CS404/504: Design and Analysis of Algorithms
Fall 2011

Class Meetings: Mon, Tue, Thu, Fri 1:10pm – 2:00pm, ARC 315
Instructor: Razvan Bunescu
Office: Stocker 337
Office Hours: Tue, Fri 10am-12pm, or by email appointment
Email: bunescu@ohio.edu
Class Website: http://ace.cs.ohio.edu/~razvan/courses/cs404/

Prerequisites: CS361 (Data Structures) and some 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:

A: Ability to apply knowledge of Computing and Mathematics appropriate to the discipline. Students will be able to:

1. Use mathematical induction to prove asymptotic bounds for time complexity.
2. Prove the correctness of algorithms using loop invariants or more general types of proofs.
3. Use asymptotic notation to formulate the time and space requirements of algorithms.
4. Prove the tight asymptotic lower bound for the running time of any comparison-based sorting algorithm.
5. Prove that a problem is P, NP, or NP-Complete.

B: Ability to analyze a problem, and identify and define the computing requirements appropriate to its solution. Students will be able to:

1. Use the Master Theorem to analyze the asymptotic time complexity of divide and conquer algorithms.
2. Use the theory of NP-completeness to determine whether a computational problem can be solved efficiently.

C: Ability to design, implement, and evaluate a computer-based system, process, component or program to meet desired needs. Students will be able to:

1. Design, implement, and test an efficient algorithmic solution for a given computational problem.

I: Ability to use current techniques, skills, and tools necessary for computing practices. Students will be able to:

1. Apply the divide-and-conquer, greedy, and dynamic programming techniques to the design and analysis of algorithms.

J: Ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.

1. Comparatively evaluate sorting algorithms.
2. Apply algorithmic principles to determine whether a given a set of requirements for a computational problem can be met.
3. 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.
4. Produce an algorithmic approach that meets a given a set of requirements for a computer-based system.

Grades:

15%: 5 HW assignments
10%: 2 Quizzes
10%: Project
30%: Midterm Exam
35%: Final Exam

Exam Dates:

Midterm: Monday, Oct. 17, 1:10pm - 2:00pm (tentative)
Final: Thursday, November 17, 2:30pm - 4:30pm

Other Important Dates:

Monday, Oct. 10: Last day to drop class.
Friday, Oct. 21: Faculty retreat, no class.
Friday, Nov. 11: Veterans Day, no class.
Monday, Nov. 14: Last day of this class.

Week 1	Preliminaries (1, 2), Asymptotic Notation (3)	
Week 2	Master Theorem (4), Heap Sort (6) D&C: Quick Sort (7)	HW1 out
Week 3	Linear Time Sort (8), D&C: Selection (9) D&C: Matrix Multiplication (28)	HW2 out Quiz 1
Week 4	D&C: Closest Pair (33) Greedy: Minimum Spanning Trees (23)	HW3 out
Week 5	Greedy: SSSP (24) Greedy: Knapsack, Review	HW4 out
Week 6	DP: Knapsack DP: Matrix-Chain Multiplication	Proj. out
Week 7	DP: LCS, DP: Coin Changing	Midterm
Week 8	DP: APSP (25) Maximum Flow, Bipartite Matching (26)	Quiz 2
Week 9	Classes P & NP (34), NP-completeness (34)	HW5 out
Week 10	NP-complete problems (34), Review	
Week 11		Final

Tentative Schedule:

Course and Attendance policies:

All homework assignments are due before class. **No late submissions will be accepted**. It is in your best interest to attend all the lectures – some of the material will not be found in the textbook. Extra credit (up to 5 final points) will be awarded for class activity.

Academic Dishonesty Policy:

All work must be the student's own. All external references used in reports must be properly cited. Plagiarism will result in an F for the exam, project or assignment, and possible for the course. Stronger measures, within the guidelines of the Student Handbook, may be taken when conditions warrant. The OU Student Code of Conduct Policy is available online at http://www.ohio.edu/judiciaries/conduct_policy.cfm.

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.