DISCRETE MATHEMATICS I

1. Thông tin về học phần (General Information)

Tên học phần (Course name):   Discrete Mathematics 1

Mã học phần (Course code):   INT1358

Số tín chỉ (Number of credits):   3

Loại học phần (Course type):   Compulsory

Học phần tiên quyết (Prerequisites):

      - Introduction to Computing and Programming

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

    - Lecture room: Projector, microphone and speaker, black board or white board
    - Laboratory:

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

    - Lý thuyết (Lectures):   36h
    - Bài tập (Exercises):   8h
    - Bài tập lớn (Projects):   0h
    - Thực hành (Labs):   0h
    - Tự học (Individual reading): 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

    - Address: Faculty of Information Technology 1 - Posts and Telecommunications

    Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District,

    Hanoi.
    - Phone number: (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The goal of this course is to introduce students to ideas and techniques from discrete mathematics that are widely used in science and engineering. This course teaches the students techniques in how to think logically and mathematically and apply these techniques in solving problems. To achieve this goal, students will learn:

- basic definitions of logic operations, sets, as well as algorithms and mathematical reasoning.
- how to solve fundamental problems in science and engineering: counting, listing, optimization as well as existence problems.

Kỹ năng (Skills):

Upon successful completion of this course, the students will be able to:

- apply knowledge of discrete mathematics in problem solving
- develop recursive algorithms to solve typical engineering problems related to counting, listing and optimization issues.

Thái độ, Chuyên cần (Attitude):

Students are required to attend the classes and complete course exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

This course introduces students to basic concepts of discrete mathematics and its applications in computer science and engineering. The studying topics are involving problems of discrete mathematics, whenever objects are counted, when relationships between finite (or countable) sets are studied, and when processes involving a finite number of steps are analyzed. Students will learn different approaches to solve these counting, listing, optimization and existing problems, and their applications in computer science and engineering.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Logic and proofs
1.1. Propositional logic
  1.1.1. Definition
  1.1.2. Operations
  1.1.3. Translating English sentences into logical expression
  1.1.4. Logic and bit operations
  1.1.5. Propositional equivalences
1.2. Predicates and quantifiers
  1.2.1. Predicates
  1.2.2. Quantifiers
  1.2.3. Translating from English into logical expression
1.3. Sets
  1.3.1. Definition
  1.3.2. Set operations
  1.3.3. Set identities
  1.3.4. Computer representation of sets
1.4. Algorithm complexity
  1.4.1. Algorithm
  1.4.2. Growth function
  1.4.3. Complexity of algorithm

Chapter 2: Counting
2.1. Problem statement
  2.1.1. Statement
  2.1.2. Typical use cases
2.2. Basic counting principles
  2.1.1. Sum rule
  2.1.2. Product rule
  2.1.3. Inclusion–exclusion principle
  2.1.3. Dirichlet principle
2.3. Problem simplification
  2.3.1. Introduction
  2.3.2. Typical examples
2.4. Recurrence relation
  2.4.1. Definition
  2.4.2. Modelling with recurrence relations
  2.4.3. Solving linear recurrence relations
 2.5. Generating functions
  2.5.1. Introduction
  2.5.2. Typical examples

Chapter 3: Listing
3.1. Problem definition
   3.1.1. Introduction
   3.1.2. Typical applications
3.2. Generating algorithm
   3.2.1. Definition
   3.2.2. Pseudo code
   3.2.3. Typical listing problems using generating algorithm
3.3. Backtrack algorithm
   3.3.1. Definition
   3.3.2. Pseudo code
   3.3.3. Typical listing problems using backtrack algorithm
3.4. Case study

Chapter 4: Optimization
4.1. Problem definition
   4.1.1. Introduction
   4.1.2. Typical applications
4.2. Brute-force algorithm
   4.2.1. Pseudo code
   4.2.2. Examples
4.3. Brand-and-bound algorithm
   4.3.1. Pseudo code
   4.3.2. Examples
3.4. Case study

Chapter 5: Existence
5.1. Problem statement
5.3. Dirichlet principle
5.4. Examples

5. Học liệu (Textbooks)
5.1. Học liệu bắt buộc (Required Textbooks)
  [1].Rosen, Kenneth H.. *Discrete Mathematics and its Applications*. 8th edition, McGraw Hill, 2018.
5.2. Học liệu tham khảo (Optional Textbooks)
  [2]. Susanna S. Epp, *Discrete Mathematics with Applications.* 5th edition, Cengage Learning, 2019

  [3]. Oscar Levin, *Discrete Mathematics: An Open Introduction,* 3rd Edition, 2019

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term exams	10%	Individual
- Final examination	70%	Individual

Trưởng Bộ môn	**Giảng viên biên soạn**
(Head of Department)	**(Lecturer)**
Ngô Xuân Bách	**Nguyễn Văn Thuỷ**