CS 344: Design and Analysis of Computer Algorithms
(Spring 2022 – Sections 5,6,7,8)

Course Syllabus*

1 Course Information

General information

Instructor: Sepehr Assadi – sepehr.assadi@rutgers.edu – https://www.cs.rutgers.edu/~sa1497

Prerequisites: CS 112 Data Structures, CS 206 Introduction to Discrete Structures.

We assume a knowledge of basic concepts of programming and data structures, e.g., lists, stacks, queues, trees, as well as basic mathematics, e.g., elementary calculus, proof by induction, linearity of expectation, permutations, logarithms, and asymptotic notation (i.e. "big-Oh", "big-Omega").

Textbook: *Algorithms*, by Erickson, © Copyright 2019 Jeff Erickson
(the electronic version is freely available at: http://jeffe.cs.illinois.edu/teaching/algorithms).

Homeworks and exams will be solely based on the materials presented in the class – this includes the parts that may not necessarily be directly covered in the textbook.

Website: https://www.cs.rutgers.edu/~sa1497/courses/cs344-s22/
The webpage will contain updated syllabus information as the semester progresses and a calendar.

There is a **Canvas website** for the course where you can find announcements and lecture notes, submit your homeworks, and check your grades. We will use **Piazza** for online discussions.

Students with disabilities: The students with disabilities are encouraged to discuss with me any appropriate accommodations that we might make on their behalf following the guidelines of the Office of Disability Services[1].

Statement of inclusivity: I am committed to creating a learning environment in which all of my students feel safe and included, regardless of race, ethnicity, religion, gender or sexual orientation. Because we are individuals with varying needs, I rely on your feedback to achieve this goal. I invite you to let me know about what I can stop, start, or continue doing to make sure every one of my students feels valued and can engage actively in our learning community.

Academic integrity: The students are expected to follow Rutgers and CS Department academic integrity policies[2] for all their work in this course.

Mask requirements: In accordance with Rutger's policy, masks must be worn during class meetings; any student not wearing a mask will be asked to leave.

Email policy: Please start the subject of all your emails to course staff with "[CS344S22]" so that they are not lost in our inboxes. It may take up 24 hours (48 hours over the weekends) before you hear back on your emails. Questions directly related to the materials of the course and clarifications about lectures should be posted on Piazza to allow for a more timely response by the entire course staff.

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*My guess is that no one ever reads the syllabus, so let us test it this time ...
[1] https://ods.rutgers.edu
[2] Rutgers policy: http://academicintegrity.rutgers.edu/
CS department policy: https://www.cs.rutgers.edu/academics/undergraduate/academic-integrity-policy

Lectures and Recitations

Class	Time	Place
Lectures	Tuesdays and Thursdays 2:00 pm – 3:20 pm	RWH-105 (Busch campus)
Recitation 1	Tuesdays 5:40 pm – 6:35 pm	ARC-107 (Busch campus)
Recitation 2	Thursdays 7:30 pm– 8:25 pm	SEC-207 (Busch campus)
Recitation 3	Tuesdays 3:50 pm– 4:45 pm	SEC-207 (Busch campus)
Recitation 4	Thursdays 5:40 pm– 6:35 pm	SEC-203 (Busch campus)

Participation in any of the lectures or recitations is **not mandatory**. However, if you decide to participate in the class, I ask you to please be respectful of your fellow students and do not use any electronic devices (cellphones, laptops, tablets) during the lectures, unless you are using a laptop or tablet for note-taking.

Office Hours

The Instructor's office hours are:

Time	Place
Mondays 5:00 pm – 6:00 pm	CoRE 310 (Busch campus)
Thursdays 4:00 pm – 5:00pm	CoRE 310 (Busch campus)

The schedule of TAs' office hours will be posted soon on the course webpage.

If you have something to discuss directly with me (e.g., a concern, a question, or a comment), send an email with the subject "[CS344S22] ?" (replace ? with what you like to discuss) to me and we will set up a time for a meeting.

Important Note: Remote Teaching Plan

The university recently announced that in-person classes will temporarily convert to remote classes through Sunday, January 30, 2022[3]. To accommodate this, we will follow an **asynchronous remote** teaching plan in the first two weeks of the course. Starting from January 31, 2022, the lectures and recitations will be held in-person according to the original schedule. The plan for remote teaching is as follows:

On Monday of each week, a series of video lectures and lecture notes on the topics of the week will be posted on Canvas. The students are expected to review these materials at their own pace. The office hours for these two weeks will be held on Zoom (link will be provided on Canvas) and will be interactive sessions for Q&A. Attendance in office hours is not mandatory but is encouraged. You will need a laptop, desktop, cellphone, tablet, or other similar devices that can connect to the internet, play videos, and conduct video/audio communications[4]. All the recordings are solely for the students registered in the course and are not to be redistributed outside of this class.

Course Staff

Instructor: Sepehr Assadi   sepehr.assadi@rutgers.edu

TAs:
Vihan Shah	vjs69@scarletmail.rutgers.edu
Janani Sundaresan	js2816@scarletmail.rutgers.edu
Parth Mittal	pm822@scarletmail.rutgers.edu
Hoai-An Nguyen	hnn14@scarletmail.rutgers.edu

Graders: This information will be posted soon.

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[3]https://coronavirus.rutgers.edu/significant-changes-related-to-covid-19/
[4]See Rutger's technology guide: https://it.rutgers.edu/technology-guide/students/

Course Topics

The main goal of this course is to help you further develop your **algorithmic thinking** skill: the art of getting to and rigorously analyzing a solution through clearly specified steps. We follow a certain set of standard topics that will help you on this front. But keep in mind that these topics are a means toward the main goal which is sharpening your algorithmic thinking skill.

The following is a **tentative list** of the topics that we will cover in this course (not necessarily in order).

- **Basics of Algorithm Design (review)**: algorithms, asymptotic analysis, proof of correctness
- **Sorting and Searching**: binary search, comparison sorting, counting sort, median selection
- **Hashing**: hash tables, hash functions
- **Algorithm Design Techniques**: divide and conquer, dynamic programming, greedy algorithms
- **Graph Algorithms**: graph search, minimum spanning trees, shortest paths, network flows
- **Advanced Topics**: intro to NP-hardness, approximation algorithms, exponential-time algorithms

2 Assignments and Grading

Grading

- 25% Quizzes (13 or 14 weekly quizzes for $\sim 2\%$ each)
- 25% Homeworks (5 homeworks for 5% each + a "homework 0" with 2% bonus credit)
- 20% Mid-term exams (2 midterms for 10% each)
- 30% Final exam
- +10% Bonus credit[5] (at the discretion of the Instructor/TAs)

Quizzes

There will be weekly quizzes on Canvas accompanying the lectures in the course. Each quiz will contain several multiple-choice (or similar types of) questions on the topics directly covered in the lectures. You should think of the quizzes as a reminder to follow the course lectures weekly; they are all at the level that if you even briefly review the topics taught in that week, you should be able to answer the quiz in less than 10 minutes. The quizzes are also a way for me to monitor the class progress and engagement as a whole.

- **Timing:** Each quiz will be released on a Thursday evening after the last lecture of the week and is due by 11:59 pm of Monday the week after, before the first lecture of the next week.

- **Format:** Quizzes are held on Canvas and their answers will be released after the deadline. You have an <u>unlimited</u> number of attempts for each quiz and your grade will be the maximum of your attempts.

- Quizzes should be done individually and you are <u>not</u> allowed to discuss these questions with other students in the class.

- **A missed/late quiz draws zero credit.** Exceptions will be made only for exceptional circumstances and you will need to provide a university-issued written verification. **However, we will be dropping the grade of your <u>three</u> lowest-graded quizzes.**

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[5]This part includes the 2% bonus credit of "homework 0".

Homeworks

Homeworks are the main assignments in this course and will help you in developing and sharpening your algorithmic thinking skills. They will involve a small number of algorithmic questions for you to solve, as well as mathematical statements to prove. You should think of homeworks as the main way of exercising your skills in this course beyond what is directly taught in the lectures.

– **Timing:** There will be five homeworks and a tentative schedule of release and due dates are available on the course calendar. Homeworks will typically be released on a Tuesday and are due two weeks later by 11:59 pm of Tuesday. Occasionally, a homework may be assigned/due on a different day so please follow the course calendar.

– **Format:** Homeworks will be released on Canvas and should also be turned in on Canvas as **a single pdf file** containing the solutions in order. Moreover, **homeworks must be typeset** and handwritten homeworks will <u>not</u> be graded.

The (strongly) preferred method for typesetting your homework is to use **LaTeX**. Simple instructions on using LaTeX are available on the course webpage and a template will be released with each homework. The course staff are also available to help you with any question you may have in using LaTeX. This policy has a twofold purpose:

  (i) *For students:* LaTeX (tremendously) helps you in writing clean and well-structured proofs (a clean proof is a necessity for a rigorous proof) as well as editing an already written proof further. Moreover, learning LaTeX is an important life-long skill that will come handy sooner or later.

  (ii) *For course staff:* Grading homeworks done in LaTeX is a considerably easier (and much more pleasant) task than handwritten homeworks.

Students that turn in **all their homeworks in LaTeX** (including "homework 0") are given a +5% bonus credit at the end of the semester (note that this is equivalent of an entire homework grade)[6].

To test the hypothesis that no one ever reads the syllabus, let us run the following experiment: at the very beginning of your "homework 0" solutions (and only on this homework) *copy and paste* the following sentence: "[CS344S22]: I have (probably) read (some of) the syllabus", to receive an additional 1% points of your bonus credit part.

– **Regrading:** You can make a regrade request for each of your homeworks **within <u>at most one week</u> after you received your grades for that homework**. To do so, send an email to the Instructor with the subject "[CS344S22] Regrade Request: Homework #?" (replace ? with the actual number). If you request a regrade for a particular question, <u>**all** parts of that question will be regraded</u> (possibly by a different course staff) and further points may potentially be deducted from your homework.

– If you leave a question **completely blank** on a homework, you will receive 25% of the grade for that question. However, you may and will receive zero credit for a completely wrong answer. This policy is only in place to discourage writing a meaningless solution in hopes of receiving a few points.

– You are allowed to discuss the homework problems with other students in the class. **But you must write your solutions <u>independently</u>.** You may also consult all the materials used in this course (notes, textbook, etc.) while writing your solution, but no other resources are allowed.

– **Late homeworks:** You are allowed to **submit <u>two</u> homeworks late, each <u>up to two days</u>** (for instance, if the deadline is on Tuesday 11:59pm, you can submit the homework until Thursday 11:59 pm). You do <u>not</u> need to ask for permission to use your extensions – simply write on the first page of your homework that you are using an extension. You will receive <u>zero credit</u> for any homework submitted after two days passed the deadline or after you have used both your extensions. Exceptions will be made only for exceptional circumstances and you will need to provide a university-issued written verification. **Use your extensions wisely!** It helps to save an extension for the end of the semester. Avoid taking an extension on the first homework.

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[6]This +5% includes the +2% points just for "homework 0".

– **Extra Questions:** Some of the homeworks may contain extra questions titled "Challenge yourself" or "Fun with algorithms". These questions are for students who like to familiarize themselves with the topics taught in the course on a more advanced level and will be significantly more challenging than typical questions or may be rather out of scope of the materials taught in this course. **These questions will not be graded** as part of your regular homework but rather will be considered toward your extra bonus credit in this course.

Mid-Term Exams

There will be two mid-term exams in this course. You should think of these exams as a mix between quizzes and homeworks and a way of both testing your understanding of the course as well as further exercising your algorithmic thinking skill.

– Mid-term exam 1 will tentatively be on Thursday, February 24, and mid-term exam 2 will be on Thursday, April 7. Both exams will be held in the classroom during the regular time of the lecture.

– Mid-term exam 1 will tentatively be from the materials in lectures 1 to 11 and mid-term exam 2 will tentatively be from lectures 12 to 20. Any changes to this plan will be announced well in advance of the exam.

– Similar to the homeworks, leaving a question **completely blank** on an exam also will result in 25% of the grade for that question.

– Both mid-term exams **are closed-book**: no textbooks, electronic devices, or cheat sheets are allowed.

– **A missed exam draws zero credit.** However, emergencies will be considered upon submitting a university-issued written verification to the Instructor.

Final Exam

– The final exam will be held at the end of the semester according to the University schedule.

– Similar to the homeworks, leaving a question **completely blank** on an exam also will result in 25% of the grade for that question.

– The final exam **is closed-book**: no textbooks, electronic devices, or cheat sheets are allowed.

– Further details on the timing and format of the final exam will be released later in the semester.

3   Academic Integrity

The students are expected to follow Rutgers and CS Department academic integrity policies[7] for all their work in this course. Please familiarize yourself with these policies if you have not done so yet. In particular,

– The Rutgers honor pledge will be included on all (major) assessments for you to sign:

> *On my honor, I have neither received nor given any unauthorized assistance on this examination (assignment).*

– Use of external website resources such as Chegg.com or others to obtain solutions to homework assignments, quizzes, or exams is cheating and a violation of the University Academic Integrity policy. Cheating in the course may result in grade penalties, disciplinary sanctions or educational sanctions. Posting homework assignments, or exams, to external sites without the instructor's permission may be a violation of copyright and may constitute the facilitation of dishonesty, which may result in the same penalties as plain cheating.

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[7]Rutgers policy: http://academicintegrity.rutgers.edu/
CS department policy: https://www.cs.rutgers.edu/academics/undergraduate/academic-integrity-policy

- You may <u>not</u> copy your homework solutions from any other student's homework. Note that allowing someone else to copy your solution is just as serious of a violation as copying someone else's solution.

- **This policy will be strictly enforced** and violations will be referred to the office of student conduct[8].

- **There are no exceptions to this policy.** If a homework problem is too hard, start earlier, come to the office hours, check your textbook, ask for help from your Instructor or TAs, or in the worst-case, just do not answer that question — academic dishonesty is *never* the right answer. If you are ever in doubt about what constitutes academic dishonesty, always ask the course staff or on Piazza.

Finally, <u>all</u> the materials released in this course are solely for the students registered in the course and are <u>not</u> to be redistributed outside of this class.

Let us even further test the hypothesis that no one ever reads the syllabus: at the very beginning of your "homework 0" solutions (and only on this homework), in addition to the sentence mentioned earlier, also *copy and paste* the following sentence: "[CS344S22]: I might have even read almost the entire syllabus!", to receive yet another 1% points from the bonus credit part (if you have included everything here and submitted your "homework 0" you will receive +4% bonus credit already in the first week of the course!).

4 Rutgers CS Diversity and Inclusion Statement

Rutgers Computer Science Department is committed to creating a consciously anti-racist, inclusive community that welcomes diversity in various dimensions (e.g., race, national origin, gender, sexuality, disability status, class, or religious beliefs). We will not tolerate micro-aggressions and discrimination that creates a hostile atmosphere in the class and/or threatens the well-being of our students. We will continuously strive to create a safe learning environment that allows for the open exchange of ideas and cherished freedom of speech, while also ensuring equitable opportunities and respect for all of us. Our goal is to maintain an environment where students, staff, and faculty can contribute without the fear of ridicule or intolerant or offensive language.

If you witness or experience racism, discrimination micro-aggressions, or other offensive behavior, you are encouraged to bring it to the attention to the undergraduate program director and/or the department chair. You can also report it to the Bias Incident Reporting System[9].

5 COVID-19 Protocols

In order to protect the health and well-being of all members of the University community, masks must be worn by all persons on campus when in the presence of others (within six feet) and in buildings in non-private enclosed settings (e.g., common workspaces, workstations, meeting rooms, classrooms, etc.). Masks must be worn during class meetings; any student not wearing a mask will be asked to leave.

Masks should conform to CDC guidelines and should completely cover the nose and mouth[10].

If you are feeling sick, or suspect you may have been exposed to COVID-19, do not come to the class. Arrangements will be made for students who are not able to attend class because of an illness or quarantine.

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[8]http://studentconduct.rutgers.edu/student-conduct-processes/academic-integrity/
[9]http://inclusion.rutgers.edu/report-bias-incident/
[10]https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/about-face-coverings.html