



ALA-TOO INTERNATIONAL UNIVERSITY

KYRGYZ REPUBLIC, BISHKEK

FACULTY OF ENGINEERING AND COMPUTER SCIENCE
DEPARTMENT OF APPLIED MATHEMATICS AND INFORMATICS

OUTLINE FOR THE DISCRETE MATHEMATICS II

Instructor:

Dr. Remudin Reshid MEKURIA

Program: Undergraduate

Year: Freshman

Cr. hr.: 6.0 hrs/week

Department taking the course: Applied Maths and Informatics

Course Objectives

Students should learn a particular set of mathematical facts and how to apply them; more importantly, such a course should teach students how to think logically and mathematically. To achieve these goals, this course stresses on the mathematical reasoning and the different ways problems are solved. Five important themes are interwoven in this text: mathematical reasoning, combinatorial analysis, discrete structures, algorithmic thinking, and applications and modeling. A successful discrete mathematics course should carefully blend and balance all the five themes.

Course Descriptions

Mathematical Reasoning: Students must understand mathematical reasoning in order to read, comprehend, and construct mathematical arguments. This text starts with a discussion of mathematical logic, which serves as the foundation for the subsequent discussions of methods of proof. Both the science and the art of constructing proofs are addressed.

Learning Outcomes

The students will be able to

- **express** a logical sentence in terms of predicates, quantifiers, and logical connectives.
- **write** an argument using logical notation and determine if the argument is or is not valid.
- **prove** basic set inequalities.
- **apply** counting principles to determine probabilities.
- **demonstrate** an understanding of relations and functions and able to determine their properties.
- **apply** the rules of inference and methods of proof including direct and indirect proof strategies, proof by contradictions, and using the principles of mathematical inductions.

Structure of the Lectures

Week 1:

- Lecture 1: Recursive Algorithms and Program Correctness
- Lecture 2: Solving examples

Week 2: Counting

- Lecture 1: The Basics of Counting
- Lecture 2: The Pigeonhole Principle

Week 3: Counting (cont.)

- Lecture 1: Permutations and Combinations
- Lecture 2: Solved Problems

Week 4:

- Lecture 1: Binomial Coefficients, Generalized Permutations and Combinations
- Lecture 2: Generating Permutations and Combinations

Week 5: Discrete Probability

- Lecture 1: An Introduction to Discrete Probability, Probability Theory

- Lecture 2: Bayes' Theorem, Expected Value and Variance

Week 6: Advanced Counting Techniques

- Lecture 1: Recurrence Relations, Solving Recurrence Relations
- Lecture 2: Divide-and-Conquer Algorithms and Recurrence Relations, Generating Functions

Week 7: Advanced Counting Techniques (cont.)

- Lecture 1: Inclusion-Exclusion, Applications of Inclusion-Exclusion
- Lecture 2: Solved Problems

Week 8: Preparation for the mid term Exam: revision of previous lessons and solving problems.

Week 9: Relations

- Lecture 1: Relations and Their Properties
- Lecture 2: n-ary Relations and Their Applications

Week 10: Relations (cont.)

- Lecture 1: Representing Relations
- Lecture 2: Closures of Relations

Week 11: Relations (cont.)

- Lecture 1: Equivalence Relations
- Lecture 2: Partial Orderings

Week 12: Graphs

- Lecture 1: Graphs and Graph Models
- Lecture 2: Graph Terminology

Week 13: Graphs (cont.)

- Lecture 1: Representing Graphs and Graph Isomorphism
- Lecture 2: Connectivity

Week 14: Graphs (cont.)

- Lecture 1: Euler and Hamilton Paths
- Lecture 2: Shortest-Path Problems

Week 15: Graphs (cont.)

- Lecture 1: Planar Graphs
- Lecture 2: Graph Coloring

Week 16: Preparation for the final term Exam: course revision and solving problems.

Teaching Materials

Text Book: Discrete Mathematics and Its Applications 7th Edition by Kenneth H. Rosen.

Reference Books:

1. Essentials of Discrete Mathematics 3rd Edition by David J. Hunter
2. Journey into Discrete Mathematics by Owen D. Byer, Deirdre L. Smeltzer, and Kenneth L. Wantz
3. Discrete Mathematics: A First Course by Alexander Stanoyevitch

Lecture Videos and Web Pages:

All lectures have been recorded and they are accessible from OCS.

Several web page links are also available on the OCS for the respective lessons.

Evaluation and Assessment Types

- | | |
|-------------------|-----|
| • Mid Term Exam | 15% |
| • Final Term Exam | 25% |

- Quizzes (continuous assessment) 50%
- Assignments 10%