

## Course Description

**Instructor.** Prof. Richard Chang <chang@umbc.edu>

Office Hours: Tue & Wed 3pm – 4:30pm, ITE 326.

**Teaching Assistants.** Aniruddha Saha <anisaha1@umbc.edu>, Dayuan Tan <dayuan1@umbc.edu>

**Course Web Page.** <http://umbc.edu/~chang/cs441>

**Time and Place.**

Section 02: Tue & Thu 10:00am – 11:15am, SOND 206

Section 01: Tue & Thu 11:30am – 12:45pm, SOND 206

**Textbook.** *Introduction to Algorithms*, third edition, Cormen, Leiserson, Rivest and Stein.  
MIT Press (ISBN: 0262033844, 978-0262033848).

**Prerequisites.** Students taking CMSC 441 should have mastered the material covered in the following courses: CMSC 203 (Discrete Structures), CMSC 341 (Data Structures) and MATH 152 (Calculus and Analytic Geometry II). The material in Appendix B, Chapter 10 and Chapter 12 of the textbook (covering sets, elementary data structures and binary search trees) should be familiar. Some knowledge of probability and counting (Appendix C of the textbook) is also expected. Students must be able to understand and be able to write proofs by induction. In addition, proficiency in the implementation of the elementary data structures (e.g. stacks, queues, linked lists, heaps and balanced binary trees) in C/C++ or Java is assumed.

**Objectives.** In this course students will

1. learn the quantitative methods used in the analysis of algorithms;
2. sharpen their problem solving skills through the design of algorithms; and
3. learn to write explanations for the correctness of algorithms and justifications for their performance.

A secondary goal of this course is to familiarize students with a range of fundamental algorithms.

**Grading.** Final grades will be based upon homework assignments (30% total), quizzes (45% total) and the final exam (25%). The syllabus lists 13 homework assignments and 6 quizzes. However, if a homework assignment or quiz is canceled and not made up (e.g., because UMBC is closed for snow or hurricane), the proportion of your grade from homework, quizzes and the final exam will remain the same. That is, homework will still count for 30% of your grade and quizzes 45% of your grade (each homework or quiz will have greater weight).

The lowest homework grade that exceeds 40% will be dropped, if this increases your overall homework average. In particular, missed homework assignments will receive a grade of 0 and will not be dropped from the computation of your homework average. The intention of this policy is to allow students to disregard the homework grade from a "bad week" but not encourage students to completely ignore a homework assignment.

The final letter grade is based on the standard formula:

$$0 \leq F < 60, \quad 60 \leq D < 70, \quad 70 \leq C < 80, \quad 80 \leq B < 90, \quad 90 \leq A \leq 100$$

Grades will not be "curved" — that is, the percentages of A's, B's and C's are not fixed. However, depending upon the distribution of grades in the class, there may be adjustments in the students' favor, but under no circumstances will the letter grades be lower than in the standard formula. As a guideline, a student receiving an "A" should be able to solve the homework problems with facility; design and analyze new

algorithms in written exams; and demonstrate an understanding of the impact of theoretical analysis in practical programming settings.

Grades are given for work done *during* the semester; incomplete grades will only be given for medical illness or other such dire circumstances. In particular, taking more classes than you can handle is not a legitimate excuse for receiving an incomplete.

**Quizzes.** There will be in-class quizzes on Tuesdays: 9/18, 10/2, 10/16, 10/30, 11/13 and 12/4. The dates for quizzes will not change unless campus is closed (e.g., due to snow). You must make every effort to attend — unexcused absences will result in a grade of zero for that quiz. Each quiz will be held during the last 30 minutes of the class period.

Each quiz will consist of one or two questions (possibly with multiple parts) on pre-announced topics. The questions will require you to solve new problems (i.e., not simply regurgitate of facts). In order to do well in these quizzes, you must be able to do the types of questions assigned for homework on your own. *If you do not learn from doing your homework, you will not pass the quizzes.*

**Exams.** The Registrar has already posted the schedule for the final exams:

Section 01: Thu Dec 13, 10:30am – 12:30pm, SOND 206

Section 02: Tue Dec 18, 10:30am – 12:30pm, SOND 206

There are no midterm exams.

**Lectures.** Students are expected to attend all lectures and are responsible for all material covered in the lecture as well as those in the assigned reading. However, this subject cannot be learned simply by listening to the lectures and reading the book. In order to master the material, you must spend time outside the classroom, to think, to work out the homework and understand the solutions.

The purpose of the lectures is to explain the parts of the reading that are difficult to understand. *Lectures do not replace the reading.* Lectures will mostly be presented on the blackboard. *You will need to take notes.* Prepared slides might be used to display diagrams that too complicated to draw during lecture, but these slides will not contain detailed write up of the material because that is in your textbook (which you should read).

**Homework Policy.** Assignments are due at the *beginning* of lecture. *Late homework will not be accepted — this is to allow for timely grading and discussion of the homework solutions.* Reasonable provisions will be made for students who are delayed by traffic, who are on travel, ... *Late homework will be rejected from students who have obviously been working on homework instead of attending lecture.* Partial credit will be given for serious attempts on the homework problems. So you should simply turn in whatever you have accomplished by the beginning of class. If you cannot attend lecture when homework is due, for some honorable reason, you must make arrangements to submit your homework directly to the instructor. Do not ask another student to submit your homework for you. This is to reduce the temptation to cheat (see below).

**Academic Integrity.** Students are allowed to, and even encouraged to, collaborate on homework problems. Collaborators and reference materials must be acknowledged at the top of each homework assignment. However, homework solutions must be written up *independently*. A student who is looking at someone else's solution or notes, whether in print or in electronic form, while writing up his or her own solution is considered to be cheating. Cases of academic dishonesty will be dealt with seriously.

Finally, looking up the solutions to homework problems completely defeats the purpose of homework assignments, which is to train your mind to think. If you bypass this training, you will do poorly in the quizzes and in the final exam. The purpose of homework isn't to obtain the correct solution — it is to have you practice thinking.

The UMBC academic integrity policy is available at: <<https://aetp.umbc.edu/ai/>>

We will follow the textbook *Introduction to Algorithms*, third edition, by Cormen, Leiserson, Rivest and Stein. The following schedule outlines the material to be covered during the semester and specifies the corresponding sections of the textbook.

Date	Topic	Quiz	Reading	Homework	
				Assign	Due
Thu 08/30	Recursion & Induction		1.1-3.2	HW1	
Tue 09/04	Summations		A.1-A.2		
Thu 09/06	Recurrences		4.1-4.2	HW2	HW1
Tue 09/11	Master Theorem		4.3-4.4		
Thu 09/13	Heapsort		6.1-6.5	HW3	HW2
Tue 09/18	Quicksort	<b>Quiz 1</b>	7.1-7.4		
Thu 09/20	Lower bounds on Sorting		8.1-8.4	HW4	HW3
Tue 09/25	Linear-Time Selection		9.1-9.3		
Thu 09/27	Dynamic Programming I		15.1-15.3	HW5	HW4
Tue 10/02	Dynamic Programming II	<b>Quiz 2</b>	15.4-15.5		
Thu 10/04	Greedy Algorithms I		16.1-16.2	HW6	HW5
Tue 10/09	Greedy Algorithms II		16.3		
Thu 10/11	Dynamic Programming vs Greedy			HW7	HW6
Tue 10/16	Dynamic Programming vs Greedy	<b>Quiz 3</b>			
Thu 10/18	Basic Graph Algorithms I		22.1-22.2	HW8	HW7
Tue 10/23	Basic Graph Algorithms II		22.3-22.4		
Thu 10/25	Basic Graph Algorithms III		22.5	HW9	HW8
Tue 10/30	Minimum Spanning Trees I	<b>Quiz 4</b>	23.1-23.2		
Thu 11/01	Disjoint Set Union		21.1-21.3	HW10	HW9
Tue 11/06	Minimum Spanning Trees II				
Thu 11/08	Shortest Paths I		24.1-24.3	HW11	HW10
Tue 11/13	Shortest Paths II	<b>Quiz 5</b>	24.4-24.5		
Thu 11/15	Shortest Paths III		25.1-25.3	HW12	HW11
Tue 11/20	Maximum Flow I		26.1-26.3		
Thu 11/22	<i>Thanksgiving break</i>				
Tue 11/27	Maximum Flow II				
Thu 11/29	Maximum Flow III			HW13	HW12
Tue 12/04	NP-completeness	<b>Quiz 6</b>	34.1-34.5		
Thu 12/06	NP-completeness				HW13
Tue 12/11	Review				
Thu 12/13	<b>Section 01 Final Exam 10:30am – 12:30pm</b>				
Tue 12/18	<b>Section 02 Final Exam 10:30am – 12:30pm</b>				