Math 210
Exam 1 Review Sheet

Section 1.1, 1.2: Propositional Logic and Applications of Propositional Logic

• Understand the definition of a proposition and be able to determine whether or not a given sentence is a proposition.
• Understand the definition and truth tables of the logical operators $\neg$, $\wedge$, $\vee$, $\oplus$, $\rightarrow$, and $\leftrightarrow$
• Be able to build the truth table of any compound proposition.
• Be able to translate back and forth between English statements and symbolic logical propositions.
• Understand the various ways of expressing a conditional statement in English (e.g. necessary, sufficient, only if, whenever, ...). Also know the difference between a conditional statement and its converse, inverse, and contrapositive statement.
• Understand how to apply logical operations to binary bit strings.
• Be able to solve simple logic puzzles by interpreting them in terms of logical propositions.

Section 1.3: Propositional Equivalences

• Understand the what it means for a proposition to be a *tautology*, a *contradiction*, or a *contingency*.
• Understand what it means for two propositions to be logically equivalent and be able to prove the logical equivalence of a pair of propositions by building truth tables.
• Memorize the list of standard logical equivalences (see handout).
• Be able to prove two propositions are logically equivalent using a 2-column proof and logical equivalences.
• Be able to prove that a proposition is a tautology using a 2-column proof and logical equivalences.
• Be able to negate propositions using De Morgan's Laws and other equivalences.

Section 1.4: Predicates and Quantifiers

• Understand the definition of a predicate involving one or more variables.
• Understand the definition of the universal quantifier, the existential quantifier, and the uniqueness quantifier.
• Be able to determine the truth value of statements involving predicates and/or quantifiers.
• Understand the definition of a *counterexample* and how to use them to show that a statement is false.
• Understand how to translate English statements into statements involving predicates and quantifiers. Be able to find multiple ways of translating the same English sentence by using different predicates and/or variable domains.
• Understand the definition of logical equivalence for statements involving predicates and quantifiers.
• Be able to negate statements involving predicates and quantifiers and be able to recognize free and bound variables.
• Understand the order of operations for statements involving quantifiers.

Section 1.5: Nested Quantifiers

• Understand how more than one quantifier can work together to form a statement involving predicates and quantifiers.
• Be able to translate English statements into symbolic statements involving *more than one* quantifier, when appropriate.
• Be able to translate symbolic statements involving predicates and *more than one* quantifier into English.
• Be able to determine the truth value of statements involving predicates and *more than one* quantifier.
• Be able to negate statements involving predicates and *more than one* quantifier.