CmSc 250 A: Introduction to Design and Analysis of Algorithms, Fall Semester 2012

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Office: Carver Science 235, Phone: 961-1841 (office), 962-1574 (home)

Course Description
This course provides a survey of useful techniques for solving problems that arise frequently in computer applications. Topics to be covered include advanced data structures, advanced sorting and searching algorithms, graph representations, algorithm design techniques, and the fundamentals of computational complexity and analysis of algorithms. Laboratory exercises will be used to demonstrate problem solving techniques. Programming assignments and laboratory work will be done in Java programming language. This is a Writing Communication course.

Prerequisites: CmSc155 Fundamentals of Computing II, CmSc175 Discrete Mathematics, Math 151 Calculus I.

Course Objectives
- Understand basic data structures for searching and sorting – hash tables, trees, heaps, and the computational complexity of the searching and sorting algorithms that use these structures.
- Understand advanced sorting algorithm and their computational complexity.
- Understand basic graph algorithms and their computational complexity.
- Understand basic classes of algorithms, such as greedy algorithms, divide-and-conquer algorithms, branch-and-bound algorithms, genetic algorithms, backtracking algorithms.
- Understand the concepts of computational complexity and computability and be able to apply in practice the Big-Oh notation technique for complexity evaluation.

Embedded Skill: Written Communication. Written Communication courses promote strong writing skills that students need in order to comprehend, analyze, and synthesize a variety of texts in a variety of disciplines. These courses teach students to write in multiple contexts, whether they are exploring and developing their own ideas, responding fairly and responsibly to the ideas and perspectives of others, or crafting polished, compelling and persuasive texts.

Through completion of a WC course, students should be able to
- articulate an idea and formulate a thesis
- organize thoughts in a logical fashion
- support arguments with credible evidence
- address the requirements of various audiences
- identify and correct sentence-level errors

These objectives will be met through the following assignments and activities:
Students have weekly writing assignments in the form of lab reports of 500 words (total for the semester about 5000). Students also work on a semester long research project which includes 4 writing assignments: a survey paper (4 – 5 pages), algorithm description and analysis (2-3 pages), program documentation (2-3 pages), a final paper (8 – 10 pages single spaced)

Coursework, assignments and tests

Teamwork

Most of your work in this class will be done in teams. Teams will be formed during the first week of the semester, but they may be reconfigured depending on the circumstances. For the purpose of grading, you will submit individually all assignments on Scholar. Documents produced as a result of teamwork have to be signed by all members of the team.

Preparation for class and class activities

You have to read each scheduled chapter in advance and prepare with your team one-page summary of the basic ideas in the chapter. Most certainly there will be difficult spots, and things that you have not understood. You have to write down all questions. Be specific – refer to a particular paragraph, statement, or figure in the textbook. In class, we will discuss the questions. Each of you will do at least one class presentation of a chosen algorithm. Your active participation in class is extremely important for completing successfully this class.

Quizzes

Almost every class period will start with a quiz. You will have to provide short answers to questions on the material discussed in the previous class. Quizzes will be graded.

Homework assignments

You will have bi-weekly homework assignments based on the exercises in the textbook. Some of the problems will involve programming. The programs should run on the Lab computers. Most of the problems are difficult and will require creative thinking and time. Please, plan in advance. You will be graded both on the correctness of your solutions and on the clarity and conciseness of their description.

Laboratory work

Our Lab time will be spent on various activities:

- Implement algorithms described in the textbook
- Discuss issues related to your homework assignments and research projects
- Practice algorithm analysis
- Solve problems from the textbook

Some lab work will be done in teams, some of it will be graded. All lab work will be documented in the form of lab reports.

Research project

The purpose of the research project is to extend your knowledge beyond the scope of the material discussed in class. You will gain experience in exploring new topics and learning about new methods and approaches in algorithm design. The work involves researching resources, studying some new theory, and developing a program that illustrates a specific approach or a method to solve problems within the scope of the researched topic. I will provide significant support in terms of materials and algorithms/source code if available.

A list of research topics will be posted on the class web page. Research topics will be assigned during the third week of the semester. Progress on the research projects will be recorded in three intermediate
reports, draft paper and a final report. Deadlines are given in the class schedule. All research projects will be presented in class during the last week of the semester. The outcome of your work will be a paper and a program to be demonstrated during the presentation.

**Mid-Term and Final exams**

The Midterm and Final exams will contain questions and problems on the material in the textbook. Your midterm grade will be determined by the current homework grades, class preparation, your progress on the research project and the result of the midterm exam.

**Policy on late assignments**

All assignments have due dates. They have to be uploaded on Scholar on or before the due date. The names of all files that you send must start with your first name and must contain a reference to the particular assignment e.g. *John_HW01.doc*.

The penalty for being late is 10% reduction of the grade for each day after the due date. You will have the option to turn in late (but not later than 24 hours after the due time) two assignments without penalty. Use this option in case of unexpected circumstances.

You are encouraged to send your homework earlier (at least 48 hours before the due time) for feedback. This will not affect your grade.

**Instructional Help**

I will be generally available for any type of questions and consultations during and outside my office hours. You are encouraged also to send questions by e-mail.

**Grading Policies**

The final grade will be determined by (but not necessarily equal to) the ratio of the points you have earned and the total number of points. The assignments and tests will be weighted as follows:

<table>
<thead>
<tr>
<th>Assignment Type</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory work</td>
<td>10%</td>
</tr>
<tr>
<td>Class Participation</td>
<td>10%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>10%</td>
</tr>
<tr>
<td>Homework assignments</td>
<td>20%</td>
</tr>
<tr>
<td>Research project</td>
<td>25%</td>
</tr>
<tr>
<td>Exams</td>
<td>25%</td>
</tr>
</tbody>
</table>

Necessary conditions to pass this class: The average grade of each type of coursework listed in the table above should be at least D-.

Grades follow a normal distribution as shown in the following table where the percentage is the lowest percentage allowed to obtain that grade.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>B +</td>
<td>87.0%</td>
</tr>
<tr>
<td>C +</td>
<td>77.0%</td>
</tr>
<tr>
<td>D +</td>
<td>67.0%</td>
</tr>
<tr>
<td>B</td>
<td>83.0%</td>
</tr>
<tr>
<td>C</td>
<td>73.0%</td>
</tr>
<tr>
<td>D</td>
<td>63.0%</td>
</tr>
<tr>
<td>A -</td>
<td>90.0%</td>
</tr>
<tr>
<td>B -</td>
<td>80.0%</td>
</tr>
<tr>
<td>C -</td>
<td>70.0%</td>
</tr>
<tr>
<td>D -</td>
<td>60.0%</td>
</tr>
</tbody>
</table>
Study Time
This is a four credit course that meets 3 days per week for 60 minutes and 1 day per week for 90 minutes. It is designed to have learning opportunities and activities totaling approximately 167 hours over the 16 weeks of the course (including finals week). The designed activities may take each student a different amount of time to finish, however the average will be 167 hours. Further estimates include:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>In class activities</td>
<td>40</td>
</tr>
<tr>
<td>In lab activities</td>
<td>19</td>
</tr>
<tr>
<td>Required readings (12 chapters x 2 hours each)</td>
<td>24</td>
</tr>
<tr>
<td>Research project (including searching and evaluating research)</td>
<td>30</td>
</tr>
<tr>
<td>Homework assignments (6 x 6 hours each)</td>
<td>36</td>
</tr>
<tr>
<td>Preparation for exams</td>
<td>18</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>167</strong></td>
</tr>
</tbody>
</table>

How to Succeed in This Class
- Read the lecture notes and the discussed sections in the textbook before and after each class session. Send questions on specific paragraphs that are difficult for you to understand.
- Start to work early on your homework. In case of difficulties, send me your questions.
- Attend classes and participate in class discussions. Take notes. Spending 15 minutes to read your notes immediately after class is very much worth the effort.
- Make a weekly schedule of the time you are going to spend studying for this class. Generally you will need 10 – 12 hours per week out-of-class time spent in studying, including work on homework problems and your research project.

Attendance
I will take attendance as required for financial aid purposes.

Academic Integrity
In all endeavors, Simpson College expects its students to adhere to the strictest standards of honesty and integrity. In keeping with the College’s mission to develop the student’s critical intellectual skills, while fostering personal integrity and moral responsibility, each student is expected to abide by the Simpson College rules for academic integrity. Academic dishonesty includes (but is not limited to) any form of cheating, plagiarism, unauthorized collaboration, misreporting any absence as college-sponsored or college-sanctioned, submitting a paper written in whole or in part by someone else, or submitting a paper that was previously submitted in whole or in substantial part for another class without prior permission. If the student has any questions about whether any action would constitute academic dishonesty, it is imperative that he or she consult the instructor before taking the action. All cases of substantiated academic dishonesty will be reported to the student’s academic advisor and the Dean for Academic Affairs. For further guidance on these rules and their sanctions, please see the college catalog.

Inclement Weather
In case classes are canceled due to inclement weather, I will send you an e-mail with instructions how to proceed with the material scheduled for the canceled class meeting.
Continuity Plan
Should the normal instructional activity on the campus be interrupted or shortened by a campus-wide closing, students will receive information from the instructor or other representative of the college about when and if the course might be continued or completed via Internet, telephone, or United States mail.

Miscellaneous
Any issues not discussed above will be solved on a case by case basis.