DISCRETE MATHEMATICS
Math 245
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Review for First Exam, Logic, Sets, Counting
Epp: 3rd Ed. Chapters 1, 2, 5 and bits of 6
Epp: 4th Ed. Chapters 1.1-2, 2, 3, 6 and bits of 9

I. Know the fundamentals of logic:

- Use a truth table: To show two statements equivalent, to prove a statement is a tautology or a contradiction, to show that an argument is valid.

- Use disjunctive normal form to create a logic statement having a given truth table.

- Use the logical equivalences we've established to simplify a statement.

II. Know how to translate from English to formal logic and vice-versa.

- Standard "or" versus "exclusive or."

- Variety of ways to express a conditional.

- Variety of ways to express universal and existential statements.

- Know how to negate a statement.

III. Logical arguments:

- Know the basic valid arguments (modus ponens, disjunctive syllogism, universal instantiation etcetera). The names are not as important as an ability to use them well.

- Given several statements, derive a conclusion using valid arguments.

- Solution of a logic puzzle (e.g. Epp 3.4 #31): 1) Identify the basic predicates, 2) translate the complex statements, 3) derive a conclusion using valid arguments.

IV. Sets: Know the definitions!

- Subset. Intersection, union, set difference, complement.

- Power set, Cartesian product, partition.

V. Sets: Know how to do simple proofs. Be able to:

- Draw a Venn diagram illustrating set operations.

- Use an element argument in a direct proof that one set is a subset of another.

- Use division into cases when appropriate.

- Give a short proof by translating to a logical statement and using logical equivalences.

- Use established properties (distributivity, De Morgan's etc.) to algebraically prove new ones.

VI. Counting:

- Know and be able to use the inclusion-exclusion formula for 2 and 3 sets. Illustrate using a Venn diagram.

- Know and be able to use the formula for the number of elements in a Cartesian product.