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Math 307  
Review sheet for Exam #2

The exam will cover the material up from the first seven homework sets (up to and including the homework due May 20th). The best thing you can do to prepare for the exam is to study these sets and make sure you know how to do all of the problems. The following is an overview of what we have been working on since the last exam:

- (1) Symbolic logic proofs. You should know the basic rules (MP, MT, RCS, LCS, CI, MPB, SI, GSP, etc.) and be able to use them in proofs. You should be able to correctly set up Deduction Theorem proofs, and Proof by Contradiction.
- (2) Quantifiers. You should be able to construct expressions involving the two quantifiers “for all” and “for sum”, translate back and forth between English and mathematical sentences, and you should be able to identify whether such expressions are true or false. You should know the rules for negating statements with quantifiers.
- (3) Line proofs. You should be able to write basic line proofs like the many that have been on homework assignments.
- (4) Set theory. You should understand sets and the basic set operations  $\cap$ ,  $\cup$ , and  $-$ . You should know the definitions of  $A \subseteq B$  and  $A = B$  and how to prove such statements. You should understand the idea of functions, the definitions for  $f(A)$  and  $I_f(B)$ , and how to prove statements about these. You should know the definition (and understand the concept) of one-to-one functions.
- (5) Binomial coefficients and counting. You should know Pascal’s relation, understand how to compute binomial coefficients, and understand their role in lots of different counting problems (e.g., the binomial theorem, counting paths on a grid, etc.)
- (6) Induction. You should be able to give very basic induction proofs, along the lines of some of the problems on the May 20 homework assignment.

Things to keep in mind when writing proofs:

1. The statement  $P \Rightarrow Q$  means “**If** we knew  $P$  were true, then we **would** know  $Q$  is true.” Do not write “ $P \Rightarrow Q$ ” in proofs when what you really mean is “**Since**  $P$  is true, **we also know**  $Q$  is true.” If you mean the latter, write the latter.
2. If you write  $(\exists k \in \mathbb{Z})[\text{BLAH}]$  then  $k$  is a bound variable in that statement and does not really “exist” in later lines of the proof. If you want to be able to do things with  $k$  later on in the proof, you need to write “There exists a  $k \in \mathbb{Z}$  such that BLAH.”