Math 3325 Spring 2018: Exam 1 Review
Instructor: Dr. Blerina Xhabli

Exam 1 will cover the material in Sections 1.1–1.7 and 2.1–2.4 of *A Transition to Advanced Mathematics* (Seventh Edition) by Smith, Eggen, and St. Andre. Possible exercise types include true/false questions; statements of axioms, definitions, and major results; computational exercises; and exercises requiring theoretical arguments (proofs). The following are the most important concepts you should concentrate on while preparing yourselves for Exam 1. ***Do not forget that your homework assignments serve as review exercises for your Exam.***

1. Definitions and axioms

You should be able to define and use the following.

(1) Even integer; odd integer
(2) a divides b (for integers a and b)
(3) Prime number
(4) Rational number; irrational number
(5) $A \subset B$ for sets A and B
(6) $A = B$ for sets A and B
(7) Power set P(A) of a set A
(8) Operations on sets: union, intersection, difference, complement
(9) Disjoint Sets
(10) Cross Products of Sets

2. Computational techniques

(1) Computations with sets: union, intersection, difference, complement
(2) Compute intersections and unions of sequences of sets *

3. Proof techniques

(1) $P \Rightarrow Q$: Prove directly.
(2) $P \Rightarrow Q$: Prove using contraposition.
(3) $P \Leftrightarrow Q$: Show that $P \Rightarrow Q$ and $Q \Rightarrow P$.
(4) $P \Leftrightarrow Q$: Prove using a sequence of iff statements.
(5) Proof by contradiction
(6) Prove that P (x) is true for all x. Methods: Direct, contradiction.
(7) Prove that there exists x for which P(x) is true. Methods: Explicitly find an x;
show that such an x must exist using an indirect argument; proof by contradiction.
(8) Statements involving multiple quantifiers
(9) Prove that there exists a unique x for which P (x) is true.
(10) Prove that a statement is false by providing a counterexample.
(11) Principle of mathematical induction (PMI)
(12) Generalized PMI

4. Theoretical results

You should know and be able to apply the following.

(1) De Morgan's laws in propositional logic
(2) Euclid's Lemma
(3) Theorem 2.1.1
(4) Theorem 2.1.5
(5) Theorem 2.2.1
(6) Theorem 2.2.2 (De Morgan's laws are given here)
(7) Theorem 2.2.3

5. Proofs

(1) Prove that $\sqrt{2}$ is irrational.
(2) Prove that the set of prime numbers is infinite.

6. Suggested extra problems

1.4: 6d, 9b	1.5: 3f, 7a
1.6: 6ij	2.1: 8, 9
2.2: 2ij, 9gh, 11b	2.4: 6d, 8f