

CMPE 250 Data Structures and Algorithms

The CMPE 250 course is the last of the sequence of introductory programming courses at Bogazici (CMPE 150-160-250) and is one of the key courses in the entire curriculum. The focus is on algorithm design, reductions and the choice of appropriate data structures for solving computational problems. Programming methodology is based on the widely-used C++ programming language. Emphasis is on good programming style, learning the ecosystem of the C++ language and the standard template library (STL).

Fall 2018

250 WThTh634 NH 105 | EF 116 | EF 116 WW45 NH 402 | NH 105

Instructors:

A. Taylan Cemgil

For contact details and further information see the web: <http://www.cmpe.boun.edu.tr/~cemgil/>

TA:

Ozlem Ozcan,

Student TA

Announcement

Book

Mark Allen Weiss

Data Structures and Algorithm Analysis in C++, Fourth Edition

ISBN-13: 9780132847377

(3rd Edition is also OK)

Course Logistics

[PDF](#)

Slides

- [C++ Review](#)
- [Basic Data Structures](#)
- [Standard Template Library](#)
- [Algorithm Analysis](#)

- [Priority Queues](#)
- [Sorting](#)
- [Hashing](#)
- [Graphs: Introduction](#)
- [Graphs: Topological Sort](#)
- [Graphs: Searching](#)
- [Spanning Trees](#)
- [Network Flows](#)
- [Dynamic Programming](#)

C++ Reference Material

In this class, we won't follow a specific book for C++ but as reference material the following online resources may be useful:

- [A web-site with useful information](#)

Grading

- Midterms : 20 + 20
- Final : 26
- Programming Projects : 26 (long) + 8 (short) (There will be 3 long projects and at least 2 short projects. All projects must be submitted.)

[Project Submission Information](#)

All projects must be genuine, repeated cheatings will be prosecuted.

Exam Dates

- Midterm 1 (7 Nov 2018, Wed, 13:00-15:00,)
- Midterm 2 (5 Dec 2018, Wed, 13:00-15:00,)
- Final (TBA)

Prerequisite

- CMPE 160, or
- a Course with coverage of most of the following topics
 - Object oriented programming concepts
 - List implementations using arrays and objects,
 - Doubly linked lists, Circular lists, Stack, and Queue Implementation
 - General tree structure; Binary trees; AVL trees; B-Trees

Topics

- Introduction to C/C++ Programming:
 - Operator overloading,
 - Pointers and reference operators,

- Shallow and Deep copy,
 - Basic STL,
 - Using the GNU compiler suite,
 - Quick review of linked lists, stacks, queues, binary trees
- Introduction to Algorithm analysis:
 - Asymptotics, Landau (Big-Oh) notation Θ , O , Ω , o
- Priority Queues:
 - Binary heaps,
 - Application in Discrete Event Simulation
- Sorting:
 - Insertion Sort,
 - Heap Sort,
 - Merge Sort,
 - Quicksort, Quick Find
 - Lower bound for any comparison based sorting algorithm,
 - contrast worst case and average case analysis,
 - indirect sorting and in-place permutations
- Hashing
- Graph Basics:
 - Definitions, Directed and undirected graphs,
 - Representations: adjacency matrix, adjacency lists,
 - Simple random graph generation and visualization (dotty)
- Directed Acyclic Graphs,
 - Topological Sort,
 - Applications: digital logic circuit simulation/testing prerequisite relations
- Searching on Graphs:
 - Breadth-first traversal, Depth-first traversal
 - Unweighted shortest path,
 - Weighted graphs,
 - Weighted shortest path,
 - Dijkstra's algorithm,
 - Application in Erdős number calculation in a social network
- Spanning Trees:
 - Prim's algorithm,
 - Kruskal's algorithm,
- Disjoint set data structures, Union/Find algorithms
- Network flows:
 - path augmentation,
 - Applications in perfect matching and marriage problem

- Dynamic programming:
 - Recursions,
 - Fibonacci numbers,
 - matrix chain multiplication,
 - maximum subsequence problem,
 - shortest paths revisited

Time Table

1	20/09/17	C++ 1. chapter
2	27/09/17	C++ 1. chapter/algorithm Analysis
3	04/10/17	Priority Queues
4	11/10/17	Priority Queues
5	18/10/17	Sorting (Insertion, quick, merge)
6	25/10/17	Sorting (Insertion, quick, merge) + Hashing
7	07/11/17	Midterm I
8	08/11/17	Graph Algorithms (Graph representations, Topological sort)
9	15/11/17	Shortest path, breadth first search, Dijkstra,
10	22/11/17	Spanning Tree (Prim, Disjoint Set, Kruskal)
11	29/11/17	Network flow, depth first search
12	05/12/17	Midterm II
13	13/12/17	Dynamic programming

Past Exams

1. [exams/2010fall-cmpe250-final.pdf](#)
2. [exams/2010fall-cmpe250-midterm1.pdf](#)
3. [exams/2010fall-cmpe250-midterm2.pdf](#)
4. [exams/2011fall-cmpe250-final.pdf](#)
5. [exams/2011fall-cmpe250-midterm1.pdf](#)
6. [exams/2011fall-cmpe250-midterm2.pdf](#)
7. [exams/2011spring-cmpe250-final.pdf](#)
8. [exams/2011spring-cmpe250-midterm1.pdf](#)
9. [exams/2011spring-cmpe250-midterm2.pdf](#)
10. [exams/2012fall-cmpe250-final.pdf](#)
11. [exams/2012fall-cmpe250-midterm1.pdf](#)
12. [exams/2012fall-cmpe250-midterm2.pdf](#)
13. [exams/2012spring-cmpe250-final.pdf](#)
14. [exams/2012spring-cmpe250-midterm1.pdf](#)
15. [exams/2012spring-cmpe250-midterm2.pdf](#)
16. [exams/2013spring-cmpe250-midterm1.pdf](#)
17. [exams/2013spring-cmpe250-midterm2.pdf](#)
18. [exams/2014fall-cmpe250-final.pdf](#)

19. [exams/2014fall-cmpe250-midterm1.pdf](#)
20. [exams/2014fall-cmpe250-midterm2.pdf](#)