UNIVERSITY OF MINNESOTA
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

4041E ALGORITHMS AND DATA STRUCTURES FALL 2016

4 CREDITS

Class Schedule: Monday, 209 Ackerman Hall, 18:30-21:00
Faculty: Professor Nikolaos Papanikolopoulos
Office: 5-201, KHKH Building
Phone: 5-0163
E-Mail: npapas@cs.umn.edu
Office Hours: Monday 17:15-18:15 and Wednesday 15:00-16:00, Room 5-201, KHKH Building
TA: William Beksi, beksi@cs.umn.edu
TA Office Hour: Thursday 15:20 - 16:20, B18-C, Walter Library
TA: Joshua Fasching, fasching@cs.umn.edu
TA Office hour: Friday 15:00-16:00, B22, Walter Library

1 Course Objective

The course objective is to provide fundamental paradigms for algorithm design with the supporting data structures. In particular, the course will start from simple algorithms in sorting and graph theory. Later in the semester, more complex geometric, algebraic, and numeric algorithms will be discussed. Finally, a special class of problems, called NP-complete problems, will be presented.

2 Topics Covered

The course will cover the following topics:

- Searching and sorting.
- String matching.
- Probabilistic algorithms.
- Graph traversals.
- Decompositions of graphs.
- Polygons and convex hulls.

- Algebraic and numeric algorithms.
- NP-completeness.

3 Textbooks

[1] T.H. Cormen, C.E. Leiserson, R.L. Rivest. and C. Stein, "Introduction to Algorithms", MIT Press, Cambridge, MA, 2009 (Third Edition).

[2] Notes available at the class website.

4 Additional References/Resources (Not Required)

[1] M. Goodrich, R. Tamassia, and M. Goldwasser, "Data Structures and Algorithms in Java", Wiley, Hoboken, NJ, 2014.

[2] R. Sedgewick and K. Wayne, "Algorithms", Addison-Wesley, Reading, MA, 2011.

[3] E. Horowitz and S. Sahni, "Fundamentals of Computer Algorithms", Computer Science Press, Rockville, MD, 1984.

[4] C.H. Papadimitriou and K. Steiglitz, "Combinatorial Optimization: Algorithms and Complexity", Dover Publications, Mineola, NY, 1998.

[5] D.E. Knuth, "The Art of Computer Programming", Addison-Wesley, Reading, MA, Volumes 1-4, Addison-Wesley, Reading, MA, 2011.

[6] U. Manber, "Introduction to Algorithms: A Creative Approach", Addison-Wesley, Reading, MA, 1989.

[7] A. Aho, J.E. Hopcroft, and J.D. Ullman, "Data Structures and Algorithms", Addison-Wesley, Reading, MA, 1983.

[8] R. Lafore, "Data Structures and Algorithms in Java", Sams Publishing, Indianapolis, IN, 2002.

[9] M. Goodrich, R. Tamassia, and D. Mount, "Data Structures and Algorithms in C++", Wiley, 2011.

[10] M. Goodrich, R. Tamassia, and M. Goldwasser, "Data Structures and Algorithms in Python", Wiley, 2013.

[11] http://interactivepython.org/runestone/static/pythonds/index.html

[12] http://users.cis.fiu.edu/∼weiss/dsaa_java/code/DataStructures/

[13] http://introcs.cs.princeton.edu/java/40algorithms/

[14] http://algs4.cs.princeton.edu/code/

[15] https://users.cs.fiu.edu/∼weiss/dsaa_c++/code/

5 Grading

The grade of the course will consist of the following components:

Homeworks	20%
Programming Assignments	20%
Mid-semester Exam 10/24/16	25%
Final Exam 12/19/16	35%

6 Email Use

Please follow the class website for answers to questions, assignments, and other tips. To help us serve you better, please put the 4041E note in the title of your emails. This is not a C++ or Python class. Thus, we assume that you know the basic structures of at least one of them.

7 Homeworks

Three homeworks will be given during the semester. They will consist of problems that will help you understand the material and monitor your progress. Solutions to the homeworks will be distributed. The homeworks are due at the beginning of the lecture. Furthermore, you must write your name, student ID, and course number on them. Late homeworks **will not be accepted**. For passing this class, it is strongly suggested to submit all the homeworks and the programming assignments.

8 Programming Assignments

Two major programming assignments will be given during this semester. Every student of this class should have an account at the CSE machines. The programming assignments must be written in C++ or Python. Finally, late programming assignments **will not be accepted.**

9 Recitations

Recitations are very important. You must try to attend all of them. In particular, the instructor will try to conduct the recitations before the midsemester exam and the final exam.

10 Cheating and Plagiarism

The exams, the homeworks, and the programming assignments must not be the result of cooperative work (unless the instructor indicates otherwise). Each student must work individually in order to understand the material in depth. You may discuss the issues but by no means, copy the homework or the programming assignment of somebody else. Copying code or pieces of code from the internet constitutes cheating. **Any student caught cheating will receive an "F" as a class grade and the University policies for cheating and plagiarism will be followed**.

11 Syllabus

Week	Topic	Reading Assignment
1	Introduction	Chapters 1, 2, 3, and Notes
2	Algs. Involving Sequences and Sets	Sections 2.1 and 2.3, Chapters 7 and 8, and Notes
3	Algs. Involving Sequences and Sets	Sections 2.1 and 2.3, Chapters 7 and 8, and Notes
4	Algs. Involving Sequences and Sets	Chapters 6, 9, and 16, and Notes
5	Algs. Involving Sequences and Sets	Chapters 6, 9, 16, and 32, and Notes
6	Graph Algorithms	Chapters 22 and 24
7	Graph Algorithms	Chapters 22 and 24
8	Graph Algorithms	Chapters 23 and 25
9	Graph Algorithms	Chapters 23 and 25
10	Graph Algorithms	Chapter 26
11	Geometric Algorithms	Chapter 33 and Notes
12	Geometric Algorithms	Chapter 33 and Notes
13	Algebraic and Numeric Algs.	Section 4.2, Chapters 30 and 31, and Notes
14	Algebraic and Numeric Algs.	Chapters 30 and 31 and Notes
15	NP-Completeness	Chapter 34 and Notes

Do not study the sections from Cormen's book with "*". Every week, the instructor will provide the specific sections of each chapter that you should study.