Mathematics 2305 – Discrete Mathematics 1

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 methods related to weak and strong induction, algorithms, set theory, combinatorics, probability, and graph theory.

2. **Students will demonstrate knowledge of fundamental principles used in counting and problem solving.** Students will demonstrate the ability to read and comprehend combinatoric methods applied to problems in probability and counting. Students will also demonstrate the ability to apply combinatoric methods as well as weak and strong induction to develop algorithms and basic mathematical proofs.

3. **Students will apply course material along with techniques and procedures covered in this course to solve problems.** Students will use the knowledge gained in this course to determine appropriate techniques for specific problems in probability and graph theory and to develop and apply algorithms to those problems.

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 graph theory, induction, probability, and combinatorics, at a level necessary for more advanced mathematics courses such as Discrete Mathematics 2, and Probability & Statistics.

Course Content

Textbook: *Discrete Mathematics: Lecture Notes, Yale University, Spring 1999* by L. Lovász and K. Vesztergombi . http://www.freebookcentre.net/maths-books-download/Discrete-Mathematics-pdf.html

Ch. 1, Introduction

Ch. 2, Let Us Count: Sets and Subsets, Sequences, Permutations

Ch. 3, Induction

Ch. 4, Counting Subsets: Ordered subsets, Combinations, The Binomial Theorem, Anagrams

Ch. 5, Pascal's Triangle

Ch. 6, Fibonacci Numbers: Identities, A formula for the Fibonacci numbers

Ch. 7, Combinatorial Probability: Events and Probabilities, Independence, The Law of Large Numbers

Ch. 8, Integers, Divisors, and Primes: Divisibility, The history of the primes, Factorization, Fermat's Little Theorem, The Euclidean Algorithm, Primality testing

Ch. 9, 12, 13; Graphs: Paths and cycles, Hamilton Circuits, Graph colorings, Matchings

Ch. 10, 11; Trees: How many trees are there?, How to store a tree, Minimal spanning trees

Ch. 15, Cryptography

Additional Topics; Arithmetic and Geometric Sequences