Course Description

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

Office Hours: Tue&Thu 12:30pm – 1:30pm (in person ITE 326)

Wed: 1:30pm – 2:30pm (online https://meet.google.com/rsb-jxhe-ffa)

Teaching Assistant: Tobbi Caplan <tcaplan2@umbc.edu>

Office Hours: Thu 2:30pm – 3:30pm (in person ITE 344)

Fri 10:00am – 11:00am (online https://meet.google.com/rjm-teoe-kqa)

Grader: Rupesh Devasam <rupeshd1@umbc.edu>

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

Time & Place. Tue & Thu 10:00am - 11:15am, Sondheim 113

Textbook. *Introduction to Algorithms,* fourth edition, Cormen, Leiserson, Rivest and Stein. MIT Press (ISBN: 978-0262046305).

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;
3. practice thinking on their feet; and
4. 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. Grades will be based upon the following distribution:

Classwork (12)	3%
Homework (13)	33%
Quizzes (5)	40%
Final Exam	24%

The planned schedule has 13 homework assignments and 5 quiz topics. However, if a homework assignment or quiz is canceled and not made up — e.g., UMBC is closed for an extended period — homework will still be worth 33% and quizzes 40%.

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 their understanding in a time-limited quiz.

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 a heavy course load is not a legitimate excuse for receiving an incomplete.

Lectures. The purpose of the lectures is to explain the parts of the reading that are difficult to understand. *Lectures do not replace the reading.* The ability to read and understand the formal language in an algorithms textbook is a skill that you develop by practice.

Quizzes. Quizzes are scheduled for Tuesday 9/30, 10/14, 10/28, 11/11 and 12/02. (See Class Schedule.) Each quiz will consist of one or two questions (possibly with multiple parts) on that topic. The questions will require students to solve new problems (i.e., not simply regurgitate facts). The quizzes are **in-person**, closed-book and closed-notes.

Final Exam. The Registrar has scheduled the final exam for Tuesday Dec 16, 10:30am to 12:30pm. *Mark your calendars --- there will not be an option to take the final exam early.*

Classwork. Students will be asked to write down answers to questions posed during lecture. The responses will be collected at the end of class and checked for completion. Classwork will be graded on a scale of 0 to 5. Classwork will not be returned. There will be approximately 12 lectures with classwork. If more classwork is assigned, only the highest 12 scores will be counted.

Homework Submission. Homework will be submitted online in PDF. You have several options for preparing your responses. You can write on paper and convert to PDF using a smartphone app.This is the recommended method. Please do not just use your phone's camera app and take a picture of your work. Use one of many free scanner apps and adjust the settings so that your submission is legible.

You could also use LaTeX (or equivalent) to prepare a document. (Although drawing diagrams could be quite challenging.) If you have a tablet or a 2-in-1 laptop *and* you have some skill with a stylus, you can use one of those. Microsoft Word and Powerpoint are not recommended since they are terrible with math notation.

In any case, *please* use letter size paper (8.5x11 inches) and leave a good margin.

Homework Policy. You 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. All cases of cheating will be reported to the Academic Conduct Committee, this is standard practice.

Finally, looking up the solutions to homework problems completely defeats the purpose of homework assignments, which is to train a student's mind to think. Students who bypass this training will do poorly on the quizzes. The primary purpose of doing homework isn't to obtain the correct solution — it is to practice thinking. Once you see a solution without thinking about the problem, you have lost the learning opportunity.

Late Homework. Homework is due on Thursdays by 11:59pm. If you submit late homework, a deduction will be taken:

1 day late (by Friday 11:59pm)	-5%
2 days late (by Saturday 11:59pm)	-10%
3 days late (by Sunday 11:59pm)	-20%
4 days late (by Monday 11:59pm)	-40%
before next class (by Tuesday **10am**)	-100%

Late homework will not be accepted after 4 days. This allows us to discuss solutions during the next lecture.

Three times during the semester, you may use a late homework pass to rescind the penalty for late homework. One pass may be used for Homework 1-5, one for Homework 6-9 and one for Homework 10-13. Late passes do not carry over and do not accrue. E.g., if you submit all four of Homework 1-5 on time, you do not have an extra late pass for the remaining homework.

University Policies and Resources.

The UMBC academic integrity policy is available at: <https://tinyurl.com/yd26tx2d>

UMBC Policies on Accessibility & Disability Accommodations; Sexual Assault, Sexual Harassment, Gender Based Violence & Discrimination; Pregnancy and Parenting; Religious Observances & Accommodations; and Hate, Bias Discrimination & Harassment are described at the Office of Equity & Inclusion's website.

Fall 2025 CMSC 441-03 Design & Analysis of Algorithms, Class Schedule

		Lecture topics	Quizzes	Textbook Reading	HW Assigned	HW Due
1	**Thu Aug 28**	Introduction, Asymptotic notation		1.1-3.3, A.1-A.2	HW1	
2	**Tue Sep 02**	Strassen, Recurrence Relations, Substitution		4.1-4.2		
3	**Thu Sep 04**	Math review, Iteration, Master Theorem		4.3-4.4	HW2	HW1
4	**Tue Sep 09**	Heapsort		6.1-6.5		
5	**Thu Sep 11**	Quicksort		7.1-7.4	HW3	HW2
6	**Tue Sep 16**	Lower bounds on sorting, Counting Sort, Radix Sort		8.1-8.4		
7	**Thu Sep 18**	Linear-time Select		9.1-9.3	HW4	HW3
8	**Tue Sep 23**	Greedy		15.1-15.3		
9	**Thu Sep 25**	Greedy			HW5	HW4
10	**Tue Sep 30**	Greedy	**Quiz 1**			
11	**Thu Oct 02**	Dynamic Programming		14.1--14.4	HW6	HW5
12	**Tue Oct 07**	Dynamic Programming				
13	**Thu Oct 09**	Dynamic Programming			HW7	HW6
14	**Tue Oct 14**	Greedy vs Dynamic Programming	**Quiz 2**			
15	**Thu Oct 16**	Basic Graph Algorithms		20.1-20.2	HW8	HW7
16	**Tue Oct 21**	Basic Graph Algorithms		20.3-20.4		
17	**Thu Oct 23**	Basic Graph Algorithms		20.5	HW9	HW8
18	**Tue Oct 28**	Minimum Spanning Trees	**Quiz 3**	21.1-21.2		
19	**Thu Oct 30**	Disjoint-Set Union		19.1-19.3	HW10	HW9
20	**Tue Nov 04**	Minimum Spanning Trees				
21	**Thu Nov 06**	Shortest paths		22.1-22.3, 22.5	HW11	HW10
22	**Tue Nov 11**	Shortest paths	**Quiz 4**			
23	**Thu Nov 13**	Shortest paths		23.1-23.2	HW12	HW11
24	**Tue Nov 18**	Matching I		25.1		
25	**Thu Nov 20**	Matching II		25.2	HW13	HW12
26	**Tue Nov 25**	Matching III		25.3		
	Thu Nov 27	***Thanksgiving Break***				
27	**Tue Dec 02**	NP-completeness	**Quiz 5**	34.1-34.5		
28	**Thu Dec 04**	NP-completeness				HW13
29	**Tue Dec 09**	Review				
	Tue Dec 16	**10:30am - 12:30pm Final Exam**				