

Elementary Data Structures and Algorithms

Dr. Dan DeBlasio
Department of Computer Science
University of Texas at El Paso

CS 2401 – Fall 2022

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(change since start of classes marked in orange)

Course Objectives: This is the second course for students majoring in Computer Science. Students will learn about fundamental computing algorithms including searching and sorting; recursion; elementary abstract data types including linked lists, stacks, queues and trees; and elementary algorithm analysis.

Prerequisite: CS 1301 and CS 1101 with a grade of C or better in both.

Knowledge and Abilities Required Before Entering the Course: Students are assumed to be comfortable programming in Java. Students should be able to code basic arithmetic expressions, define simple classes, use strings, code loops and conditional statements, write methods, create objects from classes, invoke methods on an object, perform basic text file input and output, and use arrays.

Topics covered this semester:

- Review and deeper study of arrays, objects, linked lists, and recursion.
- Introduction to algorithm analysis and rigorous study of searching and sorting algorithms.
- New data structures: binary trees (including binary search trees), stacks, and queues, along with their implementations.

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1 Logistics

Synchronous course session times and locations:

- TR 3:00pm-4:20p (class) — CCSB G.0208
- TR 1:30pm-2:50p (lab) — CCSB 1.0704

Template Weekly Assignments: While each week of the course will be slightly different, and students should stay up to date, an “average” week in the course will include:

- 2 synchronous class sessions where the instructor will lead a discussion of examples and answer questions about the materials being learned
- 2 synchronous lab sessions where the instructional staff will lead a discussion primarily related to the lab assignments
- 2 reading quizzes
- 1-2 in-class/homework activities
- 1 laboratory implementation assignment

Textbook: *Introduction to Java Programming and Data Structures* by Y. Daniel Liang from Pearson Publishing. Available at <https://console.pearson.com/enrollment/css2d1> (cost: \$90), or you can obtain a physical copy (ISBN: 978-0136520238). The textbook is **optional**, but recommended especially if you’re not progressing adequately using only the course slides.

Communication platforms:

- **Blackboard** – cs2401.deblasiolab.org/f22/blackboard – Used for announcements and grade tracking. All official grades and feedback will be sent through Blackboard. Students should monitor this site for important class information.
- **MS Teams** – cs2401.deblasiolab.org/f22/teams – Used for office hours and intra-class discussions. Several channels will be available in the team for asking and answering questions, the instructional staff will answer questions posted on teams, but other students are encouraged to provide feedback as well.
- **Replit** – cs2401.deblasiolab.org/f22/replit – Used for lab assignments. Links to assignments will be posted, students are responsible for ensuring that assignments are committed correctly before the deadline.
- **YouTube** – cs2401.deblasiolab.org/f22/youtube – Used to disseminate asynchronous video content. Students will keep up with assigned video content intended to supplement the textbook readings.

Software: Students will use the web-based Interactive Development Environment (IDE) `replit` to submit their assignments and get help from the instructional staff.

2 Instructional Staff

Instructors

Dr. Dan DeBlasio email: dfdeblasio@utep.edu
 MS Teams: cs2401.deblasiolab.org/dm (direct message)
 office: CCSB 3.1008
 office hours: T & R 10:30a-11:30a
 appointments: calendly.deblasiolab.org

Teaching Assistants

Adeel Malik email: amalik@miners.utep.edu
 office hours: M & W 1:00p-3:00p
 F 8:00a-10:00a
 both in CCSB 1.0706

Instructional Assistants

Oswaldo Escobedo email: oescobedo3@miners.utep.edu
 office hours: M 11a-1p – CCSB G.0512
 F 10:00a-12:00p – MS Teams

Gregorio Sigala email: gasigala@miners.utep.edu
 office hours: W 10:00a-12:00p
 M & W 3:00p-5:00p
 all in CCSB G.0512

3 Expectations

Communication: Students are expected to consult their emails and blackboard messages *at least* twice a week, and to answer these as relevant.

Class and Lab Participation: Keeping up with class contents and participation in both lecture and lab sessions are critical factors of your success in this course.

Students should be on time for all scheduled sessions and attend the entire session. This semester attendance will not be taken to discourage those who may be sick to stay home, but those students who attend and readily participate in the course do better on assessments.

Students should notify the instructor prior to missing a session if at all possible, and certainly right after if earlier was not possible. Students should submit their work on time and meet all deadlines. Failing to do so will affect the participation grade.

It is the student's responsibility to review the content covered during missed class(es) or labs, as well as the assignments given during their absence. Participation points also include completing post-lecture and post-labs online quizzes (when requested) that are administered as surveys to monitor students' overall progress and potential struggles.

Students should be on task. When in synchronous class or lab session, students are expected to direct their attention to the task / activity as directed by the lecture / lab instructor. For instance, synchronous class sessions are certainly not places for social-networking, working on homework, participating in other courses.

Professionalism: Students should be professional in their communications, as the context permits. Emails should contain subjects, the recipients should be addressed (i.e. "Hello Dr. DeBlasio, ..."), and the email should be signed with your name. Real-time online communication (i.e. MS Teams), while less formal, should still be professional.

4 Grading

Grades are communicated to students in a timely manner. It is the students' responsibility to keep track of their grades by compiling the grades they receive. Your semester grade will be based on a combination of homework assignments, weekly quizzes, class participation, 4 mid-term assessments, student engagement, and a pair of comprehensive exams.

The approximate percentages are as follows:

5%	Class participation
15%	Homework/Quizzes/In-class assignments grade
35%	Lab grade
20%	Mid-term assessments (4 small tests, 1 class period)
5%	Comprehensive in-class assessment (1 class period)
20%	Final exam (up to 2.75 hours)

The base percentage-score-to-letter-grade conversion for CS 2401 is as follows:

90%	or higher is guaranteed an A
80%	or higher is guaranteed a B
70%	or higher is guaranteed a C
60%	or higher is guaranteed a D
	all lower grades are an F

These minimums may be lowered without notice but will not be raised.

Important Note: Regardless of your standing in the class at that time, you need to earn a C or better at the final exam to pass the course as well as a C or better as your average grade on the lab assignments.

4.1 Homework / Quizzes / In-class assignments

4.1.1 Daily Quizzes

The purpose of each quiz is to ensure that students are staying current with the weekly content and to verify that they have acquired the skills developed in class. Short quizzes are unannounced. All quizzes will be in person, Quizzes are graded on submission not on correctness as a way to judge the progress of the student body, please try your best but note when you're making an educated guess.

There will be no make-up on missed quizzes, but up to 3 quizzes can be dropped (missed) though the course of the semester.

4.1.2 Long Quizzes

Though the course of the semester we will have longer (graded) quizzes. The modality of the quizzes will either be in class or online (to be determined). They will be scheduled directly proceeding (the meeting before) each mid-term assessment and will cover similar material. Details on these long quizzes will be announced in class as they occur.

4.1.3 In-class assignments

There will be unannounced in-class assignments, to be turned in either by the end of the class or within a short period of time after the class (details will be given for each assignment). There will be no make-up for missed in-class assignments. Grades of such assignments will weigh equally with grades from quizzes.

HW / Quizzes / In-Class Assignments Grade (HW/Q/IC)

Average (Daily Quizzes participation, Long Quiz grades,
other in-class assignments)

4.2 Lab assignments and related homework

Lab assignments are designed for you to further your practice on the concepts presented in class and demonstrate your level of mastery of these. In lab, you will typically work on either small activities related to currently covered concepts or concepts in which your instructional team thinks you should acquire more fluency, or more substantial lab assignments. Specifically, there will be approximately one lab assignments per week and a few smaller lab activities.

Attendance and active participation: You are expected to attend and actively participate in labs (active participation includes the weekly group activities).

Extra credit: there will be two extra-credit opportunities:

- Extra lab at the end of the semester can be used to replace a previous lab assignment; and
- Attended office hours with three out of the 4 instructional staff (with a specific question, at least one must be with Dr. DeBlasio) and submit all labs on time (or within any pre-approved extension), an extra 100 point lab will be averaged into the lab assignments.

Grade: Your grade for labs will be a combination of the grades you obtain at your lab assignments (90%), and your participation and performance on smaller activities, as well as your active participation in the problem-solving group activities (10%). This grade will weigh 35% of your overall CS2401 grade. You need to score 70% or higher in labs to pass CS2401, regardless of your average otherwise.

Lab Grade

Lab assignments (90%) +
Attendance/Active Participation (10%)

4.3 Exams & Assessments

There will be 4 small assessments through the semester, one comprehensive assessment, and one final exam. Because the exams contribute heavily to your total grade, it is vital that you do well on them. If you have test-taking difficulties in general, or if you have difficulties with our tests in particular, please request appropriate accommodation from UTEP's Center for Accommodation and Students' Services.

The purpose of the midterm assessments are to allow you to demonstrate mastery of course concepts covered thus far during the semester. Mid-term assessments will take place in class and are tentatively scheduled to be held in week 4, week 7, week 10, and week 13. Make-up exams will be given only in extremely unusual circumstances. If you must miss an exam, please meet with an instructor, *BEFORE* the exam.

Students are required to be on time for assessments, a 10% reduction to an assessment grade will be made if a student arrives more than 5 minutes after the start of the test, and 20% at 10 minutes,. A 100% deduction will be made after 15 minutes. Arriving to a test late is disruptive to all students in the class and cannot be tolerated.

The final exam and comprehensive assessment will be comprehensive. You must score 70% or better on the final exam to pass this course. You must take the final exam during the time shown in the schedule for the lecture section that you normally attend. Do not "drop in" to another section: there will not be a copy of the exam for you. This is University policy. If you have a scheduling conflict (e.g., if you are taking a final at EPCC) or if you are scheduled for three final exams in one day, see your instructor at least a week in advance for arranging accommodation.

Final Exam Date

Thursday, December 8th, 2022; 4:00 pm – 6:45 pm.

5 Standing in the course

Special Assignments: If deemed necessary, special assignments will be given to students to ensure that said students remain in the class and be successful. These will be designed to help students grow into the course and develop the necessary skills. It is important that students feel free to ask their instructor about any such opportunity as well so that a special plan of development for CS2401 be tailored to them.

Standing in the Course: Students will have access to their grades for all assignments so that they can self-monitor their standing and progress. However, it is also completely fine for any student to come and talk to their instructor about their standing and work together to make sure the student is as successful as can be.

Dropping the Course: Every semester, some students drop the course. We, instructors, completely understand and respect that. We only hereby ask students to inform us, ideally before, but in the worst-case right after, of their intention to drop the course. This is really important for us as it possibly informs us of ways in which to better serve our students.

6 Special notices for COVID-19

Please stay home if you have been diagnosed with COVID-19 or are experiencing COVID-19 symptoms. If you are feeling unwell, please let me know as soon as possible, so that we can work on appropriate accommodations. If you have tested positive for COVID-19, you are encouraged to report your results to covidaction@utep.edu, so that the Dean of Students Office can provide you with support and help with communication with your professors. The Student Health Center is equipped to provide COVID-19 testing.

The Center for Disease Control and Prevention recommends that people in areas of substantial or high COVID-19 transmission wear face masks when indoors in groups of people. The best way that Miners can take care of Miners is to get the vaccine. If you still need the vaccine, it is widely available in the El Paso area, and will be available at no charge on campus during the first week of classes. For more information about the current rates, testing, and vaccinations, please visit epstrong.org.

Masks in the classroom

The instructional staff will be following CDC guidance on masking in groups based on the current transmission rates in El Paso County^a. Please respect the choices of other who may prefer to be more cautious than recommendations.

^a<https://www.cdc.gov/coronavirus/2019-ncov/your-health/covid-by-county.html>

7 Resources

Special Accommodations: If you have a disability and need classroom accommodations, please contact the Center for Accommodations and Support Services (CASS) at 747-5148 or by email to cass@utep.edu, or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at www.sa.utep.edu/cass. CASS' staff are the only individuals who can validate and if need be, authorize accommodations for students with disabilities.

Scholastic Dishonesty: Any student who commits an act of scholastic dishonesty is subject to discipline. Scholastic dishonesty includes, but not limited to cheating, plagiarism, collusion, and submission for credit of any work or materials that are attributable

to another person.

Cheating is:

- Copying from the test paper of another student
- Communicating with another student during a test to be taken individually
- Giving or seeking aid from another student during a test to be taken individually
- Possession and/or use of unauthorized materials during tests (i.e. crib notes, class notes, books, etc.)
- Substituting for another person to take a test
- Falsifying research data, reports, academic work offered for credit

Plagiarism is:

- Using someone's work in your assignments without the proper citations
- Submitting the same paper or assignment from a different course, without direct permission of instructors

To avoid plagiarism, see:

https://www.utep.edu/student-affairs/osccr/_Files/docs/Avoiding-Plagiarism.pdf

Collusion is:

- Unauthorized collaboration with another person in preparing academic assignments

Important!

When in doubt on any of the above, please contact your instructor to check if you are following authorized procedure. Also, please check the UTEP's Handbook of Operating Procedures at: hoop.utep.edu.

8 Detailed Learning Outcomes

Level 3: Synthesis and Evaluation

Level 3 outcomes are those in which the student can apply the material in new situations. This is the highest level of mastery. On successful completion of this course, students will be able to identify, implement and use the following data structures as appropriate for a given problem:

1. Implement and use the following data structures to solve computational problems:
 - a. Linked lists
 - b. Binary trees as linked structures
 - c. Binary search trees as linked structures
 - d. Stacks
 - e. Queues

2. Trace code that uses:
 - a. Strings
 - b. Single-value data types
 - c. 1D and 2D arrays
 - d. Reference-based data structures
 - e. Iterative methods
 - f. Recursive Methods
 - g. Primitive vs. non-primitive data types

Level 2: Application and Analysis

Level 2 outcomes are those in which the student can apply the material in familiar situations, e.g., can work a problem of familiar structure with minor changes in the details. Upon successful completion of this course, students will be able to:

1. Describe, implement, and use the following algorithms for:
 - a. Searching: linear and binary search.
 - b. Sorting: merge sort, quicksort, and at least one quadratic sorting algorithm.
2. Use basic notions of algorithm complexity:
 - a. Use Big-O notation to describe the running time and memory requirements for an algorithm.
 - b. Determine the best- and worst-case behaviors of a simple algorithm.
3. Use standard problem-solving techniques such as: problem decomposition, iteration, and recursion.

Level 1: Knowledge and Comprehension

Level 1 outcomes are those in which the student has been exposed to the terms and concepts at a basic level and can supply basic definitions. On successful completion of this course, students will be able to:

1. Demonstrate an understanding of the features of object-oriented languages (related to the implementation of data structures discussed in other objectives)
2. Articulate the notion of average-case time complexity.