

CS 430 - FALL 2017
INTRODUCTION TO ALGORITHMS
LECTURE MONDAY/WEDNESDAY 11:25am-12:40pm - 113 Stuart
RECITATION FRIDAY 11:25-12:15pm - 113 Stuart
COURSE INFORMATION & SYLLABUS

<http://www.cs.iit.edu/~cs430>

Instructor: Matthew Bauer bauerm@iit.edu Office Hours Monday 10-11am, Tuesday 8:30-11am, Wednesday 8:30-9:30;
Office:237B SB; 312-567-5148; (fax)312-567-5067; mailbox in CS dept(235-236 SB);

TA: ???

Textbooks: (Required) Introduction to Algorithms, 3rd edition, by Thomas Cormen, Charles Leiserson, Ronald Rivest, and Clifford Stein, MIT Press, 2009.

Current Catalog Description: Introduction to the design, behavior, and analysis of computer algorithms. Searching, sorting, and combinatorial algorithms are emphasized. Worst case and average bounds on time and space usage.
Prerequisites: ((CS330 or MATH230) and CS331) or CS401 or CS403.

Course Goals: Students should be able to:

1. Use big O, omega, and theta notation to give asymptotic upper, lower, and tight bounds on time and space complexity of algorithms.
2. Determine the time complexity of simple algorithms, deduce the recurrence relations that describe the time complexity of recursively defined algorithms, and solve simple recurrence relations.
3. Design algorithms using the greedy, dynamic programming, divide-and-conquer strategies.
4. Design algorithms using at least one other algorithmic strategy from the list of topics for this unit.
5. Use and implement the fundamental abstract data types -- specifically including heaps, balanced binary search trees, and graphs -- necessary to solve algorithmic problems efficiently.
6. Solve problems using techniques learned in the design of sequential search, binary search, $O(N \log N)$ sorting algorithms, and fundamental graph algorithms, including depth-first and breadth-first search, single-source and all-pairs shortest paths, and at least one minimum spanning tree algorithm.
7. Demonstrate the following abilities: to evaluate algorithms, to select from a range of possible options, to provide justification for that selection, and to implement the algorithm in simple programming contexts.
8. Communicate theoretical and experimental analyses of a set of algorithms (i.e. sorting) in a lab report format.
9. Understand the notions of NP-completeness, NP-hardness.

Class Meetings: Meetings consist of lecture, discussion, problem solving, presentation of homework solutions and exams. Pre-reading the textbook, viewing the pre-lecture videos, preparing your notes on the lecture handouts, and regular class attendance is essential to success. Students are expected to be prepared and to actively participate in class activities. Ignore the references in the pre-lecture videos to what lecture number it is and the pre-lecture quizzes. The pre-lecture quizzes have been incorporated into the lecture handouts.

Assignments: Homework(7 total)-25% LectureParticipation-5% Exam#1-20% Exam#2-20% Exam#2-30%
A=90-100 B=80-89 C=70-79 D=60-69 E=0-59 NO LATE HOMEWORK ACCEPTED! NO EXTRA CREDIT!
Failure to attend class and participate in class discussions will result in a lowering your final grade by one letter grade. Also, the instructor reserves the right to fail any student that receives a failing score on any exam regardless of the scores on the other assignments.

Ethics: Any behavior on the homework, projects, or exams that could be considered copying or cheating will result in an immediate zero on the assignment for all parties involved, failure in the class, and notification of the Undergraduate or Graduate Dean's Office.

Communication is critical to the success and satisfaction of the learning experience. Please use e-mail to communicate any class issues with me.

| Date | Topics | Chapters | Assignment |
|---|---|------------------------|--|
| Monday, August 21, 2017 Wednesday, August 23, 2017 | Pre-Lecture 01 Video (9:25) 1.Introduction to Algorithm Design, Complexity Analysis (CS430Lecture01Activities) 1.Introduction to Algorithm Design, Complexity Analysis (CS430Lecture02Activities) | 1,2,3 | |
| Monday, August 28, 2017 Wednesday, August 30, 2017 | Pre-Lecture 02 Video (7:41) 1.Introduction to Algorithm Design, Complexity Analysis (CS430Lecture03Activities) 2.Recurrence Relations (CS430Lecture04Activities) | 1,2,3 4.3-4,5 | |
| Monday, September 04, 2017 Wednesday, September 06, 2017 | Pre-Lecture 03 Video (9:19) Labor Day - no lecture 3.Divide & Conquer Sorting Methods - Quicksort, Heaps and Heapsort (CS430Lecture05Activities) | 6,7 | HW #1 (topics 1-2) Fri Sept 8, 11:25am |
| Monday, September 11, 2017 Wednesday, September 13, 2017 | Pre-Lecture 04 Video (5:45) 3.Divide & Conquer Sorting Methods - Quicksort, Heaps and Heapsort (CS430Lecture06Activities) 4.Lower bound on sorting (CS430Lecture07Activities) | 6,7 8.1-8.3 | HW #2 (topics 3-4) Fri Sept 15, 11:25am |
| Monday, September 18, 2017 Wednesday, September 20, 2017 | 5.Medians and Order Statistics (CS430Lecture08Activities) 6.Binary Search Trees (CS430Lecture09Activities) | 9 12.1-12.3 | EXAM #1 (topics 1-4) Fri Sept 22, 11:25am-12:40pm |
| Monday, September 25, 2017 Wednesday, September 27, 2017 | Pre-Lecture 05 Video (7:07) 7.Balanced Binary Search Trees (Red-Black trees, AVL trees) (CS430Lecture10Activities) 7.Balanced Binary Search Trees (Red-Black trees, AVL trees) (CS430Lecture11Activities) | 13 | |
| Monday, October 02, 2017 Wednesday, October 04, 2017 | Pre-Lecture 06 Video (8:25) 8.Augmenting Data Structures (CS430Lecture12Activities) 9.Introduction to Dynamic Programming (CS430Lecture13Activities) | 14.1-14.2 15.2-15.5 | HW #3 (topics 5-6) Fri Oct 6, 11:25am |
| Monday, October 09, 2017 Wednesday, October 11, 2017 | Pre-Lecture 07 Video (7:25) Fall Break - no lecture 9.Introduction to Dynamic Programming (CS430Lecture14Activities) | 15.2-15.5 | HW #4 (topics 7-8) Fri Oct 13, 11:25am |
| Monday, October 16, 2017 Wednesday, October 18, 2017 | Pre-Lecture 08 Video (9:17) 9.Introduction to Dynamic Programming 1 (CS430Lecture15Activities) 10.Introduction to Greedy Methods (CS430Lecture16Activities) | 15.2-15.5 16.1-16.3 | |
| Monday, October 23, 2017 Wednesday, October 25, 2017 | 10.Introduction to Greedy Methods (CS430Lecture17Activities) 11.Amortized Analysis (CS430Lecture18Activities) | 16.1-16.3 17.1-17.2 | HW #5 (topics 9-10) Fri Oct 27, 11:25am |

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| Monday, October 30, 2017 Wednesday, November 01, 2017 | 12.Fibonacci Heaps (CS430Lecture19Activities) 13.Data Structures for Disjoint Sets (CS430Lecture20Activities) | 19 21.1-21.2 | EXAM #2 (topics 5-10) Fri Nov 3 11:25am-12:40pm |
| Monday, November 06, 2017 Wednesday, November 08, 2017 | Pre-Lecture 09 Video (9:19) 14.Graphs, Depth First Search, Breadth First Search (CS430Lecture21Activities) 14.Graphs, Depth First Search, Breadth First Search (CS430Lecture22Activities) | appendix B.4, 22 | |
| Monday, November 13, 2017 Wednesday, November 15, 2017 | Pre-Lecture 10 Video (6:21) 15.Minimum Spanning Trees, Shortest Paths (CS430Lecture23Activities) 15.Minimum Spanning Trees, Shortest Paths (CS430Lecture24Activities) | 23,24.1-24.3,25.1-25.2 | HW #6 (topics 11-13) Fri Nov 17, 11:25am |
| Monday, November 20, 2017 Wednesday, November 22, 2017 | 15.Minimum Spanning Trees, Shortest Paths (CS430Lecture25Activities) Thanksgiving - no lecture | 23,24.1-24.3,25.1-25.2 | |
| Monday, November 27, 2017 Wednesday, November 29, 2017 | 15.Minimum Spanning Trees, Shortest Paths (CS430Lecture26Activities) Review for Final | 23,24.1-24.3,25.1-25.2 | HW #7 (topics 14-15) Fri Dec 1, 11:25am |
| Final's Week | | | EXAM #3 (topics 11-15) Final's Week |

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