

Math 2513
Review for First Exam
May 30, 2014

The first exam will cover the following sections of the text: 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 4.1, and 4.2. It would be a good idea to carefully review the examples and exercises in each of these sections. Below is a guide to which definitions and theorems you should be familiar with.

1.1 Variables. This section just aimed to get you used to properly using variables and quantifiers in mathematical statements. Presumably you read it at the beginning of the course, and if you've been comfortable reading the later sections in the text, you shouldn't need to re-read it now.

1.2 The Language of Sets. This section was also mainly aimed at describing basic notation. Review the definitions on page 9 and page 11.

1.3 The Language of Relations and Functions. The definition of relation on page 14 and the definition of function on page 17 are important, so make sure you're familiar with them; and in particular make sure you are clear on what distinguishes relations from functions.

2.1 Logical Form and Logical Equivalence. You should know the truth tables for the logical connectives \sim , \wedge , and \vee , and you should know what it means to say that two statements are logically equivalent. You should know the meanings of the terms "tautology" and "contradiction", as defined on page 34. You should know De Morgan's laws: $\sim(p \wedge q) \equiv \sim p \vee \sim q$ and $\sim(p \vee q) \equiv \sim p \wedge \sim q$, but you do not need to memorize all the other logical equivalences in Theorem 2.1.1 (the blue box at the bottom of page 35). Instead, just be familiar with how these are used to simplify statement forms, as in Example 2.1.14.

2.2 Conditional Statements. You should know the truth tables for the logical connectives \rightarrow (conditional) and \leftrightarrow (biconditional). You should know what are the "contrapositive", "converse", and "inverse" of a conditional statement; and the meanings of the terms "necessary" and "sufficient" as used in conditional statements.

2.3 Valid and Invalid Arguments. You should know what it means to say that an argument is valid, and how to test an argument for validity using truth tables, as in Example 2.3.1. You should know what the arguments "modus ponens" and "modus tollens" are. You do not need to know the names of the other arguments in Table 2.3.1.

3.1 Predicates and Quantified Statements I. You should know the meanings of the terms "truth set" of a predicate, "universal statement", "counterexample", and "existential statement" (see the definitions on pages 97, 98, and 99).

3.2 Predicates and Quantified Statements II. You should know how to negate universal and existential statements (see Theorems 3.2.1 and 3.2.2).

3.3 Statements with Multiple Quantifiers. You should be clear on how changing the order of the quantifiers in a statement with multiple quantifiers affects the meaning of the statement (see the box at the bottom of page 119, and the examples which follow). You should also be clear on how to negate statements with multiple quantifiers (see page 123 and the following examples).

4.1 Direct Proof and Counterexample I. Introduction. This very important section mostly deals with the question of how to write a proof in good style. This skill does not involve memorizing anything, but comes with practice in writing proofs. You've already read the section, I hope, and so mainly what you should do now is try problems from the end of the section. However, since most of the examples in this section deal with properties of even and odd numbers and prime and composite numbers, you should know by heart the definitions on page 147 and 148. Of course, you all knew what even, odd, prime and composite numbers were before taking this course, but the point is to be familiar with the precise forms of their definitions that you use in proofs.

4.2 Direct Proof and Counterexample II. Rational numbers. You should know the definition of a rational number (page 163), read the examples if you haven't already, and, as in the previous section, practice by doing exercises from the end of the section.