1 Course Summary

Welcome to CS 535 Analysis of Algorithms. This is a theoretical computer science graduate course. We will learn to design more efficient algorithms by being able to rigorously analyze their time and space requirements. Some material overlaps with CS 430 (Introduction to Algorithms), but our treatment will be more abstract and mathematically correct.

2 Textbook

The required textbook is *Introduction to Algorithms* (third edition) by Cormen, Leiserson, Rivest, and Stein, MIT Press, 2009. ISBN-10: 0262033844 — ISBN-13: 978-0262033848 It should be available at the bookstore, and the library has a copy on reserve (available only inside the building). Other editions of the book will be fine for learning, but there may be differences in the assigned exercises and problems.


3 Prerequisites

CS 430 is listed as prerequisite. In particular, the following topics are assumed and can appear on homeworks and exams:

1. Mathematical Background (Appendices A, B, C.1, D)

2. Pseudocode, Notations, and Mergesort (Chapters 1 and 2)
3. Growth of Functions (Chapter 3) and Recurrence including the master method (Chapter 4 except 4.6)

4. Heap, Heapsort (Chapter 6) and Quicksort (Chapter 7 except 7.4)

5. Elementary Data Structures (stacks, queues, linked lists, trees - Chapter 10)

6. Binary Search Trees (Chapter 12) and some balanced version of search trees

7. Greedy Algorithms (Chapter 16)

8. Dynamic Programming (Chapter 15)

9. Graph Algorithms: BFS, DFS (Chapter 22 except 22.5), Minimum Spanning Trees (Chapter 23), Shortest Paths: Dijkstra’s algorithm (Subchapter 24.3) and the Floyd-Warshall algorithm (Subchapter 25.2)

Familiarity (or a desire and ability to learn) mathematical proofs is also necessary.

4 Getting Help

Office hours are Tuesday 3:00 - 4:00 (including immediately after the class) and Thursday 2:00-3:00 in room SB 228D, or by appointment. For an appointment send e-mail to calinescu@iit.edu. You can also call me at 312-567-5273. Please spend a little time trying to understand yourself a homework problem before asking for help.

The handouts (including this syllabus and homeworks) will be available at http://www.cs.iit.edu/~cs535. Partial homework solutions will be posted on blackboard.

The TAs for this class are Xiaolang Wang and Ying Chen. Xiaolang (xwang122@hawk.iit.edu) has office hours Monday and Wednesday 1-2, in SB 004 (basement of Stuart Building), phone 312-567-5149. Ying (ychen245@hawk.iit.edu) has office hours Monday 11-12 and Friday 1-2, in SB 110 (first floor of Stuart Building), phone 312-567-5705.

Students are expected to check email every week day of the semester. Clarifications on assignments or other important announcements might be sent by email - and will also be posted on the web page.

5 Grading

The grading allocation is given below.

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Homework</td>
<td>50%</td>
</tr>
<tr>
<td>Midterm</td>
<td>18%</td>
</tr>
<tr>
<td>Final exam</td>
<td>32%</td>
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The midterm will be on March 14, in class. The final exam will be held as scheduled by the Registrar’s office, during the week May 6-11.
Six homeworks will be assigned. You can discuss the problems with each other, but must write
the solutions individually. Seek help from me or the TA if you are having difficulties with the
homework. Except for extraordinary circumstances, homeworks will be accepted at latest one week
late. The penalty for late submission is 10% for one lecture late and 20% for one week late.

The midterms and the final exam are closed books, closed notes, no electronic devices - although
I will likely provide some of my handouts to you. At least one week in advance, I will hand
in and post an additional list of candidate problems for each exam. The midterm may contain
variants (same solution ideas) of the problems from the first three homeworks and this additional
list. The final will follow the same pattern (with homeworks 4-6, and another additional list of
candidate problems). The student in the PhD section will get one extra assignment, to replace
class participation.

The final grades will be assigned by comparison with the students who took this class in six
previous semesters. There were in total 88 A's, 164 B's, 14 C's, and one E. As a guideline, about
78% will be needed for an A, and 58% for a B (but I might modify these thresholds to ensure
fairness).

Standard departmental policy regarding academic (dis)honesty applies. This includes

In particular, homework solutions copied from the Internet are not allowed. If I have evidence
that the work submitted is not your own, I will assign a score of zero on that particular assignment
at the first occurence. It may also be reported to academic honesty@iit.edu. The second occurence
will be reported and an appropriate sanction will be applied after consultation with the office of the
Associate Provost for Academic Affairs. Whenever in doubt, ask first if some action is allowed or
not. Moreover, the students must submit the signed College of Science Academic Integrity Pledge
together with the first homework.

6 Topics to be covered

1. Lower Bounds for sorting (Subchapters 8.1, 8.2), Medians (Subchapter 9.3)
2. Splay Trees (not in the textbook)
3. Advanced Data Structures (Chapters 17, 19, 21)
4. Graph Algorithms (the parts of chapters 22, 23, 24, 25, 26 not listed as prerequisite): Strongly
   Connected Components, Shortest Paths with negative weights, Network Flows
5. NP-Completeness (Chapter 34) and (if time permits) Approximation Algorithms (Chapter
   35)
6. possibly Dynamic Programming (Chapter 15, even it is a prerequisite)
7. If time permits: Pattern Matching (Chapter 32, KMP – 32.4) and/or Geometric Algorithms
   (Chapter 33)