Computer Science 373 – Analysis of Algorithms
Fall 2020

Instructor: Steven Skiena
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Webpage: `http://www.cs.stonybrook.edu/~skiena/373/`
Office Hours: 11:05AM-12:35PM Tuesday-Thursday, and by appointment.

Course Time: Tuesday-Thursday 3:00PM - 4:20PM **Place:** Sychronous instruction on Zoom

Textbook: Skiena, *The Algorithm Design Manual*, second edition, Springer-Verlag, 2008.

- **Grading:** Grades will be assigned based on the following formula, with cut-offs determined by my opinion of students on the boundary.

    Daily Problems - 5%

    Homework Assignments - 15%

    Midterm 1 - 25%

    Midterm 2 - 25%

    Final - 30%

- **Homeworks:** There will be five homeworks over the course of the semester. Most will contain some programming component. As discussed below, all homeworks except HW4 should be done in pairs – although both students should submit copies of the assignment on Blackboard. Homeworks will be submitted electronically, and so must be typeset or scanned. On each homework assignment, only a subset of the problems will be graded.

- **Exams:** My exam strategy is as follows. Many, but **not necessarily all** homework, daily and **midterm/exam** problems will be drawn from the textbook and supplemental problems on AlgoWiki. Thus the correct way to study for this course is to review these problems and figure out how to solve them. The more you work, the better your grade will be. The midterms and exams will be closed book, but there is no need to memorize solutions. Once you have solved them once you should be able to reconstruct them on demand.

    I expect that the exams will be are a mix of freeform solutions and multiple choice. Questions will be randomly scrambled and time synchronized, using a lockdown browser, to minimize opportunties for cheating.

The midterms will be held during class time. I will have a test online midterm the week before so people can debug their technology. I do not give makeup midterms, so make sure you do the test before hand.

My midterms/exams are designed to be hard. **The average on my midterms is usually in the 60's. That is OK, because I curve the final semester grades, giving a median grade of B-.**

Rules of the Game:

1. We shall be using the second edition of my book *The Algorithm Design Manual* as the primary text for the course. **Read the book! Page numbers are available on the lecture schedule.** Errata and other resources are available at `http://www.algorist.com`.

2. This semester's lectures will be taught on Zoom, via links available within Blackboard. I also intend to upload these lectures to YouTube, where they will join video lectures from past times I have taught the course on my YouTube channel and `http://www.algorist.com`. Of course, you are paying for a live performance, so I encourage you to come to class.

3. The WWW page for the course is `http://www.cs.stonybrook.edu/~skiena/373/`. All course handouts and notes are available there, along with the latest announcements. Please check it out.

4. We will use Piazza as a question and answer platform this semester. That said, I will be doing as little as possible with it, so students will have to fill the void. The Piazza link is piazza.com/stonybrook/fall2020/csemat373, and will be available from the course webpage.

5. The best way to learn the material is by solving problems. You are encouraged to work in pairs, for the best way to understand the subtleties of the homework problems is to argue about the answers. Each of you should look at all the problems independently, and not just divide the list in two parts each time. Don't be a leech and let your partner do all the work. Unless you learn how to solve problems, I *promise* that you will get burned on the exams and thus for your final grade.

6. The partner system relies upon a certain maturity among the students. If you don't have a partner, tell me and I will hook you up with one. If you are having trouble with your partner and want a divorce, tell me and I will set you up with a new one. I will act as a broker *but not* as a counselor. I do not want to hear what a louse your old partner is, and you will get a dirty look from me when you demand a divorce regradless of who was at fault.

7. This semester CSE 373 will have a large number of students, and teaching online will be a new and frieghtening experience. Experiments like partial HW grading and partially multiple choice exams are part of my attempts to deal with this. Please be understanding and patient.

8. Another experiment that I will try this semester involves a "Head TA" who will be the point of contact on *all* HW and exam grading questions. *I will not be involved with this, except to demand this Head TA to give back as few points as possible.* History shows me that exam regrades change very few points and have very little effect on final grade outcomes, and I want to dramatically cut down on point fishing this semester.

9. At the start of each class, I will work out one previously identified homework problem, emphasizing the thought process leading to the solution. To get the most benefit from this, you should try to do the problem before lecture. The daily problems are submitted individually. I will collect your solutions for these daily problems on Blackboard just before the start of each class.

10. Only one solution to the assignment per pair need be written up, although both partners should submit the assignment. The partners should alternate who writes up the final solution, with the scribe for each assignment labeled as such. Unless announced otherwise in class, any solution to a part of a homework problem which takes more than one side of a sheet of paper will not be graded. This is to save you the ordeal of trying to impress with volume instead of quality.

11. I encourage you to make use of and (even better) contribute to the *Algorithm Design Manual Problem Solution Wiki*, available from `http://www.algorist.com`. **Try HARD to solve the problems before peaking, because learning comes from beating your head against the problems.** I never look at the Wiki and have no idea whether the Wiki solution are correct. *Cavet Emptor!*

12. There should not be any CS graduate students taking this course, and likely none from any department. But if you are a graduate student trying to take this class, come talk to me.

13. If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disablility Support Services office, 128 ECC Building (631) 632-6748. They will review your concerns and determine, with you, what accommodations are necessary and appropriate. All information and documentation of disability is confidential.

    Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following web site: `http://www.ehs.stonybrook.edu` and search Fire Safety and Evacuation and Disabilities.

14. 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. Any suspected instance of academic dishonesty will be reported to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at:

    `http://www.stonybrook.edu/uaa/academicjudiciary/`

15. I understand that accidents and troubles befall even the most dedicated student. Thus every student will get one free extension on a homework for up to a week without a late penalty. You do not have to ask for this – just write on your paper that you are using your free extension when you turn it in. Don't waste this extension or feel obligated to use it, since you will get a very dirty look if try to get another one even with a good excuse.

16. Homework assignments will be due at the *beginning of class*. The penalty is 20% per day.

17. I try to make lectures fun through jokes and analogies, but always fear saying something that may offend someone in the class. If anything I say bothers you, please contact me and tell me so. I will apologize, and then do my best to understand the issue to avoid doing so again.

18. I hope to establish as much personal contact with each of you as is possible in a class this size – even though the course is online. Don't be afraid to stop by during my Zoom office hours to ask questions or say hello. To facilitate interaction, I hope to have three Zoom 'Pizza with the Prof's at some point in the semester. I will post a request on Piazza for you to sign-up to join the fastest 15 students from the class for a virtual pizza lunch. I look forward to getting to know you.

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DATE    SUBJECT         LECTURE TOPIC               READING  IN/OUT
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8/25 Preliminaries    Introduction to algorithms    1-27
8/27 "                Asymptotic notation           31-40


9/1 "                 Logarithms and more           41-56    HW1 out
9/3 Data Structures   Elementary data structures    65-83


9/8 "                 Dictionary data structures    83-89
9/9 Pizza with the Prof (tentative)
9/10 "                Hashing                       89-98


9/15 Sorting          Applications of Sorting       103-108
9/17 "                Heapsort/Priority Queues      108-119  HW1in/HW2out
9/17 Practice midterm


9/22 "                Mergesort/Quicksort/Binsort   120-138
9/24 MIDTERM 1


9/29 Graph Algorithms  Data structures for graphs   145-160
10/1 "                Breadth-first search          161-168 HW2in/HW3out


10/6 "                Topological sort/connectivity 169-183
10/8 "                Minimum spanning trees        191-204


10/13 "                Shortest paths               205-216
10/14 Pizza with the Prof (tentative)
10/15 "                Exploiting graph algorithms   217-224


10/20 Search          Combinatorial search          230-238  HW3in/HW4out
10/22 "               Program optimization          239-247


10/27 Decomposition    Elements of dynamic programming 273-290
10/29 "                Examples of dynamic programming 291-300


11/3 "                Limitations of dynamic prog   301-310  HW4in/Hw5out
11/4 Pizza with the Prof (tentative)
11/5 "                 Dynamic programming review


11/10 SLACK CLASS
11/12 MIDTERM 2


11/17 Intractability   Reductions                    316-322
11/19 "                Easy reductions               323-329


11/23-7 no class (Thanksgiving)


12/1 "                 Harder reductions             330-333
12/3 "                 The NP-completeness challenge  334-340  HW5 in


12/15   CSE 373 Final Exam, 11:15AM-1:45PM


(*) implies there might be a substitute instructor or recording that class.
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