Introduction to COMP2711H

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Contents

Discrete Mathematics and Its Applications

What is discrete mathematics?

- Discrete mathematics is the study of **mathematical structures** that are fundamentally discrete rather than continuous.
  - For example, integers, graphs, and statements in logic.
- Discrete mathematics therefore excludes topics in "continuous mathematics" such as **calculus** and **analysis**.

Some Applications

- **Computer science**: computer algorithms, programming languages, cryptography, automated theorem proving, and software development.
- **Electrical engineering**: Digital communication systems, coding theory, consumer electronics, signal processing, and information theory.

Topics of COMP2711H

- Sets
- Propositional and Predicate Logic
- Mathematical Proofs
- Binary Relations
- Functions
- Combinatorics
- Graphs
- Discrete Probability
- Mathematical Induction
- Recursions
- Complexity of Algorithms
- Number Theory
- Groups, Rings and Fields
- Polynomials over Fields
- Finite Fields
- Some Applications of Finite Fields

Lecture Schedule (Tentative)

01. Sets
02. Propositional Logic
03. Predicate Logic
04. Mathematical Proofs
05. Binary Relations
06. Functions
07. Mathematical Induction
08. Combinatorics: Part I
09. Combinatorics: Part II
10. Recursions: Part I
11. Recursions: Part II
12. Complexity of Algorithms
13. Discrete Probability: Part I
14. Discrete Probability: Part II
15. Discrete Probability: Part III
16. Graphs: Part I
17. Graphs: Part II
18. Modular Arithmetic
19. Number Theory: Part I
20. Number Theory: Part II
21. Groups, Rings and Fields
22. Polynomials over Fields
23. Finite Fields: Part I
24. Finite Fields: Part II
25. Finite Fields: Part III
26. Review Lecture

Tutorials

Time	Monday 18:00–18:50
Venue	Room 6573
TA	LIU Hao (office hours and email address on the course web page.

You should attend the tutorials due to the following:

- New topics and contents are sometimes covered.
- Problem solving techniques are sometimes further discussed.

Learning Objectives

On successful completion of this course, students are expected to be able to:

- Understand the formulation of common problems in several areas of discrete mathematics, including combinatorics, graphs, number theory, cryptography, logic and proof, recursions, probability theory, and finite fields.
- Learn a number of discrete mathematics tools.
- Apply discrete mathematics tools learnt to solve certain problems in computer science and electrical engineering.

Reference Books

- S. S. Epp, Discrete Mathematics with Applications, Fourth Edition, Brooks/Cole, 2011.
- R. Lidl and H. Niederreiter, Finite Fields, Second Edition, Cambridge University Press, 1997.
- R. J. McEliece, Finite Fields for Computer Scientists and Engineers, Kluwer, 1987.

Grading Scheme

- Course attendance %10
- Five assignments %40
- Midterm exam %25
- Final exam %25

Important Messages to Students

- Homework solutions must be submitted at the start of class on due date. In exceptional circumstances (illness, university business, or religious observances) extensions may be granted.
- As a courtesy to graders, homeworks should be written **neatly**.
- It is crucial that you work out assignment problems yourself, though group discussions are allowed. Otherwise you will not be able to fully understand the materials covered in this course.
- This course is designed only for a very small number of top undergraduates, and may cover **more** topics and **deeper** materials than a discrete mathematics course in other universities worldwide.
- You should not take this course if you would have an easy life, as course assignments will be heavy.

Acknowledgements

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