see Homework**]
4. "True or False" problems [**see Homework and Groupwork**]
   - **(a)** Determining truth values of propositions (especially involving quantifiers)
   - **(b)** Determining if an element is contained in a given set (or power set)
   - **(c)** Determining if a set is contained in a given set
5. "Example or no such example exists" problems [**see Homework**]
   - **(a)** Examples of elements and/or sets meeting certain set-theoretic criteria
   - **(b)** Practice "prove or disprove" problems

3 Proofs

1. Make sure you could reprove all proofs from class, groupwork, homework, and writing assignments
2. Practice choosing which proof technique to use (I probably won't tell you to use contraposition or contradiction)
3. Practice using cases (the method of exhaustion)
4. Practice "prove or disprove" problems (these are easy to make up on your own)
5. Practice how to prove that a set is contained in another set and how to prove that two sets are equal