EECE2560
Fundamentals of Engineering Algorithms
Course Syllabus – Spring 2020

Course Description

Overview: Covers the design and implementation of algorithms to solve engineering problems using a high-level programming language. Reviews elementary data structures, such as arrays, stacks, queues, and lists, and introduces more advanced structures, such as trees and graphs and the use of recursion. Covers both the algorithms to manipulate these data structures as well as their use in problem solving. Introduces algorithm complexity analysis and its application to developing efficient algorithms. Emphasizes the importance of software engineering principles.

Course units: 4 Credit Hours   **Prerequisites**: EECE2160 or CS1500

Course outcomes:
1. Write computer code that is well-documented, and which adheres to the principles of good object-oriented programming.
2. Use elementary data structures, including strings, vectors, stacks, and queues.
3. Use advanced data structures, including trees, binary search trees, balanced search trees, graphs, priority queues and heaps.
4. Use dynamic memory allocation and linked lists.
5. Implement algorithms that use tree and graph traversals (such as depth-first, breadth-first, preorder, postorder, inorder and level order traversals) to solve problems like topological sort.
6. Implement algorithms that find minimum spanning trees of undirected graphs, including Prim's and Kruskal's.
7. Implement algorithms that find single-source and all-pairs shortest paths in graphs, including Dijkstra's and Bellman-Ford's algorithms.
8. Implement algorithms that use recursion and divide-and-conquer to solve problems, including quicksort, and binary search.
9. Implement algorithms that use backtracking to solve problems.

Course requirements:
1. Know how to write, compile, and run programs in C++ utilizing arrays, loops, conditional statements, functions, parameters, and pointers.
2. Know how to use object-oriented techniques, including classes, constructors, destructors, public and private members, and function overloading.

Course grades:
The course grade will be determined according to the following weighs:

Homework Assignments	45%
Class Participation	5%
Highest two grades of 2 Quizzes and the Final Exam	50%

The course grade letter will be determined according to the following distribution:

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
100	93	90	85	80	75	70	65	60	57	53	50 0

Course Instructor
Prof. Emad Aboelela

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🏢 Dana Research Center - Room 404

🕐 Office Hours:
Mon: 1 – 2 pm, Tue: 12 – 1 pm
Wed: 3 – 4 pm, Thu: 11 – 12 noon
or by appointment

Class Meetings
Section 01
📅 Mon, Wed, Thu: 09:15 – 10:20 am

📍 West Village H – Room 110
Section 02
📅 Mon, Wed, Thu: 04:35 – 05:40 pm

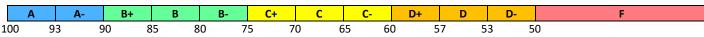📍 Ell Hall – Room 311

Teaching Assistant
Ms. Nasim Shafiee

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🕐 Office Hours:
Tuesday: 4 – 8 pm
Friday: 4 – 8 pm
in ISEC – 5th floor open space area

Course Requirements and Policies

Course Recommended Textbooks:
1. F. Carrano and T. Henry, "Data Abstraction & Problem Solving with C++: Walls and Mirrors", Pearson, 7th Edition, 2017, ISBN 978-0-13-446397-1
2. T. Cormen, C. Leiserson, R. Rivest and C. Stein, "Introduction to Algorithms", The MIT Press, 3rd Edition, 2009, ISBN: 9780262033848
3. P. Deitel and H. Deitel, "C++, How to Program", Pearson, 10th Edition, 2017, ISBN 978-9332585737

Homework Assignments will help students practice the theory presented in class. All programs must be written in C++. You are free to use the platform of your choice to write and test your C++ programs. However, programs submitted for a homework or a project assignment must compile and run in the COE Linux system. Submission of an assignment includes a PDF report along with separate files of the C++ source code of any required program. Only submissions on Blackboard are accepted. Late submission after the given due date and time; will be penalized at 1 point for each hour that it is late, and assignments report will not be accepted 48 hours after the due date/time.

Quizzes: There will be two quizzes during the weeks specified in the schedule at the end of this syllabus. Each Quiz will have an approximate duration of one hour. No make-up quizzes will be allowed.

Final Exam is a comprehensive exam. It will be closed book and closed notes. The final exam is optional as the best two scores from the two quizzes and the final exam will be considered towards your course grade.

Attendance and Class Participation are essential part of the professional education process. Attendance report is one of the requirements by the Faculty and Advisor Communication Tool (FACT). Students' advisors utilize FACT in early intervention, coaching, and assistance. Therefore, attendance will be taken through the Poll Everywhere system. Poll Everywhere will be also used to evaluate your class participation. It is a violation of the class policy for you to access the course Poll Everywhere activities while you are absent. If you should elect not to attend a class, you are responsible for any missed handouts, announcements, reading material and content covered during the missed class. In the case of missing a class due to unforeseen events or circumstances, including illness, please notify me as soon as possible to make reasonable accommodations for warranted class absences.

Linux Account: All Northeastern COE students have an account on the COE Linux system. It is your responsibility to obtain this account and use it to run our assignments C++ programs before submitting them.

TRACE: Your participation in the anonymous and confidential course TRACE survey is very important as I will use your feedback to improve the future course implementation. Therefore, completing the survey will be considered part of your class participation activities. A proof of TRACE completion can be a copy of either the confirmation e-mail you will receive, or the info posted on your account under "My Evaluations" from the drop-down menu under the home tab, on the right-hand corner.

Blackboard and Piazza: This course utilizes the university Blackboard Course Management System. In addition to the course lectures and assignments, the Blackboard course site will provide access to the Piazza platform. Piazza facilitates interaction among students and instructors in an efficient and intuitive manner. The system is highly catered to getting you help fast and efficiently from classmates, the TAs, and myself. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Piazza. It is required that you regularly check the course Blackboard site, Piazza, and your email to receive course materials, announcements, and course support in a timely manner.

Teaching Assistant: She/he is a graduate student in the department. Her/his responsibilities include holding weekly office hours and grading the homework assignments and quizzes.

Electronic devices, such as personal cell phones and laptops, are not allowed to be used in the classroom unless specifically required to accomplish a course-related activity with the permission of the instructor.

Academic integrity: A commitment to the principles of academic integrity is essential to the mission of Northeastern University. Any violation of academic integrity will be punished according to the university's policies and standards: www.northeastern.edu/osccr/academic-integrity-policy/

Accommodation: The Disability Resource Center (DRC) is committed to providing disability services that enable students who qualify to participate fully in the activities of the university. If you have any particular needs in order to complete this course, such as special seating, note taking, or examination conditions, please let me know or contact the DRC (www.northeastern.edu/drc) as soon as possible so that appropriate accommodations can be made.

Title IX: Northeastern Title IX prohibits discrimination based on gender, which includes sexual harassment and sexual assault. Title IX prohibits sex discrimination in all university programs and activities. Please visit www.northeastern.edu/ouec for a complete list of reporting options and resources.

Tentative Course Outline*			
Week**	Lecture	Quizzes	Assignments
1 (1/6/2020)	1. Introduction 2. C++ Programming Environment 3. C++ Programming Review		- Assignment 1
2 (1/13/2020)	4. Abstract Data Types 5. Recursion		
3 (1/20/2020)	- Monday: Martin Luther King Jr.'s Birthday 6. Array-Based Implementations 7. Link-Based Implementations		- Assignment 2
4 (1/27/2020)	8. Stacks 9. Lists		
5 (2/3/2020)	10. Algorithm Efficiency		
6 (2/10/2020)	11. Sorting Algorithms		- Assignment 3
7 (2/17/2020)	- Monday: Presidents' Day 12. Queues	- Quiz 1	
8 (2/24/2020)	13. Trees		- Assignment 4
9 (3/2/2020)	- Spring break week		
10 (3/9/2020)	14. Heaps		
11 (3/16/2020)	15. Hash Tables 16. Graphs		- Assignment 5
12 (3/23/2020)	- Graphs (Cont'd)		
13 (3/30/2020)	- Graphs (Cont'd)		- Assignment 6
14 (4/6/2020)	17. Introduction to software engineering principles	- Quiz 2	
15 (4/13/2020)	- Review - Wednesday: Reading day		
(4/20/2020)	- Monday: Patriots' Day		
Final Exam	TBD		

*The outline below is tentative, and it is subject to changes during the semester.

**The dates in this column are the dates of the Monday of each week. They are not necessarily the dates of any lecture, assignment, or quiz that appear on their same row.