

Course Description

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

Office Hours: Tue & Thu 2:00pm – 3:00pm

Teaching Assistant. Aditi Choksi <aditichoksi@umbc.edu>

Office Hours: Mon & Fri 10:00am – 11:00am

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

Time. Tue & Thu 11:30am – 12:45pm

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;
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

Homework	30%
Exercises	5% 10%
Peer Grading	5% 10%
Self-check	5%
Participation	5%
Quizzes	50%

The planned schedule has 12 homework assignments, 20-25 exercises, and 6 quiz topics. However, if a homework assignment or quiz is canceled and not made up (e.g., because UMBC is closed for snow or hurricane), the percentage of each category will remain the same (e.g., homework will still be 30% of your final grade).

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

Lectures. A substantial portion of our meeting time will be devoted to answering questions, going over homework solutions, peer grading and quizzes. To make this possible, some lectures will be delivered asynchronously. You will need to do both: attend the synchronous lectures and watch the asynchronous 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.

Participation. ~~Class participation has been removed as a graded item. Your participation will be determined by how often you ask good questions. You may ask questions during a synchronous lecture using the chat feature. You may also email Prof. Chang with questions about homework and lecture (both synchronous and asynchronous). Emailed questions that cannot be answered by a quick email response (e.g., requires drawing diagrams) will be answered during class time. For full credit for participation, you should aim to ask a good question for about a third of the lectures.~~

Exams. There are no exams. We will use the time slot for the final exam, Thursday December 10 10:30am – 12:30pm, for make-up quizzes.

Quizzes. Starting Thursday September 24, there will be quizzes every Thursday. The quizzes will be given during the class meeting time. You must turn on your camera during these quizzes. You will hand write your responses on paper, convert your response into a PDF document and submit electronically. (Note: you may not type or use a stylus to create your responses. It must be done with pen or pencil on paper.)

The quizzes will be scored on 6 topics: recurrence relations, divide-and-conquer algorithms, greedy algorithms, dynamic programming and two topics on graph algorithms.

Each quiz will consist of one or two questions (possibly with multiple parts) on pre-announced topics. The questions will require students to solve new problems (i.e., not simply regurgitate of facts). The quizzes are open-book and you may bring notes hand-written on one 8.5x11 inch sheet of paper (both sides).

Quiz Policy. If you do poorly on a quiz topic, you may take a make-up quiz during one of the scheduled make-up quiz times. There are six such make-up quiz times. You can make up a quiz on any prior quiz topic. You must declare your topic by Tuesday before the quiz. Your score for the topic will be the *average* of all the quiz scores on that topic. (Note: if you are happy with your score for a quiz topic, you should not take a make-up quiz because that could *lower* your score.)

Addendum: students who choose to retake two quizzes during the final exam's time slot must pick two different topics.

In addition, you may bail on a quiz and not submit a response. When you bail, that attempt will not count in the average for that quiz topic. For example, if you score 70% and 90% on two attempts at dynamic programming, your average is 80%. If you bailed on the first attempt instead and scored 90% on the second attempt, then your average is 90%. However, you must be absolutely certain that you have enough make-up opportunities to submit at least one quiz for each topic. Otherwise, you will have a 0 on some topics.

Your responses on quizzes must *absolutely* be your individual work. You may consult the textbook and your one sheet of handwritten notes. You may not consult any person, or any online sources.

The very generous quiz policy, which at least doubles the workload for your professor, was designed to give you a better option than cheating. Why cheat when you can retake the quiz? Just do your best, then study more and do better on the retake. If you are really unprepared for a quiz, just bail.

If you nevertheless decide to cheat on a quiz, then you will receive a score of 0 on that quiz *and* all of your past and future retakes on quizzes will be revoked. If you bailed on the first attempt at a prior quiz topic, then you will receive a 0 on that topic. If you assist another student on a quiz, then you have cheated as well. These are intended to be harsh penalties, so just don't cheat.

Self-Check Questions. ~~Self-Check Questions have been removed as a graded item. After each meeting time, there will be a set of self-check questions that must be completed before the next meeting time. These are multiple-choice or true/false questions that should be fairly easy to answer if you understood the lecture.~~

Exercises and Peer Grading. Prior to most class meetings, you will also be asked to complete an exercise. Your response must be submitted online by midnight in PDF. (See homework submissions below for details on PDF submissions.) During class, your responses will be graded by two or more classmates. You will receive a score for your response *and* for peer grading. Some provisos:

- The score you receive for the exercise will be the average of the peer graded scores.
- Prof. Chang and/or the TA will spot check some of the peer grading and make adjustments if the scores given by the peer graders are incorrect.
- If you give incorrect scores, you will lose points for poor peer grading.
- If you alert Prof. Chang that the score you received is incorrectly high, then you can keep your erroneously high score but the graders will lose points for poor grading. (This is to prevent collusion.)
- You will submit your responses anonymously. The graders will not know your identity and you will not know the graders' identity.

Homework. 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 or a scanner. (This is the recommended method.) 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.

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 Tuesday may be submitted on Thursday). One full-credit unexcused late assignment will be accepted for Homework 1-4, one for Homework 5-8 and another for Homework 9-12. You do not accrue any credit for submitting homework assignments on time. For example, if you submitted all of Homework 1-8 on time, you can still only turn in one of Homework 9-12 late for full credit.

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

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.

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 homework is not to obtain the correct solution — it is to practice thinking.

Sharing. You do not have permission to share any course material with anyone. Do not post this syllabus, homework questions, quiz questions, recorded lectures to Chegg, Course Hero, Reddit, or any site. Do not share any course material with students who are not in this class, because they might in turn post the material. Finding their course materials Chegg makes old professors cranky. You much rather not have to deal with old cranky professors.

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

Additional UMBC Policies for Fall 2020 on Student Safety, Technology Access, Success in Online Courses and Enrollment Dates are described in [a separate handout](#).

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