Extended Syllabus

(Summer 2024)

Course Title	Data Structures	Course Number	TBD
Credit	TBD	Enrollment Eligibility	TBD
Class Time	N/A	Classroom	N/A

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Ⅰ. Course Overview

1. Description

The main objective of this course is to learn the design, analysis, implementation, and theory of data structures. Throughout the course we will look at elementary data structures such as lists, stacks, queues, and trees, and how they are implemented using a programming language. Also, we will use these data structures to solve a variety of computational problems and analyze their efficiency.

2. Prerequisites

C Programming or equivalent. The students are expected to have some experience in basic C programming.

3. Course Format (%)

Lecture	Discussion	**Experiment /Practicum**	Field study	Presentations	Other
80 %	%	**20 %**	%	%	%

4. Evaluation (%)

mid-term Exam	**Final Exam**	Quizzes	Presentations	Projects	**Assignments**	**Participation**	Other
30 %	**30 %**	%	%	%	**30 %**	**10 %**	%

Ⅱ. Course Objectives

Knowledge:
(1) Understanding why data structures are important in solving computational problems
(2) Understanding frequently used elementary data structures such as lists, stacks, queues and trees
(3) Understanding how data structures are used in algorithms to solve problems

Skill:
(1) Implementing data structures and algorithms using a programming language (such as C)
(2) Designing efficient algorithms

Attitude:
(1) Designing algorithms and mathematically analyzing their efficiency
(2) Problem solving by designing algorithms and selecting the best data structures

Ⅲ. Course Format

(* In detail)

- Lectures
- Programming assignments
- Supplementary labs may be provided to help students with the assignments

Ⅳ. Course Requirements and Grading Criteria

- Programming assignments will be given based on the theory learned in class.
- The students should use C language to accomplish the given requirements.
- Additional requirements may be given such as documenting the code and writing report documents.

Ⅴ. Course Policies

- Students may not copy others' work. Copying will result in a score of 0.
- For programming assignments, we run a software that evaluates similarity between the codes. If the similarity score is high, the TAs will look at the code and decide whether they are actually copied work or not.
- Discussing ideas with others is encouraged.

Ⅵ. Materials and References

- Textbook: Ellis Horowitz et al., Fundamentals of Data Structures in C, 2nd edition, Silicon Press, 2007.
- Supplementary book: Thomas Cormen et al., Introduction to Algorithms, 3rd edition, MIT Press, 2009.

Ⅶ. Course Schedule

(* Subject to change)

Week 1 (Day1)	**Learning Objectives**	intro to data structures
	Topics	Introduction to the concept of algorithms, understanding course objectives, basics of algorithm specification, and overview of different data structures.
	Class Work (Methods)	lecture
	Materials (Required Readings)	chapter 1
	Assignments	Assignments will be announced in class.
Week 1 (Day2)	**Learning Objectives**	intro to data structures
	Topics	Deep dive into data abstraction, understanding its importance in data structures, introduction to complexity analysis of algorithms.
	Class Work (Methods)	lecture
	Materials (Required Readings)	chapter 1

	Assignments	Assignments will be announced in class.
Week 1 (Day3)	**Learning Objectives**	arrays
	Topics	Fundamentals of arrays, memory organization of arrays, techniques for implementing and manipulating arrays in programming language.
	Class Work (Methods)	lecture
	Materials (Required Readings)	chapter 2
	Assignments	Assignments will be announced in class.
Week 1 (Day4)	**Learning Objectives**	arrays
	Topics	Developing algorithms using arrays, array manipulation techniques, case studies of array-based problem-solving.
	Class Work (Methods)	lecture
	Materials (Required Readings)	chapter 2
	Assignments	Assignments will be announced in class.
Week 2 (Day5)	**Learning Objectives**	stacks & queues
	Topics	Introduction to stacks and queues, understanding their underlying principles, implementation strategies for both data structures.
	Class Work (Methods)	lecture
	Materials (Required Readings)	chapter 3
	Assignments	Assignments will be announced in class.
Week 2 (Day6)	**Learning Objectives**	stacks & queues
	Topics	Exploring algorithms that use stacks, understanding stack operations, practical applications of stacks in computing.
	Class Work (Methods)	lecture
	Materials (Required Readings)	chapter 3
	Assignments	Assignments will be announced in class.
Week 2 (Day7)	**Learning Objectives**	stacks & queues
	Topics	Continuing with algorithms using stacks, including complex problem solving with stacks.
	Class Work (Methods)	lecture
	Materials	chapter 3

	(Required Readings)	
	Assignments	Assignments will be announced in class.
Week 2 (Day8)	**Learning Objectives**	
	Topics	Midterm exam
	Class Work (Methods)	
	Materials (Required Readings)	
	Assignments	
Week 3 (Day9)	**Learning Objectives**	linked lists
	Topics	Introduction to linked lists, understanding singly linked lists, memory management for linked lists.
	Class Work (Methods)	lecture
	Materials (Required Readings)	chapter 4
	Assignments	Assignments will be announced in class.
Week 3 (Day10)	**Learning Objectives**	linked lists
	Topics	Problem-solving using linked lists, algorithmic approaches, and complex operations in linked lists.
	Class Work (Methods)	lecture
	Materials (Required Readings)	chapter 4
	Assignments	Assignments will be announced in class.
Week 3 (Day11)	**Learning Objectives**	linked lists
	Topics	Advanced problems and solutions using linked lists, and linked list variations.
	Class Work (Methods)	lecture
	Materials (Required Readings)	chapter 4
	Assignments	Assignments will be announced in class.
Week 3 (Day12)	**Learning Objectives**	trees
	Topics	Basics of tree data structures, introduction to binary trees, tree traversal methods, and applications.
	Class Work	lecture

	(Methods)	
	Materials (Required Readings)	chapter 5
	Assignments	Assignments will be announced in class.
Week 4 (Day13)	**Learning Objectives**	trees
	Topics	Exploring different types of trees - heaps, binary search trees, decision trees, and their practical uses.
	Class Work (Methods)	lecture
	Materials (Required Readings)	chapter 5
	Assignments	Assignments will be announced in class.
Week 4 (Day14)	**Learning Objectives**	graphs
	Topics	Introduction to graph theory, various ways of graph representation, basic graph searching algorithms.
	Class Work (Methods)	lecture
	Materials (Required Readings)	chapter 6
	Assignments	Assignments will be announced in class.
Week 4 (Day15)	**Learning Objectives**	graphs
	Topics	Detailed study of minimum spanning trees, shortest path algorithms, and their practical uses.
	Class Work (Methods)	lecture
	Materials (Required Readings)	chapter 6
	Assignments	Assignments will be announced in class.
Week 4 (Day16)	**Learning Objectives**	
	Topics	Final exam
	Class Work (Methods)	
	Materials (Required Readings)	
	Assignments	

Ⅷ. Special Accommodations

None.

Ⅸ. Aid for the Challenged Students

If you need special aid in taking this course, send an email to the instructor.