

# CS2401 Elementary Data Structures and Algorithms

Spring 2019

**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:** This semester, we will cover the following:

- 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.

## Logistics:

**Lecture sessions:** MW 10:30 a.m. -12 p.m. in CRBL C205

**Instructor:** Dr. Martine Ceberio – [mceberio@utep.edu](mailto:mceberio@utep.edu) – office room: CCSB 3.0406

**Office hours:** MW from 9 a.m. to 10:30 a.m.

+ **by appointment & open-door policy**

**Teaching Assistant:** Daniel Ornelas – [dornelas4@miners.utep.edu](mailto:dornelas4@miners.utep.edu)

**Instructional Assistant:** Daniela Garcia – [dgarciaher@miners.utep.edu](mailto:dgarciaher@miners.utep.edu)

**Peer Leader:** Oscar Galindo – [ogalindomo@miners.utep.edu](mailto:ogalindomo@miners.utep.edu)

**Textbook:** CS2401: Elementary Data Structures / Algorithms, by Zybooks (cost: \$77), available at [zybooks.zyante.com](http://zybooks.zyante.com). To subscribe to your textbook, please enter the following code:

**UTEPCS2401CeberioSpring2019**

**Communication platform:** We will use Piazza for class discussion as well as for posting assignments. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Piazza. If you have any problems or feedback for the developers, email [team@piazza.com](mailto:team@piazza.com).

Find our class page at: [piazza.com/utep/spring2019/cs2401](http://piazza.com/utep/spring2019/cs2401)

**Software:** Software used in this course is available on the desktop computers in the main computer lab and in the two instructional labs on the first floor. To use the course software on your home or laptop computer, instructions will be given in the labs and available online on our piazza page.

**IMPORTANT INFORMATION:** Do attend the lecture section of the instructor whose lab you are registered in.

## 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, 3 mid-term exams, student engagement, and a final exam.

The approximate percentages are as follows:

- 10% Homework
- 7% Quizzes, including in-class assignments
- 25% Lab grade
- 55% Exams (3 mid-term exams and 1 final exam)
- 3% Class and lab participation (includes on-time lecture and lab attendance, active participation in class and in lab, completion of any quizzes for attendance and survey purposes)

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

- 90% or higher is an A
- 80-89% is a B
- 70-79% is a C
- 60-69% is a D
- Below 60% is an F

*Note: Regardless of your standing in the class at that time, you need to earn a 65 or better at the final exam to pass the course as well as a 65 or better as your average grade on the lab assignments.*

## Expectations

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

**Class and Lab Participation:** Attendance and participation in all 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**. Attendance will be taken at every session (at first you will have to sign in but as time goes the instructor will know you and mark you present without your help) and will count towards your class participation grade.

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

**Professionalism: Students should notify the instructor prior to missing a session** if at all possible, and certainly right after if earlier was not possible. The instructor will allow two unexcused absences per semester before having the option to deduct points from the final grade (5 points per subsequent unexcused absence). **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 obtain the content covered during missed class(es) or labs.** 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.

**Quizzes and in-class assignments:** The purpose of each **quiz** is to ensure that students are staying current with the weekly reading assignments and to verify that they have acquired the skills developed in class. Quizzes are unannounced. They usually will usually be on-line quizzes accessible on socrative.com. There will be **no make-up** on missed quizzes.

There will also 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 online quizzes.

**Homework: Reading and homework assignments** will be announced in class and/or posted on piazza (under the Timeline section of Resources). If you miss a lecture session, it is your responsibility to find out what you missed, including assignments that might have been given in class. You should expect to spend **at least four hours per week outside of lecture** on reading and homework. You should plan to devote extra **four hours on your lab assignments**. Most of your homework will be work assigned on your online zybook: all deadlines are already available on your zybook (and on piazza, under Resources/Timeline) so that you can plan ahead. Completing the assigned activities on time will be crucial to your success in the class (since these activities prepare you for classwork) and to getting a good grade. Reading and homework assignments to be completed on your online textbook are usually meant to familiarize you with concepts that will be covered in depth in class. If you struggle in any way while working on these, it is crucial that you seek help as soon as possible.

**Online homework grade:** at each deadline, your instructor will collect your progress towards the due assignment. The % of completion you have achieved will be used to compute your grade on this particular homework.

**Extra-credit opportunities:** You will be given several opportunities to collect extra credit, to be applied to your homework grade (not to exceed an overall homework grade of 105%). These opportunities are already listed in the timeline of activities shared with you on piazza. There are three types of extra credit opportunities: catch-up homework, review homework, and extra work.

- Catch-up homework assignments are regularly scheduled during the semester and are meant to help you make up some of the points you may not have made by the deadline of each individual homework assignment. For each catch-up homework in which you get 100%, you will receive an extra 15 points to count towards your homework grade (not to exceed an overall homework grade of 105%).
- Review homework: is a one-time opportunity. If you complete at least 70% of the Review homework assignment due on March 3<sup>rd</sup>, you will receive 20 extra points to count towards your homework grade.
- Extra work: is also a one-time opportunity. If you complete at least 80% of the Debugging and troubleshooting homework assignment due on February 17<sup>th</sup>, you will receive 15 extra points to count towards your homework grade.

**Lab assignments and related homework:** 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. There will be 8 longer lab assignments and a few smaller lab activities. Lab assignments are designed for you to further your practice on the concepts presented in class and demonstrate your level of mastery of these. Homework can be assigned that is specific to the lab activities. In particular, you will notice that two assignments listed on your online zybook are labeled "Lab HW". Your completion of these will count towards your lab grade.

Other activities: in lab, once a week on most weeks, you will participate in group work during which you will solve problems (offline: at the white board).

Attendance: You are expected to attend and actively participate in labs. Attendance will be taken and will count towards your overall standing in the class.

Grade: Your grade for labs will be a combination of the grades you obtain at your lab assignments (80%), your participation and performance on smaller activities, as well as your active participation in the problem-solving group activities (15%), and finally, your homework completion (5%). This grade will weigh 25% of your overall CS2401 grade.

**Exams:** There will be **3 midterm exams** and **one final exam**. All four exams together will weigh 55% of your overall final grade for CS2401. Because the exams contribute so 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 come let me know as soon as possible and/or request appropriate accommodation from UTEP's Center for Accommodation and Students' Services.

The purpose of the **midterm exams** is to allow you to demonstrate mastery of course concepts covered thus far during the semester (hence each exam is comprehensive). Mid-term exams will take place during the regular lecture sessions and are tentatively scheduled to be held around week 6 (Feb. 27), week 12 (April 10), and week 14 (May 1). 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.

The **final exam** will be comprehensive. You must score 65% 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 in advance for accommodation. The final exam is scheduled to be held on May 17<sup>th</sup> from 10 a.m. to 12:45 p.m. (all final exams schedules are also available online, on the UTEP website). It is the students' responsibility to keep informed.

## Standing in the course

**Special Assignments:** will be given to students if deemed necessary, which will need to be completed 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.

## 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](mailto: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](http://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: <http://sa.utep.edu/osccr/wp-content/uploads/sites/8/2012/09/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: <https://admin.utep.edu/Default.aspx?tabid=73922>.

## 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. Design and implement solutions to computational problems using the following data structures:
  - a. multi-dimensional arrays;
  - b. lists implemented as arrays or linked lists;
  - c. stacks;
  - d. queues;
  - e. binary trees and binary search trees.

### 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 concepts:
  - a. classes, subclasses, and inheritance
  - b. encapsulation and information hiding
2. Describe, implement, and use the following algorithms:
  - a. sequential and binary search
  - b. quadratic and  $O(n \log n)$  sorting
  - c. string manipulation and parsing
3. Describe and trace computer representation and memory allocation of:
  - a. integers, real numbers, arrays and objects
  - b. methods, including recursive methods and the use of activation records
4. Use basic notions of algorithm complexity:
  - a. use Big-O notation to express the best-, average- and worst-case behaviors of an algorithm
  - b. determine the best, average and worst-case behaviors of a simple algorithm
5. Use recursion and iteration as problem solving techniques

### 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. Explain the concept of polymorphism