Design and Analysis of Algorithms September 6, 2018
Massachusetts Institute of Technology 6.046/18.410J
Daskalakis, Devadas, Gupta, and Rubinfeld Handout 1

Course Information

Welcome to 6.046, the most exciting class in Course 6! This class covers fundamental algorithmic ideas that have had (and continue to have) a major influence on the evolution of computer science and several other disciplines, ranging from mathematics to biology to the social sciences. We hope you will enjoy the class!

This handout describes basic course information and policies. Most of the sections will be useful throughout the course. The main items to pay attention to **NOW** are:

- ◇ Make sure you are signed up through Learning Modules.
  `https://learning-modules.mit.edu/class/index.html?uuid=/course/6/fa18/6.046#info`
- ◇ Make sure you are signed up for the Piazza webpage for the class.
  `https://piazza.com/mit/fall2018/6046`
- ◇ Please note the dates and times of the two midterm quizzes and keep your schedule free. Also note that this class will have a final exam, whose date will fall during finals period.
- ◇ Please note, and carefully adhere to, the collaboration policy for homework.

1 Course Website

The course website is at:
`https://learning-modules.mit.edu/class/index.html?uuid=/course/6/fa18/6.046#info`

Check the website for the weekly office hours, class material, problem sets, the course calendar, and announcements. You should visit this site regularly to be aware of any changes in the course schedule, updates to the office hours of the TAs, etc.

We will be using Gradescope to submit and grade assignments. You can use the code MG2K5P to add this course on gradescope.

2 Staff

The lecturers for this course are Costis Daskalakis, Srini Devadas, Debayan Gupta, and Ronitt Rubinfeld. To contact the lecturers as a group use the address `6.046-faculty@mit.edu`. Please see the course website for names and contact information of our teaching assistants.

Your TA is your first point of contact for questions about the class. The TA mailing list `6.046-tas@mit.edu` will reach all the TAs and the staff mailing list (not to be used frivolously!) `6.046-staff@mit.edu` includes the entire course staff (TAs and lecturers).

Our policies regarding problem sets and exams are clearly outlined in this handout. If a situation arises that is not addressed in this handout, please send your questions to Debayan Gupta at `debayan@mit.edu`.

3 Prerequisites

This subject is a header for the (old and new) MIT 6-2 and 6-3 programs. You are expected to have taken:

- 6.006 *Introduction to Algorithms* (a prerequisite for this class) **and**
- either 6.042/18.062J *Mathematics for Computer Science* (a prerequisite for 6.006) or 18.200 *Principles of Discrete Applied Mathematics*

and received a grade of C or better. Students will be responsible for material covered in *both* areas. If you have not taken 6.006 and 6.042/18.200, you must talk to or e-mail a TA or an instructor during the first week.

4 Lectures & Recitations

Lectures will be held in room **32-123** from 11:05 A.M. to 12:25 P.M. on Tuesdays and Thursdays. You are responsible for material presented in lectures, including oral comments made by the lecturers. While we will post lecture notes that will be helpful in the event of an unavoidable absence, the notes are meant to augment lecture attendance, not replace it.

Students must also attend a one-hour recitation session each week (starting September 7, 2018). You are responsible for material presented in recitations. In the past, attendance in recitations has been highly correlated with performance. Recitations also give you a more personalized opportunity to ask questions and interact with the course staff.

Recitations will be taught by the teaching assistants at various times (10am to 4pm) on Fridays.

Recitation Scheduling. You have already been assigned a recitation section by the registrar. Please check your recitation section on LMod. The website also allows you to switch, but we will cap any sections that get too crowded as well as switch some people between simultaneous sections, so check again before you go.

5 Problem Sets

TEN weekly problem sets will be assigned during the semester. The course calendar, available on the course webpage, shows the tentative schedule of assignments and due dates. The actual due date will always be written on the problem set itself. Homework must be turned in by 11:59 P.M. on the due date.

- **Grace Days:** You are expected to submit your homework on time. Nonetheless, because unexpected situations might occur (like travel, overload, conflicts, illnesses, and family emergencies), you have a budget of **10 late days** throughout the semester. The budget is spent in increments of 1 day (24 hours), and you may not use more than 2 grace days per problem set. You do not need to inform us about your use of your budget. The course staff will keep track of the days you have spent. If you submit your problem set later than two days after the deadline, your submission will not count towards your grade. The same will hold true if you are late and have no budget left. Beyond the use of grace days, late homework will not be accepted without a note from the Deans' Office (S^3: `https://studentlife.mit.edu/s3`) and, even then, only in extreme circumstances.

- **Discount Policy:** Your two lowest homework scores will each be counted with half-weight compared to each of the other eight.

- **Submission Format:** Solutions to all parts of the problem set should be submitted online to gradescope in a single document file. **Your file must be in PDF format prepared in LaTeX using the template provided.** If the PDF file does not clearly indicate which parts the solutions refer to, or has parts missing, it is assumed that the student did not attempt that part of the problem. Therefore, before submitting, make sure all of your work is included in the PDF file.

  Start each question on a new page and mark the top of the page with the following: (1) your name, (2) the question number, and (3) the names of any people you worked with on the problem (see Section 9), or "Collaborators: none" if you solved the problem entirely by yourself.

  The problem sets may include exercises that should be solved but not handed in. These questions will be clearly marked and are intended to help you master the course material. Material covered in exercises will be tested on exams.

- **Regrade Requests:** Any student who feels that a problem set was not graded properly may submit a regrade request through Gradescope within one week of the graded assignment being returned to the student. Please note the following before submitting a regrade request:

  1. You should carefully read the posted solutions for the problem in question.
  2. Indicate which rubric items you deserve (if applicable), where in your solution write-up you address them, and explain why you deserve extra points. Any regrades without justification will not be processed.
  3. The course staff reserves the right to regrade the entire assignment, and your grade may increase or decrease as a result of a regrade.

  If you are still unsatisfied with your grade after the regrade, please email your recitation instructor and we'll look into it.

6 On the Importance of Clarity

You should be as clear and precise as possible in your write-up of solutions. Understandability of your answer is as desirable as correctness, because communication of technical material is an important skill.

A simple, direct analysis is worth more points than a convoluted one, both because it is simpler and less prone to error, and because it is easier to read and understand. Sloppy answers will receive fewer points, even if they are correct, so make sure that your solutions are concise and well thought-out.

You will often be called upon to "give an algorithm" to solve a certain problem. Your write-up should take the form of a short essay. A topic paragraph should summarize

the problem you are solving and what your results are. The body of your essay should provide the following:

1. A description of the algorithm in English and, if helpful, pseudocode.
2. At least one worked example or diagram to show more precisely how your algorithm works.
3. A proof (or indication) of the correctness of the algorithm.
4. An analysis of the asymptotic running time behavior of the algorithm.

Remember, your goal is to communicate. Graders will be instructed to take off points for convoluted and obtuse descriptions.

7 Quizzes & Final Exam

This course will have two midterm quizzes, and a final exam:

Quiz 1:	Wednesday, October 10, 7:30 P.M. to 9:30 P.M. in 10-250, 6-120
Quiz 2:	Wednesday, November 14, 7:30 P.M. to 9:30 P.M. in 10-250, 6-120
Final Exam:	3 hours during Final Exam Week (scheduled by the Registrar)

For the two quizzes, if your last name starts with A-S, you will be in 10-250; T-Z: 6-120.

There will be no lecture on the Thursdays immediately after the two quiz days.

Each of the quizzes and the final exam will be closed book. However, **you will be allowed to bring and use one single-sided, letter-sized piece of paper with your own notes for the first quiz, two for the second quiz, and three for the final**. These should not be necessary but might be helpful.

Attendance at the quizzes and the final is mandatory. Legitimate conflicts can be discussed with the teaching staff but must be due to extenuating circumstances and discussed in advance. If a student misses either quiz or the final exam due to an emergency, **a note from the Deans' Office** (S^3: `https://studentlife.mit.edu/s3`) **will be required justifying his or her absence before a makeup will even be considered.**

Regrade requests. Any student who feels that a quiz or final exam was not graded properly may submit a regrade request. The request must be made online by the announced deadline. The request should include a detailed explanation of why she or he believes that a regrade is warranted. The course staff reserves the right to regrade the entire quiz or exam.

8 Grading Policy

The final grade will be based on ten problem sets (with the lowest two given half-weight), two quizzes, and a final exam.

The grading breakdown is as follows:

Problem sets	20%
Quiz 1	25%
Quiz 2	25%
Final exam	30%

Please note that we will not allow make-up exams if you schedule an interview that conflicts with an exam!

9 Collaboration Policy

We encourage you to collaborate with your peers to deepen your understanding of the course material. However, you should approach collaboration *on problem sets only* with care, and follow the guidelines below. **Copying from online resources, books, or notes from previous versions of this or other classes is strictly forbidden — copying will be considered a serious offense and dealt with accordingly.**

1. **You should spend at least 30–45 minutes trying to solve each problem entirely by yourself.** If you find yourself unable to solve the problem, you can seek help, either by approaching the TAs, or by using Piazza, or by collaborating with your peers.
2. **Do not be a Spoiler.** If you already solved the problem, do not give away the answer to your friend. The best way you can help your friend is to give hints and allow her or him the pleasure of coming up with the answer her/himself. Our past experience has overwhelmingly shown that students who do not attempt the problem sets on their own generally perform poorly in the exams, and thus in the class overall.
3. **You must write up each problem solution entirely by yourself without assistance,** even if you collaborate with others to solve the problem. Doing otherwise will be considered plagiarism, an academic offence with serious repercussions. You are asked on problem sets to identify your collaborators. If you did not work with anyone, you should write "Collaborators: none."

   It is a serious violation of this policy to submit a problem solution that you cannot orally explain to a member of the course staff. Plagiarism and other dishonest behavior cannot be tolerated in any academic environment that prides itself on individual accomplishment.

If you have any questions about the collaboration policy, or if you feel that you may have violated the policy, please talk to one of the course staff. Although the course staff is obligated to deal with cheating appropriately, we are far more understanding and lenient if we find out from the transgressor himself or herself rather than from a third party or on our own.

Needless to say, **no collaboration whatsoever is permitted on quizzes or exams.**

10 Textbook

The primary written reference for the course is the third edition of the textbook *Introduction to Algorithms* by Cormen, Leiserson, Rivest, and Stein (MIT Press). We will be using material and exercise numbering from the third edition, making earlier editions unsuitable as substitutes.

The textbook can be obtained from the MIT Press Bookstore, the Coop, and at various other local and online bookstores.

In addition, as and when necessary, we will post additional reference material and links on the course homepage.

11 Advice and resources for effective learning

Because of the conceptual nature of the material, just attending lectures and recitations and doing the homework, are unlikely to be sufficient for learning all the concepts. **Setting aside time to do the reading and to study your notes from lecture and recitation is generally necessary to truly learn and internalize the material**, and to be able to apply it in new ways later in the course as well as for the rest of your life.

Homework is essential for learning the material. Rather than thinking of problem sets as just a requirement, recognize them as an excellent means for learning the material, and for building upon it. Spread out the time you have to work the problems. Many people learn best by reading the problems long before they are due, and working on them over the course of a whole week; they find that their minds make progress working the problems in the background or during downtime throughout the day. Few people do their best learning the night before an assignment is due. Work with others if that is helpful, but with the goal of learning first and solving the problems second. **It is worth reading the posted homework solutions, even if you received full credit**. Often the clarity of explanation or details of implementation are different from the way you were thinking about things in ways that can improve your learning.

Recitation is an integral part of this class and extends the material presented in lecture. Recitation allows you to ask questions and discuss the material in a more intimate environment. Preparation for recitation can pay off in big dividends. Office hours are an essential means of filling in any gaps in your understanding and overcoming difficulties you may be having with the problem sets. There is no need to attend only the office hours of your own recitation instructor; attend whatever office hours are convenient for you. Preparing for office hours, as with recitation, can make everything more productive.

Don't hesitate to ask for help. This class is largely conceptual, and the concepts tend to build on one another. **If you are having trouble understanding the material, it is important to catch up rather than risk falling further behind**. We can help.

Office hours are a particularly useful mechanism for learning material and working through difficulties on problem set assignments. Moreover, if you have questions about the course or problem sets, please use Piazza or email `6.046-tas@mit.edu` as opposed to an individual TA or lecturer—that will give you a better chance of getting a speedy response.

Extra help may be obtained from the following two resources. The MIT Department of Electrical Engineering and Computer Science provides one-on-one peer assistance in many basic undergraduate Course VI classes. Tutoring is free. 6.046 staff can send recommendations to HKN on behalf of students who might benefit the most from this service; such students will be prioritized in tutor assignment. Please note that HKN usually has very few tutors available for 6.046, so make sure you apply early! More information is available at the tutoring link on the HKN home page: `https://hkn.mit.edu/`

Tutoring is also available from the Talented Scholars Resource Room (TSR^2) sponsored by the Office of Minority Education. The tutors are undergraduate and graduate students. For further information, go to `http://web.mit.edu/tsr/`

This class has great material, so HAVE FUN!