

# CS 4040/5040: Design and Analysis of Algorithms

## Spring 2020

**Class Meetings:** Tue, Thu 9:00 – 10:20am, ARC 321

**Instructor:** Razvan Bunescu

**Office:** Stocker 341

**Office Hours:** Tue, Fri 3:00 – 4:00pm, or by email appointment

**Email:** bunescu@ohio.edu

**Class Website:** <http://ace.cs.ohio.edu/~razvan/courses/cs4040>

**Prerequisites:** CS 3610 (Data Structures) and basic mathematical dexterity.

### **Textbook:**

*Introduction to Algorithms* by T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, 3rd ed, The MIT Press, 2009.

### **Course Description:**

This course provides an introduction to the modern study of computer algorithms. Through this course students should be able to:

- 1) Analyze algorithm performance using complexity measurement.
- 2) Master major algorithms design techniques such as divide and conquer, greedy and dynamic programming.
- 3) Apply the above approaches to solve a variety of practical problems such as sorting and selection, graph problems, and other optimization problems.
- 4) Understand the theory of NP-completeness.

### **Course Outcomes:**

1. *Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions.* Students will be able to:

1. Apply the divide-and-conquer, greedy, and dynamic programming techniques to the design and analysis of algorithms.
2. Prove the correctness of algorithms using loop invariants or more general types of proofs.
3. Use the theory of NP-completeness to determine whether a computational problem can be solved efficiently.

2. *Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the programs discipline.* Students will be able to:

1. Design, implement, and test an efficient algorithmic solution for a given computational problem.
2. Use mathematical induction to prove asymptotic bounds for time complexity.
3. Use asymptotic notation to formulate the time and space requirements of algorithms.
4. Use the Master Theorem to analyze the asymptotic time complexity of divide and conquer algorithms.

5. Compare the implementation choices of specific data types, such as priority queues or graphs, and justify which is the most appropriate one for a given application.
6. Apply algorithmic principles to determine whether a given a set of requirements for a computational problem can be met.

6. *Apply computer science theory and software development fundamentals to produce computing-based solutions.* Students will be able to:

1. Produce an algorithmic approach that meets a given a set of requirements for a computer-based system.

**Grading:**

24%: 6 HW Assignments

10%: Project

16%: 2 In-Class Quizzes and multiple Take-Home Blackboard Quizzes

20%: Midterm Exam

30%: Final Exam

**Grading Scale:**

A (> 92%) A-(> 90%) B+(> 87%) B(> 83%) B-(> 80%)

C+(> 77%) C(> 73%) C-(> 70%) D+(> 67%) D(> 63%) D-(> 60%)

**Exam Dates:**

**Midterm:** Thursday, Mar. 5, in class.

**Final:** Thursday, Apr. 30, 8:00am – 10:00am.

**Other Important Dates:**

Tuesday, Mar. 10: Spring break, no class.

Thursday, Mar. 12: Spring break, no class.

Friday, Mar. 27: Last day to drop class.

Thursday, Apr. 23: Last day of this class.

**Course and Attendance policies:**

Assignments: All homework assignments are due before class. **No late submissions will be accepted.**

Attendance: **It is in your best interest to attend all the lectures.** Some of the material will not be found in the textbook or on the slides. Extra credit will be awarded for class activity. Also, be sure to check your OU email on a regular basis for important announcements.

**Academic Dishonesty Policy:**

**All work must be the student's own.** All external references used in reports must be properly cited. No credit will be given for duplicate or plagiarized work. Additional measures may be imposed by the University Judiciaries, when conditions warrant. Students may appeal academic sanctions through the grade appeal process. The OU Student Code of Conduct Policy is available online at:

<http://www.ohio.edu/communitystandards/academic/students.cfm>

**Disability-based Accommodation:**

Any student who suspects s/he may need an accommodation based on the impact of a disability should contact the class instructor privately to discuss the student's specific needs and provide written documentation from the Office of Student Accessibility Services. If the student is not yet registered as a student with a disability, s/he should contact the Office of Student Accessibility Services.

**Mental Health and Wellness:**

College can be a stressful time, and many things can prevent you from performing at your best, including strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. If you find yourself dealing with these or other issues that affect your mental health or academic performance, Ohio University offers services that can help. Drop-in counseling is available in Hudson Hall (3rd floor) from 9:45-3:15 Monday-Friday, as well as Counselor-in-Residence hours Sunday-Thursday from 5-10 pm in Living Learning Center, Room 160. Services are free to students with the OHIO Guarantee. If you need immediate assistance, you may call (740) 593-1616 24 hours per day, 7 days a week. For additional resources, visit:

<http://www.ohio.edu/student-affairs/counseling>.

**Other Policies:**

Be sure to notify the professor of any exam conflicts or other extenuating circumstances well in advance. **No missed exams will be made up without prior approval.** Medical excuse forms need to explicitly mention that the student could not have attended the exam at the specified time due to health concerns.