ESE 344 SOFTWARE TECHNIQUES FOR ENGINEERS

Stony Brook University, Electrical and Computer Engineering Department

Prof. Alex Doboli

Spring 2025 (Subject to minor changes)

Catalog Description: This course covers software techniques for solving electrical and computer engineering problems in the C++ programming language. Design, implementation, and application to engineering problems of non-linear data structures and related advanced algorithms are covered. This includes binary trees, trees, graphs, and networks. OOP features such as Polymorphism, templates, Exception handling, File I/O operations, as well as Standard Template Library are used in the programming projects.

Credits: 3

Prerequisites: ESE 224

Textbook:

1. T. Cormen, C. Leiserson, R. Rivest, C. Stein, "Introduction to Algorithms", 4th edition, MIT Press, 2022, ISBN 978-0262046305. [***This is the textbook used in the lectures***]
2. M. A. Weiss, Data Structures and Algorithm Analysis, Pearson, 4th Edition, 2014, ISBN-13: 978-0132847377. [***reference***]
    a. Author website: http://users.cs.fiu.edu/~weiss/
    b. Source code: http://users.cs.fiu.edu/~weiss/dsaa_c++4/code/
3. Data Structures and Program Design in C++, R. L. Kruse and A. J. Ryba, Prentice-Hall, Inc., 1999, ISBN 0-13-768995-0. [***reference***]
4. References: Online resources. [***reference***]

Syllabus:

	Monday	**Wednesday**
Week 1	Course presentation; Introduction	**Analysis & design of algorithms**; Divide and conquer
Week 2	**Analysis of algorithms**; Standard notations	**Recurrences**;
Week 3	**Recurrences**;	**Sorting algorithms**; Heapsort;
Week 4	**Sorting algorithms**; Heapsort; Quicksort;	**Sorting algorithms**; Quicksort; Sorting in linear time
Week 5	**Sorting algorithms**; Sorting in linear time	**Advanced data structures**; Review of binary trees
Week 6	**Advanced data structures**; Hash tables	**Advanced data structures**; B trees
Week 7	**Greedy algorithms**;	***Review for midterm exam***
	Spring break	*Spring break*
Week 8	**Greedy algorithms**;	***Midterm***

Week 9	**Graph algorithms**; Representation; Breadth-first search; Depth-first search; Topological search; Strongly connected components	**Graph algorithms**; Minimum spanning trees; Kruskal and Prim's algorithms; Single-shortest path algorithms
Week 10	**Graph algorithms**; Single-shortest path algorithms;	**Graph algorithms**; all pair shortest path algorithms
Week 11	**Graph algorithms**; Graph partitioning	**Graph algorithms**; Clustering
Week 12	**Dynamic programming;**	**Dynamic programming**;
Week 13	**Special algorithms**; Matrix operations;	**Special algorithms**; Polynomials and FFT; String matching;
Week 14	**Special algorithms**; Polynomials and FFT; String matching;	***Review for final exam***

GRADING

Part I: Assignments

- Bi-weekly homework: 40%

Part II : Tests

- Midterm: 25%
- Final exam: 35%

Late submission policy: Homework submitted up to 2 days late will be graded out of 75% of the maximum. Please email the instructor before the submission deadline on case you need an extension.

Grading Policy: In the written tests part, out of a maximum of 100 points, you must get at least 45 points to pass the course.

Final grades are assigned based on absolute percentage of total marks as below. A : 90—100 , A- : 85—89.99 , B+ : 80—84.99, B : 75—79.99, B- : 70—74.99 C+ : 65—69.99, C : 60—64.99, C- : 55—59.99, D+ : 52—54.99, D : 48—51.99, F : 0—47.99

Course Learning outcomes:

Students should have:

1. Understood and implemented advanced data structures including arrays, linked lists, binary trees, trees, and graphs.

2. Understood and implemented algorithms for engineering applications that use the data structures -- trees, graphs, and networks.

3. Used C++ programming language, its advanced features, and object-oriented style of programming in solving engineering problems.

Student Accessibility Support Center Statement

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, Stony Brook Union Suite 107, (631) 632-6748, or at sasc@stonybrook.edu. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and the Student Accessibility Support Center. For procedures and information go to the following website: https://ehs.stonybrook.edu/programs/fire-safety/emergency-evacuation/evacuation-guide-disabilities and search Fire Safety and Evacuation and Disabilities.

Academic Integrity Statement

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Professions, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html

Critical Incident Management

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Student Conduct and Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.