Data Structure and Graph Algorithms

Fall 2025

Wednesday 13:20 – 16:20

Professor D. J. Guan

Office: SA 034

Office Hours: Wednesday 10:00 – 11:30

Email me before coming to my office.

Textbook

- Thomas H. Cormen, Charles E. Leiserson
  Introduction to Algorithms, 3rd Edition (The MIT Press).
- Adam Drozdek
  Data Structures and Algorithms in C++.
- Michael T. Goodrich, Roberto Tamassia
  Data Structures and Algorithms in C++i.

Program = Data structure + Algorithms

1 Programming Assignments

1. date
   - `struct` new data type
   - `class`: new data type and its associated functions
2. array and pointers
   - `array`
   - `pointers`
   - dynamic allocation of memory
3. sorting
   - `array`
   - static data
   - time complexity, $O(n^2)$ vs $O(n \log n)$
4. maze
   - queue
   - shortest path
5. sparse matrix
   - linear list
6. arithmetic expression
   - stack
7. segment tree
   - binary tree
   - search in the tree
8. Hoffman code
   - binary tree
   - search in the tree
   - files
9. minimum spanning tree
   - graph algorithm
   - dynamic set
10. shortest path
    - graph algorithm
    - priority queue

2 Data Structures

1. stack
    - push
    - pop
    - empty?
2. queue
    - enqueue
    - dequeue
    - empty?
3. priority queue
    - insert
    - delete
    - select-min
    - empty?
    - decrease-key
    - increase-key

3 Implementation of Data Structures

	stack	queue	priority queue
array			
pointer			

4 Report

The report for each programming assignment must contain the following items.

1. Data structures used in the programming assignments.
   - The data stored in each entry of the data structure.
   - The functions provided by the data structure.
   - The implementation of the functions.
2. Design of the program.
   - Algorithms to solve problems using the data structures.
   - The efficient implementation of the algorithms.
3. Compilation and execution of the program.
   - A listing of the entire program, with messages generated by the compiler.
   - A demonstration of each implemented function or feature.
4. Conclusions.

5 Score

The scores for each of your programming assignment will be given based on the following criteria.

1. $\leq 50\%$: Incomplete reporting and insufficient implementation results.
2. 50% – 60%: Report meets most of the requirements but insufficient implementation results.
3. 60% – 75%: Report meets most of the requirements and completes most required functions.
4. 75% – 85%: Report meets the requirements and completes all required functions.
5. $\geq 85\%$: Report meets the requirements and completes additional functions.

These criteria are only a general guideline.

6 Test

There are at most two tests, one during the mid-term and the other during the final week of lectures.

There may also be quizzes during class.