CS 590 A – Algorithms

Department of Computer
Fall 2023

Instructor: In Suk Jang, Ph.D
Canvas Course Address: https://sit.instructure.com/courses/68572
Course Schedule: Wednesday 6:30 – 9 PM
Contact Info: ijang@stevens.edu
Virtual Office Hours: Friday 10 – 11 AM
Virtual Office Hours Link: https://stevens.zoom.us/j/5516841287
Classroom Location: Gateway South 021

COURSE DESCRIPTION

This is a course on more complex data structures and algorithm design and analysis, using one or more modern imperative language(s) as chosen by the instructor. Topics include advanced and/or balanced search trees, further asymptotic complexity analysis, standard algorithm design techniques, graph algorithms, complex sort algorithms, and other "classic" algorithms that serve as examples of design techniques.

STUDENT LEARNING OUTCOMES

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

- **Complexity** – Explain 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** – Use the Master Theorem to prove asymptotic assumptions
- **Sorting** - Compare and analyze basic and advanced sorting algorithms.
- **Trees** - Implement advanced search trees such as Binary Search and Red-Black Trees.
- **Graphs** - Implement standard algorithms using graphs and weighted graphs in C++ (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.

COURSE FORMAT AND STRUCTURE

This course is fully online. To access the course, please visit stevens.edu/canvas. For more information about course access or support, contact the Technology Resource and Assistance Center (TRAC) by calling 201-216-5500.

Course Logistics

All course materials, such as lecture slides and assignments, will be available on Canvas. Any course announcements or changes (e.g., assignment extensions, etc.) will be made via Canvas. Students are encouraged to have a daily notification set up.

- You are encouraged to "mentally enroll" in this course as if it occurred on Thursday. In other words, our weeks will run from Monday to Sunday. I will post information (online activities, discussion starters, etc.) for the upcoming week by Wednesday evening so that when you log in on Thursday, you can begin the new week.
- When assignments are due, they are due by 11:59 p.m. EST on the due date listed in the course schedule.
- Deadlines are an unavoidable part of being a professional, and this course is no exception. Course requirements must be completed and posted or submitted on or before the specified due date and delivery time deadline. Due dates and delivery time deadlines are in Eastern Time (as used in Hoboken, NJ). Please note that students living in distant time zones or overseas must comply with this course time and due date deadline policy. Avoid any inclination to procrastinate. Due dates have been established for each assignment to encourage you to stay on schedule.
- Assignments received every 24 hours after the due date will have 10% of the total points deducted.
- Assignments received more than two weeks late after the due date will receive 0 points.
- An assignment file should be appended by your username, such as "assignment1_kim53.doc". This makes it easier for me to manage assignment files you download to my computer.

Instructor's Online Hours

The regular office hours will be Friday from 10 AM to 11 AM after the lecture review session. Students can make appointments on different days and times for any schedule conflicts except Monday and Wednesday.
For quick and short questions, students can send me emails via Canvas. I will be available via email and respond as soon as I am available (generally within 24-48) hours.

When emailing me, please place in the subject line the course number/section and the topic of the email (i.e., CS590 A – Assignment 2 Question). This will help me locate your emails more quickly when I scan the hundreds of emails that seem to make it into my box each day.

TENTATIVE COURSE SCHEDULE

Week	Day	Topics Covered	Reading	Assignments
1	9/6	Orientation / Advanced C++ review	Lecture Notes	
2	9/13	Foundations I: Growth of Functions / Insertion sort	Ch 2, 3	Assignment 1
3	9/20	Foundations II: Divide-and-Conquer	Ch 4	
4	9/27	Sorting and Order Statistics I: Heapsort / Quicksort	Ch 6, 7	Assignment 2
5	10/4	Sorting and Order Statistics II: Sorting in Linear Time / Medians and Order Statistics	Ch 8, 9	
6	10/11	Data Structures I: Elementary Data Structure / Binary Search Trees	Ch 10, 12	Assignment 3
7	10/18	Midterm Data Structures II: Red-Black Trees	Ch 13	
8	10/25	Advanced Design and Analysis Techniques: Dynamic Programming / Greedy Algorithms	Ch 15, 16	Assignment 4
9	11/1	Advanced Design and Analysis Techniques: Dynamic Programming / Greedy Algorithms		
10	11/8	Graph Algorithms I: Elementary Graph Algorithms	Ch 22	Assignment 5
11	11/15	Graph Algorithms II: Minimum Spanning Trees	Ch 23	
12	11/22	Thanksgiving Recess		
13	11/29	Graph Algorithms III: Shortest Paths	Ch 24,25	
14	12/6	Review		
15	12/13	Final Exam		

COURSE MATERIALS

Textbook(s): Introduction to Algorithms, 3rd Edition, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein

COURSE REQUIREMENTS

- **Homework (60%):** The programming assignments will be done individually. No collaboration is allowed between students. No code from online resources can be used besides the code I will share with you. Any sign of collaboration will result in a 0 and is reported to the Honor Board. Programming assignments might be tested for similarity using the MOSS, or similar software, and any sign of collaboration will be reported to the HONOR board. Students who are caught collaborating for a second time will receive a failing grade (F) in the course.

- **Exams:** The midterm (15%) exam will be given in week 7. The final exam (25%) will be given on the last day of the semester. An announcement will be posted with more details on week 13. The exam will be a paper exam in the classroom.

TECHNOLOGY REQUIREMENTS

Baseline technical skills necessary for online courses

- Basic computer and web-browsing skills
- Navigating Canvas

Technology skills necessary for this specific course

- Live web conferencing using Zoom
- Recording a slide presentation with audio narration
- Recording, editing, and uploading video via Panopto

Required Equipment

- Computer: current Mac (OS X) or PC (Windows 7+) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed
- Microphone: built-in laptop or tablet mic or external microphone

GRADING PROCEDURES

Your grade will depend on responses to the five assignments, both on how many you do and how well you do them. Each assignment will be scored as a percent according to the following rules:

1. Each assignment must be submitted on time. Any late submission (even a few minutes late) will be penalized 10% per 24 hours.
2. Any tendency to copy or cheat will assign a 0 for a particular assignment. The work will be reported to the University for the second attempt, and a student will receive an “F” for the course.

Late Policy

A 10% late submission penalty will be applied every 24 hours from the due date. All assignments must be submitted for passing consideration. Late assignments must receive my permission, and a penalty will be assessed. All written assignments must be submitted to the course website; email submissions or re-submissions are not accepted.

Academic Integrity
This is a graduate-level course. All students, regardless of the status (full-time or part-time) or rank (graduate or undergraduate), will have an equal amount of work and will be equally evaluated.

Generative AI Technologies
You may use AI programs e.g. ChatGPT to help generate ideas and brainstorm. However, you should note that the material generated by these programs may be inaccurate, incomplete, or otherwise problematic. Beware that use may also stifle your own independent thinking and creativity.

You may not submit any work generated by an AI program as your own. If you include material generated by an AI program, it should be cited like any other reference material (with due consideration for the quality of the reference, which may be poor).

Any plagiarism or other form of cheating will be dealt with under relevant Stevens policies.

Undergraduate Honor System
Enrollment into the undergraduate class of Stevens Institute of Technology signifies a student's commitment to the Honor System. Accordingly, the provisions of the Stevens Honor System apply to all undergraduate students in coursework and Honor Board proceedings. It is the responsibility of each student to become acquainted with and to uphold the ideals set forth in the Honor System Constitution. More information about the Honor System including the constitution, bylaws, investigative procedures, and the penalty matrix can be found online at http://web.stevens.edu/honor/.

The following pledge shall be written in full and signed by every student on all submitted work (including, but not limited to, homework, projects, lab reports, code, quizzes and exams) that is assigned by the course instructor. No work shall be graded unless the pledge is written in full and signed.

"I pledge my honor that I have abided by the Stevens Honor System."

Students who believe a violation of the Honor System has been committed should report it within ten business days of the suspected violation. Students have the option to remain anonymous and can report violations online at www.stevens.edu/honor.

Graduate Student Code of Academic Integrity
All Stevens 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 on the Office of Graduate Academics web page.

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 Senior Vice Provost for Graduate Education or to the Honor Board, who will refer the report to the senior vice provost. The Honor Board Chairman will give the Senior Vice Provost for Graduate Education 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.

ACCOMMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. The Office of Disability Services (ODS) works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, psychiatric disorders, and other disabilities to help students achieve their academic and personal potential. They facilitate equitable 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 the ODS staff. The ODS staff will facilitate the provision of accommodations on a case-by-case basis.

For more information about Disability Services and the process to receive accommodations, visit https://www.stevens.edu/student-diversity-and-inclusion/disability-services. If you have any questions please contact the Office of Disability Services at disabilityservices@stevens.edu or by phone: 201.216.3748.

Disability Services Confidentiality Policy
Student Disability Files are kept separate from academic files and are stored in a secure location within the Office of 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.

INCLUSIVITY

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in academic discourse and innovation. In this class, the perspective of people of all races, ethnicities, gender expressions and gender identities, religions, sexual orientations, disabilities, socioeconomic backgrounds, and nationalities will be respected and viewed as a resource and benefit throughout the semester. Suggestions to further diversify class materials and assignments are encouraged. If any course meetings conflict with your religious events, please do not hesitate to reach out to your instructor to make alternative arrangements.

You are expected to treat your instructor and all other participants in the course with courtesy and respect. Disrespectful conduct and harassing statements will not be tolerated and may result in disciplinary actions.

Name and Pronoun Usage
As this course includes group work and class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect. This includes the ability for all students to have their chosen gender pronoun(s) and chosen name affirmed. If the class roster does not align with your pronouns and/or name, please inform the instructor of the necessary changes.

Religious Holidays
Stevens is a diverse community that is committed to providing equitable educational opportunities and supporting students of all ethnicities and belief systems. Religious observance is an essential reflection of that rich diversity. Students will not be subject to any grade penalties for missing a class, examination, or any other course requirement due to religious observance. In addition, students will not be asked to choose between religious observance and academic work. Therefore, students should inform the instructor at the beginning of the semester if a requirement for this course conflicts with religious observance so that accommodations can be made for students to observe religious practices and complete the requirements for the course.

MENTAL HEALTH RESOURCES

Part of being successful in the classroom involves a focus on your whole self, including your mental health. While you are at Stevens, there are many resources to promote and support mental health. The Office of Counseling and Psychological Services (CAPS) offers free and confidential services to all enrolled students who are struggling to cope with personal issues (e.g., difficulty adjusting to college or trouble managing stress) or psychological difficulties (e.g., anxiety and depression). Appointments can be made by phone (201-216-5177), online at https://stevensportal.pointnclick.com/confirm.aspx, or in person on the 2nd Floor of the Student Wellness Center.

EMERGENCY INFORMATION

In the event of an urgent or emergent concern about your own safety or the safety of someone else in the Stevens community, please immediately call the Stevens Campus Police at 201-216-5105 or on their emergency line at 201-216-3911. These phone lines are staffed 24/7, year-round. For students who do not reside near the campus and require emergency support, please contact your local emergency response providers at 911 or via your local police precinct. Other 24/7 national resources for students dealing with mental health crises include the National Suicide Prevention Lifeline (1-800-273-8255) and the Crisis Text Line (text "Home" to 741-741). If you are concerned about the wellbeing of another Stevens student, and the matter is *not* urgent or time sensitive, please email the CARE Team at care@stevens.edu. A member of the CARE Team will respond to your concern as soon as possible.