

## Course Description

**Instructor.** Prof. Richard Chang, [chang@umbc.edu](mailto:chang@umbc.edu), 410-455-3093.

Office Hours: Tue 10am–11am, Wed & Thu 1:30pm – 2:30pm, ITE 326.

**Teaching Assistants.** TBA

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

**Time and Place.**

Tuesday & Thursday 11:30am – 12:45pm, ACIV 014 (Section 1)

Monday & Wednesday 10:00am – 11:15am, SOND 204 (Section 2)

**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 201 & 202 (Computer Science I & II), 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 school 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.

**Quizzes.** In-class quizzes are listed in the course syllabus.

Section 1 (Thu): 2/13, 2/27, 3/13, 4/3, 4/17, 5/1.

Section 2 (Wed): 2/12, 2/26, 3/12, 4/2, 4/16, 4/30.

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 final exams will be given on Thursday, May 15, 10:30am – 12:30pm (Section 1) and on Monday, May 19, 10:30am - 12:30pm (Section 2). There are no midterm exams.

**Lecture and Homework Policy.** 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.

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.

*The UMBC academic integrity policy is available at [http://www.umbc.edu/undergrad\\_ed/ai/](http://www.umbc.edu/undergrad_ed/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	
Section 2	Section 1				Assign	Due
Mon 01/27	Tue 01/28	Introduction, Proof by Induction		1.1-3.2	HW1	
Wed 01/29	Thu 01/30	Summations		A.1-A.2		
Mon 02/03	Tue 02/04	Recurrences		4.1-4.2	HW2	HW1
Wed 02/05	Thu 02/06	Master Theorem		4.3-4.4		
Mon 02/10	Tue 02/11	Heapsort		6.1-6.5	HW3	HW2
Wed 02/12	Thu 02/13	Quicksort	<b>Quiz 1</b>	7.1-7.4		
Mon 02/17	Tue 02/18	Lower bounds on Sorting		8.1-8.4	HW4	HW3
Wed 02/19	Thu 02/20	Linear-Time Selection		9.1-9.3		
Mon 02/24	Tue 02/25	Dynamic Programming I		15.1-15.3	HW5	HW4
Wed 02/26	Thu 02/27	Dynamic Programming II	<b>Quiz 2</b>	15.4-15.5		
Mon 03/03	Tue 03/04	Greedy Algorithms I		16.1-16.2	HW6	HW5
Wed 03/05	Thu 03/06	Greedy Algorithms II		16.3		
Mon 03/10	Tue 03/11	Dynamic Programming vs Greedy				HW6
Wed 03/12	Thu 03/13	Dynamic Programming vs Greedy	<b>Quiz 3</b>			
Mon 03/17	Tue 03/18	<i>Spring Break</i>				
Wed 03/19	Thu 03/20	<i>Spring Break</i>				
Mon 03/24	Tue 03/25	Hash Tables		11.1-11.5	HW7	
Wed 03/26	Thu 03/27	Basic Graph Algorithms I		22.1-22.2		
Mon 03/31	Tue 04/01	Basic Graph Algorithms II		22.3-22.4	HW8	HW7
Wed 04/02	Thu 04/03	Basic Graph Algorithms III	<b>Quiz 4</b>	22.5		
Mon 04/07	Tue 04/08	Minimum Spanning Trees I		23.1-23.2	HW9	HW8
Wed 04/09	Thu 04/10	Disjoint Set Union		21.1-21.3		
Mon 04/14	Tue 04/15	Minimum Spanning Trees II			HW10	HW9
Wed 04/16	Thu 04/17	Shortest Paths I	<b>Quiz 5</b>	24.1-24.3		
Mon 04/21	Tue 04/22	Shortest Paths II		24.4-24.5	HW11	HW10
Wed 04/23	Thu 04/24	Shortest Paths III		25.1-25.3		
Mon 04/28	Tue 04/29	Maximum Flow I		26.1-26.3	HW12	HW11
Wed 04/30	Thu 05/01	Maximum Flow II	<b>Quiz 6</b>			
Mon 05/05	Tue 05/06	Maximum Flow III			HW13	HW12
Wed 05/07	Thu 05/08	NP-completeness		34.1-34.5		
Mon 05/12	Tue 05/13	Review				HW13
Mon 05/19	Thu 05/15	<b>Final Exam 10:30am–12:30pm</b>				