KENNESAW STATE UNIVERSITY

Syllabus

Course: MATH 2345 Discrete Mathematics

Term: Fall 2025

Credit Hours: 3

Class Day (s): Tuesday and Thursday

Course Textbook: Discrete, Mathematics, Eighth Edition, **Richard Johnsonbaugh,** *DePaul University, Chicago*

Or

Discrete Mathematics, 5th edition, by Susanna Epp, e-text version

Instructor Information:

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Topics:

Chapter 6: Counting Methods and the Pigeonhole Principle

In many discrete problems, we are confronted with the problem of counting. For example, to estimate the run time of an algorithm, we needed to count the number of times certain steps or loops were executed. Counting also plays a crucial role in probability theory. Because of the importance of counting, a variety of useful aids, some quite sophisticated, have been developed. In this chapter we develop several tools for counting. These techniques can be used to derive the binomial theorem. The chapter concludes with a discussion of the Pigeonhole Principle, which often allows us to prove the existence of an object with certain properties.

6.1 Basic Principles, Multiplication Principle, Addition Principle, Multiplication Principle. Inclusion-Exclusion Principle,

6.2 Permutations and Combinations

6.3 Generalized Permutations and Combinations

6.8 The Pigeonhole Principle (First Form, Second Form, Third Form)

Chapter 7: RECURRENCE RELATIONS

7.1 Introduction

7.2 Solving Recurrence Relations

In this section we discuss two methods of solving recurrence relations:

iteration and a special method that applies to **linear homogeneous recurrence relations with constant coefficients.**

(a) Population Growth.

(b) Find of Hanoi puzzle can be solved.

(c) Solve the recurrence relation

$$p_n = a - \frac{b}{k}\, p_{n-1}$$

for the price p_n in the economics model of Example 7.1.9 by iteration.

(d) Linear homogeneous recurrence relation of order k with constant coefficients.

(e) More Population Growth.

(f) Find an explicit formula for the Fibonacci sequence.

Chapter 8: Graph Theory

Undoubtedly, one of the reasons for the recent interest in graph theory is its applicability in many diverse fields, including computer science, chemistry, operations research, electrical engineering, linguistics, and economics.

We begin with some basic graph terminology and examples. We then discuss some important concepts in graph theory, including paths and cycles. Two classical graph problems, the existence of Hamiltonian cycles and the traveling salesperson problem, are then considered. A shortest-path algorithm is presented that efficiently finds the shortest path between two given points. After presenting ways of representing graphs, we study the question of when two graphs are essentially the same (i.e., when two graphs are isomorphic) and when a graph can be drawn in the plane without having any of its edges crossed. We conclude by presenting a solution based on a graph model to the Instant Insanity puzzle.

8.1 Introduction

8.2 Paths and Cycles

8.3 Hamiltonian Cycle and Traveling Salesperson Problem

8.4 A Shortest – Path Algorithm

8.5 Representation of Graphs

8.6 Isomorphisms of Graphs

8.7 Planar Graphs

Chapter 9: Trees

Trees form one of the most widely used subclasses of graphs. Computer science, in particular, makes extensive use of trees. In computer science, trees are useful in organizing and relating data in a database. Trees also arise in theoretical problems such as the optimal time for sorting. In this chapter we begin by giving the requisite terminology. We look at subclasses of trees (e.g., rooted trees and binary trees) and many applications of trees (e.g., spanning trees, decision trees, and game trees).

9.1 Introduction

9.2 Terminology and Characterizations of Trees

9.3 Spanning Trees

9.4 Minimal Spanning Trees

9.5 Binary Trees

Chapter 12: Automata, Grammers, and Languages

Chapters 1 – 5

These five chapters are essential for learning Discrete Mathematics, but we do not have enough time to cover all the sections. Therefore, we will focus on the following topics, which are most relevant for students in this course:

Logic, Elementary Proof Writing, Mathematical Induction, Elementary Set Theory.

Evaluation: Homework = 10 points, Quizzes = 25 points, Midterm = 30 points, Final = 35 points.

Course Policy

Attendance

Attendance is crucial for successfully passing this course. I strongly advise all my students not to miss any lectures. If you do not attend class, you may find it extremely difficult to understand the concepts taught.

Homework

I will email your homework assignments, and it is essential that you attempt to solve them or at least think critically about them. Problem-solving is key to mastering Discrete Mathematics, and without it, achieving a true understanding will be challenging.

Please note the following regarding homework:

- **All homework must be submitted on the due date. Late submissions will not be accepted.**
- **Homework must be submitted in person by placing it on my desk in the classroom. Emailed submissions will not be accepted.**
- **To receive credit for your homework, at least 60% of the problems must be correct. For example, if 10 problems are assigned, you must solve all 10, and at least 6 of them must be correct.**

Classroom Etiquette

You are not allowed to use your phone during class. If it is necessary to answer a call or read a message, please step outside the classroom, handle the matter, and then return promptly.

Makeup Policy

There will be no makeup quizzes, midterms, or final exams.

If you are unable to attend the final exam for medical reasons, you will initially receive an "F" for the course. However, if you provide an official document from a hospital proving your illness, the matter will be reviewed by a committee that includes a medical professional. If your claim is approved, the Education Office will change your grade to "W" (Withdrawal), allowing you to withdraw from the course.

Grading Policy

My grading scale is as follows:

- 95–100: A
- 80–94: B
- 70–79: C
- 60–69: D
- Below 60: F

Instructional Continuity Plan

Kennesaw State University (KSU) may decide to close campuses, operate on a delayed schedule, or transition to remote instruction for inclement weather or in case of emergency.

The University will announce campus closures, delayed schedules, or remote instruction through KSU Alerts sent to your cell number on file and to your

university email account. In addition, announcements will be posted on KSU's home page: www.kennesaw.edu.

Our class continuity plan includes:

1. **Communication: Please check D2l Brightspace or e-mail for necessary instructions.**
2. **Virtual Classes: If in-person classes are not possible, we may transition to virtual classes using MS Teams.**
3. **Assignments and Assessments: Deadlines for assignments and assessments may be adjusted to accommodate the emergency situation.**

We understand that emergencies create unique challenges. If you need additional support during an emergency, reach out via Brightspace or e-mail. The university also offers resources such as counseling and academic support, which can be accessed remotely.