CS 590–WN: Algorithms Computer Science Department

School of Engineering and Science
Summer 2023

Classroom Location: Online course
Course Coordinator: Reza Peyrovian
Contact Info: rpeyrovi@stevens.edu
Virtual Office Hours: Listed on course homepage
Virtual Live Sessions: Go to the "Zoom" tab on the left-hand navigation bar to access live virtual sessions for this course.

Prerequisite(s): CS 501, CS 570
Corequisite(s):
Cross-listed with:

COURSE DESCRIPTION
This course will provide focus on more complex data structures, and algorithm design and analysis, using one or more modern imperative language(s). Topics include advanced and/or balanced search trees; hashing; further asymptotic complexity analysis; standard algorithm design techniques; graph algorithms; complex sort algorithms; and other "classic" algorithms that serve as examples of design techniques.

LEARNING OBJECTIVES.

After successful completion of this course, students will be able to:

- **Complexity –** Differentiate the meaning of big-O, Theta, and Omega notations. Calculate the asymptotic running time of standard algorithms, and use it to compare efficiency.
- **Master Theorem –** Apply the Master Theorem to prove asymptotic assumptions.
- **Sorting -** Compare and analyze basic and advanced sorting algorithms.
- **Trees -** Implement search trees such as Binary Search Trees, AVL trees, and Red-Black Trees.
- **Graphs -** Implement standard algorithms using graphs and weighted graphs in C++/Java (e.g., DFS, BFS, MST, topological sort).
- **Shortest Paths –** Implement standard algorithms to solve the shortest path finding problem. (Dijkstra, Bellman-Ford, Floyd-Warshall).
- **Algorithmic Design -** Apply standard algorithm design techniques such as the greedy technique, dynamic programming, hashing, and space/time trade-offs

FORMAT AND STRUCTURE

- Weekly activities, including topics are posted on Canvas.
- Canvas email is the main form of online communication between students and instructor. Any one-on-one session needed will be set up using the communication method of choice (Office Hour, phone, Blackboard Collaboration, etc.)

COURSE MATERIALS

Textbook:

Algorithm Design and Applications by Goodrich and Tamassia, John Wiley Publishing 2015, ISBN 978-1-118-33591-8

Other Readings: Will be posted on Canvas

Materials: Will be posted on Canvas

COURSE REQUIREMENTS

Homework There will be several homework assignments in each module.

Projects One or more projects on advanced topics will be assigned for submission.

Exams There will be two exams: a midterm exam and a final exam.

Live Sessions All modules have a live session where you meet with your instructor. Attendance is required. There will be an attendance quiz during each live session.

GRADING PROCEDURES

Grades will be based on:

Live Session (all modules)	5%
Engagement Quizzes (all modules)	5%
Application Exercises (all modules)	15%
Reinforcement and Creativity Exercises (all modules)	30%
Application Programming Assignments (Modules 4 and 13)	15%
Midterm Exam (Module 7)	15%
Final Exam (Module 13)	15%

ACADEMIC INTEGRITY

Graduate Student Code of Academic Integrity

All Stevens's graduate students promise to be fully truthful and avoid dishonesty, fraud, misrepresentation, and deceit of any type in relation to their academic work. A student's submission of work for academic credit indicates that the work is the student's own. All outside assistance must be acknowledged. Any student who violates this code or who knowingly assists another student in violating this code shall be subject to discipline.

All graduate students are bound to the Graduate Student Code of Academic Integrity by enrollment in graduate coursework at Stevens. It is the responsibility of each graduate student to understand and adhere to the Graduate Student Code of Academic Integrity. More information including types of violations, the process for handling perceived violations, and types of sanctions can be found at www.stevens.edu/provost/graduate-academics.

Special Provisions for Undergraduate Students in 500-level Courses

The general provisions of the Stevens Honor System do not apply fully to graduate courses, 500 level or otherwise. Any student who wishes to report an undergraduate for a violation in a 500-level course shall submit the report to the Honor Board following the protocol for undergraduate courses, and an investigation will be conducted following the same process for an appeal on false accusation described in Section 8.04 of the Bylaws of the Honor System. Any student who wishes to report a graduate student may submit the report to the Dean of Graduate Academics or to the Honor Board, who will refer the report to the Dean. The Honor Board Chairman will give the Dean of Graduate Academics weekly updates on the progress of any casework relating to 500-level courses. For more information about the scope, penalties, and procedures pertaining to undergraduate students in 500-level courses, see Section 9 of the Bylaws of the Honor System document, located on the Honor Board website.

EXAM ROOM CONDITIONS

Exams will be online. Procedure for exams is posted on Canvas.

The following additional procedures apply to exams for this course. As the instructor, I reserve the right to modify any conditions set forth below by printing revised Exam Room Conditions on the exam.

1. Students may use the following devices during exams. Any electronic devices that are not mentioned in the list below are not permitted.
2. Students in online courses may use laptops.

3. Students may use the following materials during quizzes exams. Any materials that are not mentioned in the list below are not permitted.

Material	Permitted ?	
	Yes	No
Handwritten, typed notes and lecture notes	X	
Course Textbook	X	
Other books and articles		X
Online Material		X
Internet Search		X

4. Students are not allowed to work with or talk to other students during exams.

LEARNING ACCOMMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. Student Counseling and Disability Services works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, and psychiatric disorders in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from SCDS staff. The SCDS staff will facilitate the provision of accommodations on a case-by-case basis. These academic accommodations are provided at no cost to the student.

Disability Services Confidentiality Policy

Student Disability Files are kept separate from academic files and are stored in a secure location within the office of Student Counseling, Psychological & Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

For more information about Disability Services and the process to receive accommodations, visit https://www.stevens.edu/sit/counseling/disability-services. If you have any questions please contact:

> Lauren Poleyeff, Psy.M., LCSW - Disability Services Coordinator and Staff Clinician in Student Counseling and Disability Services at Stevens Institute of Technology at lpoleyef@stevens.edu or by phone (201) 216-8728.

INCLUSIVITY STATEMENT

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in education and innovation. Our community represents a rich variety of backgrounds, experiences, demographics and perspectives and Stevens is committed to fostering a learning environment where

every individual is respected and engaged. To facilitate a dynamic and inclusive educational experience, we ask all members of the community to:

- be open to the perspectives of others
- appreciate the uniqueness their colleagues
- take advantage of the opportunity to learn from each other
- exchange experiences, values and beliefs
- communicate in a respectful manner
- be aware of individuals who are marginalized and involve them
- keep confidential discussions private

COURSE SCHEDULE

Refer to Canvas for weekly activities, including topics, course material, assignments, due dates, and instructions. Your instructor may also use Canvas email to update assignments and guidelines.

Textbook: Algorithm Design and Applications by Goodrich and Tamassia,

Week 1: Chapter 1

Week 2: Chapters 2

Week 3: Chapters 3 and 4

Week 4: Chapter 5

Week 5: Chapter 6

Week 6: Chapter 7

Week 7: Chapters 8 and 9

Week 8: Chapter 10

Week 9: Chapter 11

Week 10: Chapter 12

Week 11: Chapter 13

Week 12: Chapter 14

Week 13: Chapter 15