Course Description

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

  Office Hours: Tue 1:00pm – 2:00pm & Wed 1:30pm – 3:30pm, ITE 326.

Teaching Assistants. Aniruddha Saha `<anisaha1@umbc.edu>`

  Office Hours: TBA.

Course Web Page. `http://umbc.edu/~chang/cs441`

Time and Place. Tue & Thu 2:30pm – 3:45pm, ITE 227

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 12 homework assignments and 5 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 final letter grade is based on the standard formula:

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

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: 2/19, 3/5, 4/2, 4/16 and 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 Registrar has already posted the schedule for the final exam:

> Thu May 16, 1:00pm – 3:00pm, ITE 227

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 be a mix of prepared slides and presentations on the white/blackboard. *You will need to take notes and read the textbook.* The slides are not a transcript of the lecture.

Late Homework Policy. Assignments are due at the *beginning* of lecture — *this is to allow for timely grading and discussion of the homework solutions.*

Three times during the semester, you will be allowed to submit a late homework assignment without excuse and without penalty one lecture late (e.g., homework due on Thursday maybe submitted in class the next Tuesday). One late unexcused late assignment will be accepted for Homework 1-4, one for Homework 5-8 and another for Homework 9-12. This late policy is to allow you to juggle due dates from your other classes and deal with life issues such as colds, cars that won't start, etc. You do not accrue any credits for submitting all of your homework on time. For example, if you submit Homework 1-8 on time, you can still only turn in one of Homework 9-12 late. Instead, you will be commended for doing a good job balancing your workload, staying healthy and maintaining your vehicle.

Unexcused late homework not covered by the policy above may be submitted up to two weeks late (but no later than the final exam) for 50% credit.

All homework must be submitted on paper, in person, in class. Do not submit your homework by email. 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
Tue 01/29	Introduction		1.1-3.2		
Thu 01/31	Summations & Recurrences		A.1-A.2, 4.1-4.2	HW1	
Tue 02/05	Master Theorem		4.3-4.4		
Thu 02/07	Heapsort		6.1-6.5	HW2	HW1
Tue 02/12	Quicksort		7.1-7.4		
Thu 02/14	Lower bounds on Sorting		8.1-8.4	HW3	HW2
Tue 02/19	vEB Trees	**Quiz 1**	20.1-20.3		
Thu 02/21	Linear-Time Selection		9.1-9.3	HW4	HW3
Tue 02/26	Dynamic Programming I		15.1-15.3		
Thu 02/28	Dynamic Programming II		15.4-15.5	HW5	HW4
Tue 03/05	Greedy Algorithms I	**Quiz 2**	16.1-16.2		
Thu 03/07	Greedy Algorithms II		16.3	HW6	HW5
Tue 03/12	Dynamic Programming vs Greedy				
Thu 03/14	Dynamic Programming vs Greedy				HW6
Tue 03/19	*Spring Break*				
Thu 03/21	*Spring Break*				
Tue 03/26	Basic Graph Algorithms I		22.1-22.2		
Thu 03/28	Basic Graph Algorithms II		22.3-22.4	HW7	
Tue 04/02	Basic Graph Algorithms III	**Quiz 3**	22.5		
Thu 04/04	Minimum Spanning Trees I		23.1-23.2	HW8	HW7
Tue 04/09	Disjoint Set Union		21.1-21.3		
Thu 04/11	Minimum Spanning Trees II			HW9	HW8
Tue 04/16	Shortest Paths I	**Quiz 4**	24.1-24.3		
Thu 04/18	Shortest Paths II		24.4-24.5	HW10	HW9
Tue 04/23	Shortest Paths III		25.1-25.3		
Thu 04/25	Maximum Flow I		26.1-26.3	HW11	HW10
Tue 04/30	Maximum Flow II	**Quiz 5**			
Thu 05/02	Maximum Flow III			HW12	HW11
Tue 05/07	NP-completeness		34.1-34.5		
Thu 05/09	NP-completeness				HW12
Tue 05/14	Review				
Thu 05/16	**Final Exam 1pm – 3pm**				