CS1303T Discrete Structures 2

Lecture 0:

Course Administrivia

Dr Abdullah Alharbi

Semester 2
(1447 AH – 2026 AD)

Lecture content:

- **Course Administrivia**:
  - Course Details
  - Course Coordinator & Instructor
  - Course Description:
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    - Textbooks
  - Success in Discrete Structures 2
  - Feedback
- **Introduction to Discrete Mathematical Structures**:
  - What is Discrete Mathematics?
  - Kinds of Problems Solved Using Discrete Mathematics
  - Goals of a Course in Discrete Mathematics
  - Discrete Mathematics is a Gateway Course

Course Administrivia

❖ Course Details:

- **Course code:** CS1303T
- **Course title:** Discrete Structures 2
- **Groups:** 1, 2, 141 & 148
- **Credit hours:** 3
- **Unit prerequisite:** CS1303 Discrete Structures 1
- **Date & Time:** Group 1 (Sunday 1, 2 & Tuesday 10)
  Group 2 (Sunday 3, 4 & Tuesday 9)
  Group 141 (Tuesday 3, 4 & Monday 9)
  Group 148 (Wednesday 3, 4 & Sunday 9)
- **Room:** Group 1 & 2 (12-0.003), Group 141 & 148 (12-0.021).

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❖ Course Instructor:

- **Name:** Dr Abdullah ALHARBI
- **Phone:** 0567936958 (*Mobile*)
- **Office:** 12-1.114 (Second floor)
- **Email:** *asaharbi@uqu.edu.sa*
- **Website:** https://uqu.edu.sa/asaharbi/App/CV
- **Consultation time:** See the *Blackboard* for the most updated times.
- **Lecture material:** will be posted on the *Blackboard*

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❖ Course Description:

- Discrete Structures 2 will help students to:
  - Build on foundational discrete mathematics concepts from an earlier course.
  - Focus on advanced topics: number theory, counting principles, relations, graphs, and trees.
  - Explore both theoretical foundations and practical applications in computer science.
  - Emphasize modelling and solving computational problems.
  - Involve problem-solving practice, algorithm design, and collaborative projects.
  - Develop analytical skills and logical reasoning.
  - Foster appreciation for the role of discrete mathematics in technology and innovation.
  - Prepare students for advanced studies and professional challenges in computing and related disciplines.

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- **Topics**:
  - Number Theory
  - Counting Theory
  - Relations
  - Graphs
  - Trees

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- **Number Theory**:
  - Divisibility & Modular Arithmetic
  - Integer Representations & Algorithms
  - Primes & Greatest Common Divisors
  - Solving Congruences
  - Applications of Congruences

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- **Counting Theory**:
  - The Basics of Counting
  - The Pigeonhole Principle
  - Permutations and Combinations
  - Binomial Coefficients and Identities
  - Generalized Permutations and Combinations
  - Generating Permutations and Combinations

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- **Relations**:
  - Relations and Their Properties
  - n-ary Relations and Their Applications
  - Representing Relations
  - Closures of Relations
  - Equivalence Relations
  - Partial Orderings

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- **Graphs**:
  - Graphs and Graph Models
  - Graph Terminology and Special Types of Graphs
  - Representing Graphs and Graph Isomorphism
  - Connectivity
  - Euler and Hamilton Paths
  - Shortest-Path Problems
  - Planar Graphs
  - Graph Coloring

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- **Trees**:
  - Introduction to Trees
  - Applications of Trees
  - Tree Traversal
  - Spanning Trees
  - Minimum Spanning Trees

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❖ Weekly Schedule:

- The following table shows *a tentative schedule* for the materials that will be covered in this unit; however, required changes can be made throughout the semester.

No	Topic	Week#
1.	**Number Theory**	1 - 3
2.	**Counting Theory**	4 - 6
3.	**Relations**	7 - 9
4.	**Graphs**	10 - 13
5.	**Trees**	14 - 15

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❖ Assessment Items:

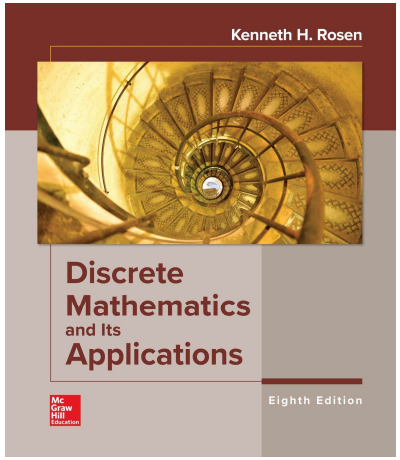
- The assessment (*tentative*) for this course consists of the following:

	Item	Weighting	Due date
1	**Assignments**	20%	Weekly
2	**Midsemester Exam**	20%	TBA
3	**Quizzes**	20%	TBA
4	**Final exam**	40%	TBA

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❖ Textbooks & References:

- Book #1 is the required textbook for this course.



1. Discrete Mathematics and Its Applications

By: Kenneth H. Rosen

Mc Graw Hill; Eighth Edition (January 1, 2018)

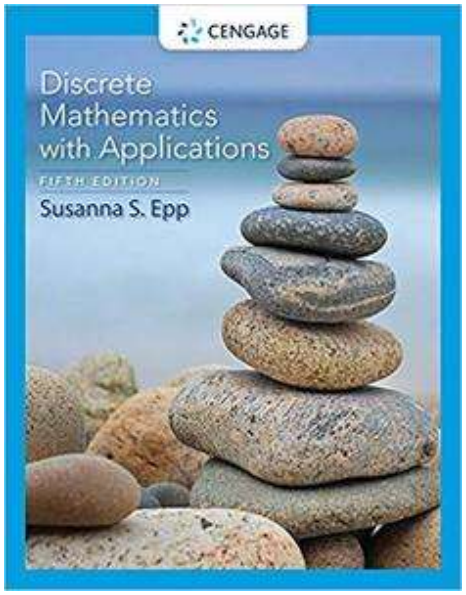
ISBN-10: 1260091996

ISBN-13: 978-1260091991

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❖ **References**:

- The following references are very handy:



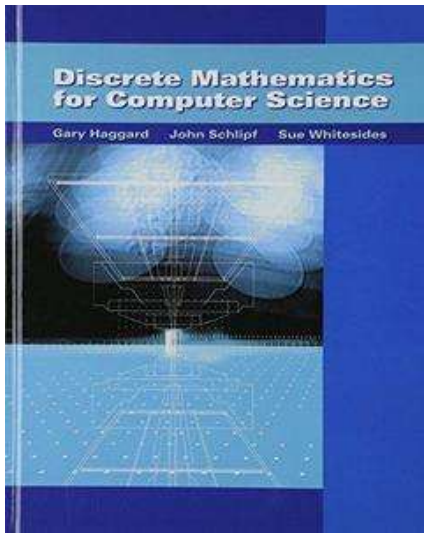
2. Discrete Mathematics with Applications

By: Susanna S. Epp

Cengage Learning; 5th Edition (January 1, 2019)

ISBN-10: 1337694193

ISBN-13: 978-1337694193



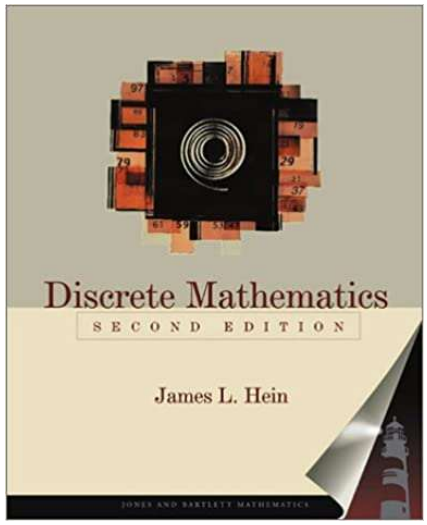
3. Discrete Mathematics for Computer Science

By: Gary Haggard, John Schlipf, Sue Whitesides

Cengage Learning; 1st Edition (February 1, 2005)

ISBN-10: 053449501X

ISBN-13: 978-0534495015



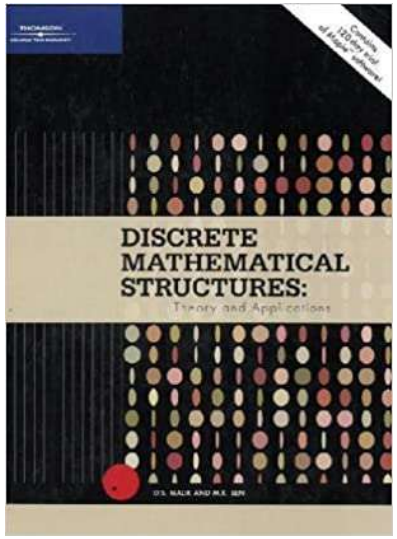
4. Discrete Mathematics

By: James L Hein

Jones & Bartlett Publishers; 2nd Revised ed. Edition (January 1, 2002)

ISBN-10: 0763722103

ISBN-13: 978-0763722104



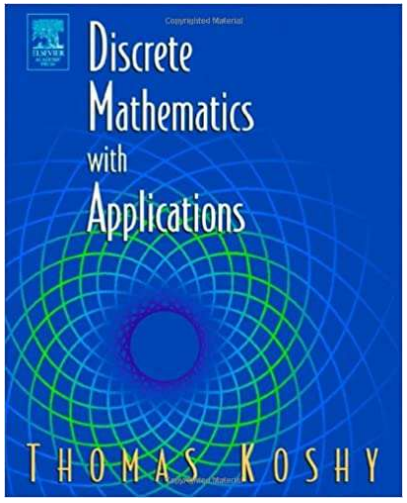
5. Discrete Mathematical Structures: Theory and Applications

By: D.S. Malik and M.K. Sen

Course Technology; 1st Edition (May 20, 2004)

ISBN-10: 0619212853

ISBN-13: 978-0619212858



6. Discrete Mathematics with Applications

By: Thomas Koshy

Academic Press; 1st Edition (December 26, 2003)

ISBN-10: 0124211801

ISBN-13: 978-0124211803

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How to succeed in Discrete Structures 2:

- The unit consists of two lectures a week (two-hour and one-hour lectures).
- These two lectures are mainly used to explain the theoretical contents, however, sometimes and if needed; some problem-solving sessions (tutorials) will be given as well.
- Lectures and tutorials sessions of this course are very important.
- They will assist you in understanding the course's materials and therefore will help in improving your grade.
- The lectures of this course are logically connected, so attending each class without being absent is essential.
- It is also crucial that you keep reviewing the lecture material periodically and never leave that until examinations time.
- Also, doing the practical/tutorials on time will strengthen your understanding of the information that has been given during lecture times, and it will help you out in doing the assessment tasks successfully.
- Good Luck!

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❖ Your feedback is important to us!

- Your feedback about this course is very welcome.
- I am more than happy to hear from you about the teaching and the learning approaches that have been used through out the entire semester.
- Please feel free to email me any feedback or suggestions.
- No personal information is needed.

What is Discrete Mathematics?

- Discrete mathematics is the part of mathematics devoted to the study of discrete (as opposed to continuous) objects.
- Calculus deals with continuous objects and is not part of discrete mathematics.
- Examples of discrete objects:
  - integers
  - steps taken by a computer program
  - distinct paths to travel from point A to point B on a map along a road network
  - ways to pick a winning set of numbers in a lottery
- A course in discrete mathematics provides the mathematical background needed for all subsequent courses in computer science and for all subsequent courses in the many branches of discrete mathematics.

Kinds of Problems Solved Using Discrete Mathematics

- How many ways can a password be chosen following specific rules?
- How many valid Internet addresses are there?
- What is the probability of winning a particular lottery?
- Is there a link between two computers in a network?
- How can I identify spam email messages?
- How can I encrypt a message so that no unintended recipient can read it?
- How can we build a circuit that adds two integers?

Kinds of Problems Solved Using Discrete Mathematics

- What is the shortest path between two cities using a transportation system?
- Find the shortest tour that visits each of a group of cities only once and then ends in the starting city.
- How can we represent English sentences so that a computer can reason with them?
- How can we prove that there are infinitely many prime numbers?
- How can a list of integers be sorted so that the integers are in increasing order?
- How many steps are required to do such a sorting?
- How can it be proved that a sorting algorithm always correctly sorts a list?

Goals of a Course in Discrete Mathematics

- **Mathematical Reasoning**:
  - Ability to read, understand, and construct mathematical arguments and proofs.
- **Combinatorial Analysis:**
  - Techniques for counting objects of different kinds.
- **Discrete Structures:**
  - Abstract mathematical structures that represent objects and the relationships between them.
  - Examples are sets, permutations, relations, graphs, trees, and finite state machines.

Goals of a Course in Discrete Mathematics

- **Algorithmic Thinking**:
  - One way to solve many problems is to specify an algorithm.
  - An algorithm is a sequence of steps that can be followed to solve any instance of a particular problem.
  - Algorithmic thinking involves specifying algorithms, analyzing the memory and time required by an execution of the algorithm, and verifying that the algorithm will produce the correct answer.
- **Applications and Modeling:**
  - It is important to appreciate and understand the wide range of applications of the topics in discrete mathematics and develop the ability to develop new models in various domains.
  - Concepts from discrete mathematics have not only been used to address problems in computing, but have been applied to solve problems in many areas such as chemistry, biology, linguistics, geography, business, etc.

Discrete Mathematics is a Gateway Course

- Topics in discrete mathematics will be important in many courses that you will take in the future:

➢ **Computer Science**:

- Computer Architecture, Data Structures, Algorithms, Programming Languages, Compilers, Computer Security, Databases, Artificial Intelligence, Networking, Graphics, Game Design, Theory of Computation, ……

➢ **Mathematics:**

- Logic, Set Theory, Probability, Number Theory, Abstract Algebra, Combinatorics, Graph Theory, Game Theory, Network Optimization, …
- The concepts learned will also be helpful in continuous areas of mathematics.

➢ **Other Disciplines:**

- You may find concepts learned here useful in courses in philosophy, economics, linguistics, and other departments.

Any Questions?

- In the next lecture, we will discuss the '**Number Theory**' in two or three parts.
- See you then!