CSCI 311
Algorithms and Data Structures
Spring 2017 Syllabus

Instructor: Dr. Judy Challinger

<table>
<thead>
<tr>
<th>Office Hours</th>
<th>see my <a href="http://www.ecst.csuchico.edu/~jchallinger">homepage</a> for current information</th>
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</thead>
<tbody>
<tr>
<td>Office Location</td>
<td>OCNL 226</td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:jchallinger@csuchico.edu">jchallinger@csuchico.edu</a></td>
</tr>
<tr>
<td>Web</td>
<td><a href="http://www.ecst.csuchico.edu/~jchallinger">www.ecst.csuchico.edu/~jchallinger</a></td>
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Lecture: TR 3:30-4:45 OCNL 124
Activity Section 2: TR 11-11:50 OCNL 251
UPE Assistant T - Ken Siew R - Ken Siew
Activity Section 3: TR 1-1:50 OCNL 251
UPE Assistant T - Terrence Lim R - Mark Woolsey
Course Information

Prerequisite: CSCI 211, CSCI 217 or MATH 217, all with a grade of C or higher.

Required Textbook:

Introduction To Algorithms, Third Edition - aka "CLRS"
Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein
The MIT Press
July 2009
ISBN: 9780262033848

On 2 hour reserve in Meriam Library.

- Errata!
- Solutions Manual

Required - Access to ECC Server (jaguar): You will access this account via the lab machines or remotely at jaguar.csuchico.edu, using your portal credentials. This ECC Linux server is where your programming assignments will be graded. You are responsible for ensuring that your submissions compile and execute correctly on jaguar. All programming in this course is done in C++ using the GNU toolchain.

Catalog Description: This course focuses on object-oriented methodologies in designing and implementing a variety of data structures and algorithms. Coverage includes recursion, trees, search structures, hashing, heaps, sorting algorithms, and graph algorithms. Data structure and algorithm combinations will be studied and analyzed along with their relative merits using both mathematical and empirical measurements. The course includes a number of large programming assignments focusing on object-oriented software engineering and algorithm development. Students will be required to design, implement, test, and analyze their programs in at least one object-oriented language. 3 hours lecture, 2 hours activity.
Topics:

- growth of functions and asymptotic notation
- algorithm design and analysis, proofs of correctness
- object-oriented design and implementation
- algorithmic strategies, divide-and-conquer, greedy strategies
- sorting algorithms & properties
- hash tables and hash functions
- binary trees, red-black trees, B-trees
- graph data structures, breadth-first search, depth-first search
- minimum spanning trees, shortest paths
- selected advanced topics as time allows

Learning Outcomes: Upon completion of this course, students will be able to...

1. Explain what is meant by “best”, “expected”, and “worst” case behavior of an algorithm.
2. In the context of specific algorithms, identify the characteristics of data and/or other conditions or assumptions that lead to different behaviors.
3. Determine informally the time and space complexity of simple algorithms.
4. State the formal definition of big O.
5. List and contrast standard complexity classes.
6. Perform empirical studies to validate hypotheses about runtime stemming from mathematical analysis by running algorithms on input of various sizes and comparing performance.
7. Use big O notation formally to give asymptotic upper bounds on time and space complexity of algorithms.
8. Explain the use of big omega and big theta to describe the amount of work done by an algorithm.
9. Use recurrence relations to determine the time complexity of recursively defined algorithms.
10. Use recursion trees to visualize the time complexity of recursively defined algorithms.
11. Use a divide-and-conquer algorithm to solve an appropriate problem.
12. Use a greedy approach to solve an appropriate problem.
13. Determine an appropriate algorithmic approach to a problem.
14. Implement simple search algorithms and explain the differences in their time complexities.
15. Implement common quadratic and $O(n \log n)$ sorting algorithms.
16. Implement a hash table with an effective hashing function and collision resolution.
17. Discuss the runtime and memory efficiency of principal algorithms for sorting, searching, and hashing.
18. Explain how tree balance affects the efficiency of various binary search tree operations.
19. Solve problems using fundamental graph algorithms, including depth-first and breadth-first search.
20. Describe the heap property and the use of heaps as an implementation of priority queues.
21. Solve problems using graph algorithms, including single-source and all-pairs shortest paths, and at least one minimum spanning tree algorithm.

You are responsible for regularly checking the course schedule. The schedule will show lecture topics, reading assignments, due dates, and the dates of the examinations. Future lecture topics are tentative, and are subject to change. As the semester progresses, the schedule will be updated to reflect the material actually covered and/or changes in due dates.

Class Rules and Expectations: Your attendance at all class meetings (lecture and lab) is required. Students with 3 or more unexcused absences from either lecture or lab will be dropped from the course. See the catalog. If you are absent for any reason, it is your responsibility to communicate with me. Coming to class gives you the opportunity to ask questions, do collaborative work, network with your peers, hear tips and hints about exams and assignments, etc. Habitual absences negatively impact your learning and your grades. The number one predictor of success or failure in this course is "engaged attendance". During lecture and lab, you are expected to be focused on the material from this course. Put away phones, use laptops only for course-related tasks, and minimize distractions to yourself and the other students in the course. Students creating a distraction to themselves or others will be asked to leave the classroom. To make the most of your time in class, do the assigned reading for each week before you come to lecture.
Time Commitment: This is a 4 unit course. You should expect to spend at least 2 hours outside of class for each hour in class. So you should expect to spend at least 15 hours per week on this course reading, writing, coding, and attending class. This is a federal requirement. See the catalog. If you don't make the commitment to spending this time, you will not get much out of the course and may not earn a passing grade. So make yourself a weekly schedule and block out the study times and stick to it.

Grading: Your grade will be based on the following:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Midterm</td>
<td>20%</td>
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<tr>
<td>Final Exam</td>
<td>30%</td>
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<tr>
<td>Quizzes</td>
<td>10%</td>
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<tr>
<td>Assignments</td>
<td>40%</td>
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Exams: There will be one midterm and a comprehensive final. No makeup exams will be given unless arranged in advance. Exams are not returned to students, but you are welcome to come to office hours to view your exam.

Quizzes: There will be periodic quizzes on the reading assignments to date. Quizzes may or may not be announced in advance. Keep up on the assigned reading! Don't be late to class! No makeup quizzes will be given unless arranged in advance. Quizzes are returned to students.

Assignments: These may include programming assignments, research and writing assignments, presentations, preparation and class participation, and in-class activities. Assignments are due by the date specified. Programming assignments will have a 24 hour grace period in which the assignment may be turned in for reduced credit. Other than this, late assignments will not be accepted. You are expected to work independently on all assignments unless otherwise instructed. Failure to do so will result in disciplinary action for academic dishonesty. All programming assignments are to be done independently with no exceptions. Read my expectations for programming assignments.

Final Grade Assignment: Your letter grade will be based on the percentage of the available points you earn in the course, as follows:
<table>
<thead>
<tr>
<th>Percent</th>
<th>Grade</th>
<th>University Definition</th>
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<tbody>
<tr>
<td>[95-100]</td>
<td>A</td>
<td>Superior Work</td>
</tr>
<tr>
<td>(90-95)</td>
<td>A-</td>
<td></td>
</tr>
<tr>
<td>(87-90)</td>
<td>B+</td>
<td>Very Good Work</td>
</tr>
<tr>
<td>(83-87)</td>
<td>B</td>
<td>Adequate Work</td>
</tr>
<tr>
<td>(80-83)</td>
<td>B-</td>
<td>Minimally Acceptable Work</td>
</tr>
<tr>
<td>(77-80)</td>
<td>C+</td>
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</tr>
<tr>
<td>(73-77)</td>
<td>C</td>
<td>Unacceptable Work</td>
</tr>
<tr>
<td>(70-73)</td>
<td>C-</td>
<td></td>
</tr>
<tr>
<td>(65-70)</td>
<td>D+</td>
<td></td>
</tr>
<tr>
<td>(60-65)</td>
<td>D</td>
<td></td>
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<tr>
<td>(0-60)</td>
<td>F</td>
<td>Unacceptable Work</td>
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**University Policies and Campus Resources:**

**Dropping and Adding:** Dr. Challinger will adhere to the policies published by the University with respect to such things as adding and dropping courses, and grading policies. You should be aware of the deadlines, penalties, and limitations for adding and dropping classes. It is your responsibility to familiarize yourself with these policies. You will find them in the CSU Chico University Catalog under Academic Policies and Regulations.

**Academic Integrity:** Students are expected to be familiar with the University’s Academic Integrity Policy. Your own commitment to learning, as evidenced by your enrollment at California State University, Chico, and the University’s Academic Integrity Policy requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the Office of Student Judicial Affairs. It is your responsibility to understand the definition of academic integrity, and conduct yourself accordingly. More information is available from Student Judicial Affairs. When in doubt, ask your Professor! Infractions of this nature will be vigorously prosecuted by Dr. Challinger and the College of Engineering, Computer Science, & Construction Management. **Cheating on exams or assignments will result in an F in the course and referral to Student Judicial Affairs.**
Americans with Disabilities Act: If you need course adaptations or accommodations because of a disability or chronic illness, or if you need to make special arrangements in case the building must be evacuated, please contact the Accessibility Resource Center (ARC) as they are the designated department responsible for approving and coordinating reasonable accommodations and services for students with disabilities. ARC will help you understand your rights and responsibilities under the Americans with Disabilities Act and provide you further assistance with requesting and arranging accommodations.

Accessibility Resource Center
530-898-5959
Student Services Center 170
arcdept@csuchico.edu