CS 313E Elements of Software Design

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Instructor: Jesse Zou
Pronouns: he/him/his
Email: jesseminghaozou@utexas.edu

Course Description

This is the second course in the Elements of Software series. The emphasis of this course is on software development using object-oriented methodology. This course includes how to design software, how to create reusable software components, and how to compose programs from already available components. Furthermore, students learn about some basic data structures and algorithms and how to match the data structures and algorithms to problems.

UNIVERSITY CATALOG COURSE DESCRIPTION

Object-oriented design of software using Python, a modern high-level language. Introduction to abstract data types, fundamental algorithms, and basics of complexity analysis.

PRE-REQUISITES

Computer Science 303E, 312, or 312H with a grade of at least C-.

FLAGS

There are no flags for this course.

COURSE OBJECTIVES

In this course you will learn how to solve computational problems. Given a computational problem you should be able to:

1. Analyze (understand in detail) the problem
2. Design an algorithm to solve the problem. In this design process, you will choose the appropriate data structure and the most efficient algorithm

3. Implement the learned algorithm in Python 3
4. Write your own test cases to test your algorithm. You will pay careful attention to edge cases. Make sure that the output matches the format as specified.

COURSE TOPICS OVERVIEW

Topic	Tentative Dates
CS303E Review	January 17 - January 24
Testing, Debugging, Exceptions, and Assertions	January 29
Object Oriented Programming (OOP)	January 29 - January 31
Inheritance	February 5
Algorithm Complexity	February 7
Basic Algorithms	February 12
Algorithm Classes	February 14 - February 19
Hashing Data Structures	February 21
Recursion	February 26 - February 28
Stacks, Queues, and Linked Lists	March 4 - March 18
Binary Trees	March 20 - April 1
Heaps	April 3
Balanced Binary Trees	April 8
Graphs	April 10
Weighted Graphs	April 17 - April 22
Dynamic Programming	April 24 - April 29

A more complete schedule is available on Canvas.

Course Requirements and Grading

RECOMMENDED MATERIALS

- **Introduction to Algorithms, Third Edition**, September 2009. By Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein Publisher:The MIT Press ISBN:978-0-262-03384-8. (known as CLRS Algorithm Book)

- **The Practice of Computing Using Python**, by W. Punch and R. Enbody, 3rd edition, Pearson Publishing, ISBN 978-0-13-437976-0

REQUIRED DEVICES

- A mobile phone or laptop is required for in-class quizzes.
- A laptop is recommended for the in-class exercise, but you may pair with someone who has a laptop to work on the exercise.
- A lab computer in GDC (see me for more information) or your own computer is required for programming assignments (projects).

EXPECTATIONS

Course Structure

Because people are creatures of habit, the course's weekly structure will be as consistent as possible.

Before each lecture, approximately 15-30 minutes of material will be delivered asynchronously through recordings and other mediums. The asynchronous material serves as a conceptual primer to help understand the more technical details during the in-class lecture. Problem Sets will also be due before each lecture.

At the beginning of class, a Quiz will be given covering the topics given in the Problem Set. The lecture will cover technical and practical applications of the topic discussed in the asynchronous material. An exercise may occur during class for students to develop a hands-on understanding of the material. The professor and a TA will assist groups with the exercise and then address common mistakes and suggestions for improvement.

This class uses the Lectures Online recording system. This system records the audio and video material presented in class for you to review after class. Links for the recordings will appear in the Lectures Online tab on the Canvas page for this class. You will find this tab along the left-side navigation in Canvas. To review a recording, simply click on the Lectures Online navigation tab and follow the instructions presented to you on the page. You can learn more about how to use the Lectures Online system at http://sites.la.utexas.edu/lecturesonline/students/how-to-access-recordings/.

You can find additional information about Lectures Online at: https://sites.la.utexas.edu/lecturesonline/.

Programming Assignments will mostly align with the topic schedule and are scoped so that they can be finished in a week. Each Programming Assignment begins on Thursday at midnight and is due at 11:59 pm on the following Friday (8 days). More information below in Assignments and Grading.

A schedule of topics, programming assignments, and due dates is available on Canvas. The schedule is subject to change, so please check it throughout the semester.

There are no exams in this class.

Professionalism

- Understand that students in this course have different levels of experience and confidence. Be generous and brave with your classmates.
- Use professional language and tone of voice with your professor, TAs, and classmates. Act as you would with your boss and colleagues at a job.
- Check Canvas several times a week to become familiar with new assignments and due dates.
- Contact the professor as early as possible if life circumstances are impacting your work.

ASSIGNMENTS AND GRADING

Assignments and grades are tracked on Canvas. See Canvas modules for the daily course schedule. No additional points can be earned outside of the work described in this syllabus. There is flexibility built into the grading policy discussed below, with quiz buffer points, regrade periods, late deadlines, and dropped grades. Because of this, there are (almost) no exceptions to the grading policy for individual students and circumstances. If you get kidnapped and slip into a coma on the same day, special arrangements can be made. Know that this is extremely rare. But, do let me know if you get kidnapped as soon as possible, and not on the last day of class.

Welcome Survey - A welcome survey is assigned at the beginning of the semester so that I can learn how best to help you succeed in the course.

Problem Sets (2 each per week) - Problem Sets are available after each lecture, and are to be completed before the next lecture. You will have three tries per Problem Set, and Problem Sets are weighted on a 10-point scale. These are meant to be low-stakes assessments to help you gauge your understanding. Getting all 10 questions correct on a Problem Set will give you one buffer point on the subsequent Quiz, capped at 10/10 points.

Quizzes (in-class, 2 each per week) - In-class Quizzes occur at the beginning of each lecture for 15 minutes, so be sure to arrive on time. Each Quiz will have 10 questions, weighted on a 10-point scale, and cover the same topics in the Problem Set. Quizzes are closed-note, and it is not possible to take a Quiz outside of the original in-person lecture.

The four lowest Quiz grades will be dropped. Because of this flexibility, there are no Quiz makeups or extensions.

Exercises (in-class, 1-2 each per week) - In-class exercises will occur at the end of some lectures to provide hands-on practice with the topics. Exercises will be drawn from both in-class lectures and asynchronous material. Exercises will either be practical coding tasks in Hackerrank or Canvas Quizzes due by the end of class. Exercises are closed-note, but you may ask the instructor and TAs for help.

The three lowest Exercises will be dropped. Because of this flexibility, there are no Exercise makeups or extensions.

Programming Assignments (1 per week) - Each Programming Assignment begins on Thursday at midnight and is due at 11:59 pm on the following Friday (8 days). The first Programming Assignment is required to be completed individually, but all others can be completed in pairs, using pair programming guidelines. Each Assignment includes detailed instructions that must be followed to receive full credit. Plan to spend around 15 hours per week programming. There are no slip days in this course.

The last possible time to submit an assignment is 48 hours after the original due date, Sunday at 11:59 pm. However, there is a penalty of 10 points (out of 100 points) per day. Your assignment is one day late until 11:59 pm on the day after it is due, and two days late from then until 11:59 pm on the second day. After this time, no submissions are possible. There are no extensions. Assignments not submitted will receive a 0 and may not be submitted for a regrade.

eCIS - At the end of the semester, uploading a screenshot showing that you've completed the course evaluation to the appropriate assignment on Canvas will earn you 1% extra credit.

LETTER GRADE

Grading categories are weighted as follows:

Category	Weight	Total	Available Drops
Welcome Survey	2%	1	
Quizzes	50%	27	4
Exercises	15%	18	3
Programming Assignments	33%	13	
eCIS (end-of-course survey)	1%	1	

Grade letter cutoffs are below. Percentages will not be rounded. For example, to earn an A, you must have a percent of 93.0 or above. A 92.99 is an A-.

Grade Letter Cutoffs										
A	A-	B+	B	B-	C+	C	C-	D+	D	D-
93	90	87	83	80	77	73	70	67	63	60

These nominal cutoffs will not be increased; for example, a student achieving a raw score of 90 is guaranteed to receive an A- in the course. However, these cutoffs might be lowered if necessary to improve the grade distribution.

GRADE DISPUTES

Scores for assignments will be posted on Canvas. You have one week from the date the assignment grade is posted to dispute your grade. The TAs will be grading the Programming Assignments. Visit the TAs and see if you can resolve your differences. If you cannot resolve your differences, you may visit me to explain the situation. We will not entertain any grade disputes one week after the grades are returned.

COMMUNICATION

We will be using Ed Discussion integrated into Canvas for general discussion of class-related questions. Please do not post solutions or code to any homework assignment problems on Ed Discussion. All communications to the Teaching Assistants will be through Ed Discussion. If you want to reach out to the Teaching Assistants then post a private note to them on Ed Discussion. Do NOT send them private e-mails. If you want to reach me send me an email. If you have assignment-related questions, it is best to visit the TAs during their office hours. If you have content-related questions visit me during my office hours.

Academic Integrity

You are encouraged to study for exams, discuss the Problem Sets and programming assignments, and discuss debugging techniques with your colleagues. If you are unsure about whether a particular source of external information is permitted, contact the instructor before looking at it.

Note that cooperation is not the same thing as cheating. The Problem Sets and programming assignments must be the work of the student(s) turning them in. Materials from the web should only be used for educational purposes. For example, you can read about exceptions and look at examples of exception code, but you must not copy any code from the web or be looking at any of this code from the web when writing anything you turn in, whether the code is copied or generated, including code generated software such as GitHub Copilot of ChatGPT. If you discuss an assignment with another student or look at examples from the web, you should employ the following technique: after a discussion with another student or looking at example code you should do something that has nothing to do with computer science or programming for at least half an hour before resuming programming.

It is generally okay to verbally discuss the concepts needed to do Problem Sets and programming assignments. Three guidelines will help you keep on the right side of the line.
- First, other than the TA and instructor, it is never okay to look at the written work of another person or show another person your written work until after all grading on an assignment is completed. This includes looking at paper print-outs, sketching solutions on a whiteboard or napkin, or looking at a screen to help debug. The moment you start looking at another student's (or pair's) source code you have crossed the line into cheating. It should go without saying that copying other people's code or solutions is strictly prohibited. You also may not look at any course project material relating to any

project similar to or the same as this course's class projects. For example, you may not look at the work done by a student in past year's courses, and you may not look at similar course projects at other universities.

- Second, while you are discussing an assignment with another student, you must not be writing their words or recording the conversation in any way. Similarly, you should not read from your own work. After discussing a problem with another student (or the TA!), take a break for a half hour before going back to work on the assignment. If you can't remember what the person said after a half hour, you didn't really understand it.
- Third, everyone in the class is expected to take appropriate measures for protecting one's work. For example, you should protect your files and printouts from unauthorized access.

Note that these guidelines are necessarily generalizations and cannot account for all circumstances.

Students are expected to behave professionally and ethically according to the https://www.cs.utexas.edu/academics/conduct

You must take the quizzes and exercises in class. Sending and/or receiving the access code, the questions, or the answers to anyone is a violation of the honor code of the University.

PROJECT WITHDRAWAL FORM

If you find yourself in a situation where code submitted by you or your partner violates the academic integrity policies of this class, you may submit a project withdrawal form before we begin grading. The form linked on Canvas allows you to withdraw your code from consideration by course staff without penalty beyond a 0 for the assignment. Please be sure to follow all guidelines listed in the form's description.

GENERATIVE AI

As generative artificial intelligence tools, like ChatGPT, become more prevalent we must be careful about how we integrate them into our class.

- You are allowed to use AI for review, study, or research purposes throughout the course.
- You are allowed to interact with AI while answering syntax and Problem Set questions, although the final answer must be developed by you and documented in your own words.
- You are **not** allowed to use AI during In-Class Quizzes or Exercises. Any questions you may have can be asked of the instructor or the TAs.
- You are **not** allowed to use AI to code your Programming Assignments.

For more information about using Generative AI Tools at UT Austin, please visit: 5 Things To Know About ChatGPT https://ctl.utexas.edu/5-things-know-about-chatgpt

Whole-Person Care

NAMES AND PRONOUNS

Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender, gender variance, and nationalities. Class rosters are provided to the instructor with the student's chosen name, which you may update through UTDirect (https://utdirect.utexas.edu/apps/ais/chosen_name/student/). These rosters also provide a gender marker to faculty, which can be updated following the instructions from the Gender and Sexuality Center (http://diversity.utexas.edu/genderandsexuality/publications-and-resources/). That said, we will gladly honor your request to address you by a name that is different from what appears on the official roster and by the pronouns you use (she/he/they/ze, etc). Please advise us of any changes early in the semester so that we may make appropriate updates to our records.

COUNSELING AND MENTAL HEALTH CENTER

The Counseling and Mental Health Center serves UT's diverse campus community by providing high quality, innovative, and culturally informed mental health programs and services that enhance and support students' well-being, academic and life goals. To learn more about your counseling and mental health options, feel free to reach out to one of us to help get connected, or call CMHC at (512) 471- 3515.

If you are experiencing a mental health crisis, call the CMHC Crisis Line 24/7 at (512) 471- 2255.

OUTSIDE CIRCUMSTANCES AND PERSONAL EMERGENCIES

If there are outside circumstances that you feel inhibit your ability to participate in this class, please let us know as soon as possible. We will do our best to provide resources or accommodations to help you succeed.

In the case of medical or mental health concerns, family emergencies, interpersonal violence, and other situations, Student Emergency Services (SES) can help. You may contact them directly through email (studentemergency@austin.utexas.edu) or by phone (512-471-5017), or you may contact one of us and we will assist you with the process.

If you find yourself in an emergency situation, please prioritize yourself over communicating with us. Only notify us if you have the time and bandwidth to do so; documentation through SES is required eventually, but not immediately. Regardless of whether you notify us or not, trust that we will do something reasonable once we learn of your situation, and we will discuss a plan of action with you once you feel ready and able to do so.

DISABILITY AND ACCESS

In this class, we respect and welcome students of all backgrounds, identities, and abilities. Your success in this class is important to me and not everyone learns in the same way. If there are circumstances that make the learning environment and activities difficult, if you have medical information that you need to share with me, or

if you need specific arrangements in case the building needs to be evacuated, please meet with me (ideally, by the 12th class day) to discuss how we can make accommodations for you. I promise to maintain the confidentiality of these discussions, and you are not required to disclose to me any specifics on the nature of your disability.

Any student with a documented disability who requires academic accommodations should contact Services for Students with Disabilities at 471-6259 (voice) or 512-410-6644 (Video Phone) as soon as possible to request an official letter outlining authorized accommodations. This letter should be presented to the instructor in each course at the beginning of the semester and accommodations discussed at that time. For more info, visit http://ddce.utexas.edu/disability/about/.

RELIGIOUS HOLY DAYS

Religious holy days sometimes conflict with class and examination schedules. If you will miss an examination, work assignment, or other project due to the observance of a religious holy day you will be given an opportunity to complete the work missed within a reasonable time after the absence. It is the policy of The University of Texas at Austin that you must notify each of your instructors at least fourteen days prior to the classes scheduled on dates you will be absent to observe a religious holy day (earlier notification is preferable).

TITLE IX REPORTING

Title IX is a federal law that protects against sex and gender-based discrimination, sexual harassment, sexual assault, sexual misconduct, dating/domestic violence and stalking at federally funded educational institutions. UT Austin is committed to fostering a learning and working environment free from discrimination in all its forms. When sexual misconduct occurs in our community, the university can:

1. Intervene to prevent harmful behavior from continuing or escalating.
2. Provide support and remedies to students and employees who have experienced harm or have become involved in a Title IX investigation.
3. Investigate and discipline violations of the university's relevant policies (https://titleix.utexas.edu/relevant-polices/).

Beginning January 1, 2020, Texas Senate Bill 212 requires all employees of Texas universities, including faculty, to report any information to the Title IX Office regarding sexual harassment, sexual assault, dating violence, and stalking that is disclosed to them. Texas law requires that all employees who witness or receive any information of this type (including, but not limited to, writing assignments, class discussions, or one-on-one conversations) must be reported. I am a Responsible Employee and must report any Title IX related incidents that are disclosed in writing, discussion, or one-on-one. Before talking with me, or with any faculty or staff member about a Title IX related incident, be sure to ask whether they are a responsible employee.

If you would like to speak with someone who can provide support or remedies without making an official report to the university, please email advocate@austin.utexas.edu. For more information about reporting options and resources, visit http://www.titleix.utexas.edu/, contact the Title IX Office via email at titleix@austin.utexas.edu,

or call 512-471-0419. The Title IX office has developed supportive ways to respond to a survivor and compiled campus resources to support survivors. Although graduate teaching and research assistants are not subject to Texas Senate Bill 212, they are still mandatory reporters under Federal Title IX laws and are required to report a wide range of behaviors we refer to as sexual misconduct, including the types of sexual misconduct covered under Texas Senate Bill 212.

UNIVERSITY RESOURCES

For a list of university resources that may be helpful to you as you engage with and navigate your courses and the university, see https://utexas.instructure.com/enroll/TP964H.

Acknowledgments and Copyright

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