Mathematics 3300 – Introduction to Abstract Mathematics

Student Learning Outcomes

1. Students will demonstrate factual knowledge of the mathematical notation and terminology used in this course. Students will demonstrate the ability to read, interpret, and use the vocabulary and symbolism of propositional calculus, proof methods, set theory, functions, cardinality, and discrete structures.
2. Students will demonstrate knowledge of fundamental methods of proof and problem solving. Students will demonstrate the ability to read and comprehend mathematical arguments utilizing direct and indirect proof, case analysis, and mathematical induction.

3. Students will apply course material along with techniques and procedures covered in this course to prove theorems and solve problems. Students will use the knowledge gained in this course to determine appropriate methods of proof for specific problems and to develop and write formal mathematical arguments.
4. Students will develop specific skills, competencies, and thought processes sufficient to support further study or work in this field or related fields. Students will acquire proficiency in the fundamental concepts of set theory, logic, functions, properties of the real number system, and methods of proof, at a level necessary for more advanced mathematics courses such as linear and abstract algebra, real and complex analysis, and topology.

Course Content

Textbook: http://people.uleth.ca/~dave.morris/books/proofs+concepts.pdf

Ch. 1, Mathematical Reasoning: Statements, Compound Statements, Implications, Contrapositive and Converse.
Ch. 2, Sets: Sets and Subsets, Combining Sets, Collections of Sets.
Ch. 3, Functions: Definition and Basic Properties, Surjective and Injective Functions, Composition and Invertible Functions.
Ch. 4, Binary Operations and Relations: Binary Operations, Equivalence Relations.
Ch. 5, The Integers: Axioms and Basic Properties, Induction, The Division Algorithm and Greatest Common Divisors, Primes and Unique Factorization, Congruences, Generalizing a Theorem.
Ch. 6, Infinite Sets: Countable Sets; Uncountable Sets, Cantor's Theorem, and the Schroeder-Bernstein Theorem; Collections of Sets.
Ch. 7, The Real and Complex Numbers: Fields, The Real Numbers, The Complex Numbers.
Optional: Portions of Ch. 8 (Polynomials, Unique Factorization, Polynomials over **C**, **R**, and **Q**), results from geometry, basic results from linear algebra, analysis, and numerical analysis.