4190.101
Discrete Mathematics

Course Introduction

Gunhee Kim

Outline

- Class Introduction
- Introduction to Discrete Mathematics

Overview

- Instructor
  - Lecturer: Gunhee Kim (gunhee@snu.ac.kr) (Office Hour: Mon 9:30~11:00 AM)
  - TAs: Yookoon Park, Sangho Lee, Youngjin Kim (ta.dm@vision.snu.ac.kr)
  - Please discuss with TAs for homework and exams

- Location and Time
  - 302-208 Mon/Wed 9:30 AM ~ 10:45 PM

- Materials
  - Textbook: Discrete Mathematics and Its Applications, Kenneth Rosen (7th GLOBAL edition), McGraw Hill
  - Class notes will be posted via ETL

Homepages

- SNU ETL
  - Class notes, HW, and Exams
  - See syllabus_dm2017_(date).pdf (the first file in ETL) for course Info and schedule
  - It will be updated frequently whenever anything is changed

- Visit frequently!

초안지

- I would accept about 20 students
  - Email to TA (ta.dm@vision.snu.ac.kr) in **Today**
  - Write down the followings
  - (1) 이름 및 학번
  - (2) 현재 전공 및 복수/부전공 계획
  - (3) 왜 Discrete Math를 이번 학기, 이 강의를 들어야 하는지

Logistics

- A: 30%, B: 40%, C or below: 30%
  - Relative evaluation urged by the University
  - Proportions are subject to change
- **Three** Exams: Midterm I (25%), Midterm II (25%), Final (30%)
  - Will be based on exercises of textbook
- Homework: 20%
- Attendance: -0.5~1 per absence (out of 100)
  - Being late twice is counted as one absence
  - Randomly at the beginning of class

Homework

- Homework assignments – 20%
  - Equally weighted **FIVE** HW assignments
  - Posted via ETL
  - Use the ETL board for homework questions
  - Submit at the beginning of the class on due date
  - Within 24 hours after the deadline, your can still submit the homework directly to TAs, but your credits will be half
  - After 24 hours, your credits are zero (Do not submit)
  - Exercises of textbook

Etc

- Use the ETL board for questions (about HW and exams)

  - If you post an accurate answer to a question, you will earn extra credit

- Anyone who cheats on any assignment or exam will receive zero score

  - Cheating includes (1) copying other students' solutions or solution book, (2) googling for solutions, (3) omitting key citations of references, (4) copying any parts of other codes (in programming assignment)

이의 제기 (김영란 법)

- 부정청탁
  - "~도 맞는 거 아닌가요?/맞게 해주세요"도 부정청탁이 **될 수** 있음
  - 부정청탁의 경우, 첫번째는 거절의 의무, 두번째는 신고의 의무 (기관의 장)

- 모든 숙제, 채점, 성적 관련 이의 제기는 written form으로만 가능
  - Hardcopy 나 이메일 (사진 첨부 가능)
  - 부정청탁시 증거로 사용하기 위함
  - 조교의 답변도 written form (email)로 함

이의 제기 방법

- 처음 이의 제기시 최대한 객관적으로 명확히 작성하여 제출함
  - 절대 TA나 교수자를 먼저 찾아오지 말 것
  - TA는 이의신청 들어오면 대면을 요청하거나, 최대한 자세히 살펴보고 신중하게 결정
  - 만약 TA 가 거절을 하는 경우, 더 이상 재고의 여지는 없음
  - (부정청탁으로 판단되는 경우) 같은 내용으로 다시 요청하면 학교에 신고 and/or 성적 letter 강등 (ex. B0 → C0)

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What is Discrete Mathematics?

- Discrete mathematics is the part of mathematics devoted to the study of discrete (as opposed to continuous) objects
  - Calculus and analysis deals with continuous objects and is not part of discrete mathematics
  - Examples of discrete objects: integers, graphs, statements in logic
  - Discrete – digital: obtained by counting
  - Continuous – analog: obtained by measuring
- Characterized as the branch of mathematics dealing with **countable sets**

Discreteness

- Countable Set
  - A set with the same cardinality (# elements) as some subset N of the natural numbers
  - Either a finite set or a countably infinite set (i.e. natural numbers)
  - In other words, a set is countable if there is a bijection (i.e. one-to-one correspondence) from that subset to N

- A set that is infinite and not countable is called uncountable

Why Study Discrete Math?

- It provides tools and techniques to design and analyze the computer system
  - The basis of all of digital information processing: discrete manipulations of discrete structures represented in memory
  - Digital computer is basically a finite discrete system, part or all of which can be modeled by discrete math

- It is the basic language and conceptual foundation of all of computer science

- A generally useful tool for rational thought!

Kinds of Problems in Discrete Math

- 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 in Discrete Math

- 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 Math

- **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 Math

- **Algorithmic Thinking**
  - One way to solve many problems is to specify the solution as an algorithm
  - An algorithm is a sequence of steps that can be followed to solve any instance of a particular problem
  - Specifying algorithms, analyzing the memory and time required by an execution of the algorithm, and verifying the algorithm produces the correct answer

- **Applications and Modeling**
  - 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 Math is a Gateway Course

- Topics in discrete math 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, …

- Other Disciplines

  - The concepts may be useful in courses in philosophy, economics, linguistics, and other departments