CS 535-(01,02,03) Syllabus Version 1.02

Gruia Calinescu
Department of Computer Science
Illinois Institute of Technology

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1 Course Summary

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 textbook is *Introduction to Algorithms* (third edition) by Cormen, Leiserson, Rivest, and Stein, MIT Press, 2009. The first, second, or international editions would be O.K. for learning, but not for assigned homework.

Our library has on-line access to the third edition of this book: login into `https://portal.iit.edu/public/dashboard`, search for library, click on *Galvin Library*, then click on *See All Databases*, find *Books 24x7*, click on it and search for "Cormen".

A reference (optional) book is *Computers and Intractability* by M. R. Garey and D. S. Johnson, For a concise but hard treatment of the subject, I recommend the books "Data Structures and Network Algorithms", by Tarjan, and "The Design and Analysis of Algorithms" by Kozen.

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 Tuesdays and Thurdays 10-11, in room SB 228D, and TBD, on Zoom, or by appointment. For an appointment send e-mail to `calinescu@illinoistech.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. Handouts (including this syllabus and homeworks) will be available on Canvas. Partial homework solutions will also be posted on Canvas.

Students are expected to check email every week day of the semester. Clarifications on assignments and other important announcements will also be posted on Canvas (and thus will be sent by email).

The TA for ths class is Adil Tanveer (`atanveer2@hawk.illinoistech.edu`). Adil has office hours Mondays and Wednesdays 2-3 in SB 004 (basement of Stuart Building). One of these times he will also be available on Zoom or equivalent.

5 Grading

The grading allocation is given below.

Homework	54%
Midterm	16%
Final exam	30%

The midterm will be on **October 7**, in class. The final exam will be held as scheduled by the Registar's office, during the week December 8-13.

The midterm and the final exams are closed books and closed notes (except for the notes supplied by the instructor), and may contain, among other problems, modified homework problems. during the week **December 8-13**. Makeup exams will be only for emergency situations. The midterm and the final exam are closed books, closed notes, no electronic devices - altough I will likely provide some of my handouts to you during the exam.

PhD students who want to use the result of this class for passing the qualifier exam must register for Section 02. They will get an extra exam in the last week of class. Their HW grade will only count for 42% of the grade, and this extra exam will count for 12% of the grade. Other students that are considering a PhD here can ask for permit to register in Section 02 (and they will be subject to Section 02 rules and not be able to use the Section 01 grading scheme).

Six homeworks will be assigned, and are to be solved individually, using for help only the textbook and the discussion in class. Seek help from me or the TA if you are having any difficulties with the homework.

The penalty for late assignments is: 10% one lecture late and 20% one week late. No assignment will be accepted if more than one week late[1]. Students must submit homeworks on Canvas, and Section 01 02 students may be required hard coppies.

A composite score will be computed according to the scale above. The final grades will be assigned by comparison with the students who took this class in seven previous semesters. There were in total 101 A's, 206 B's, 21 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:

`https://www.iit.edu/student-affairs/student-handbook/fine-print/code-academic-honesty`

[1] or maybe sooner, if an exam is scheduled within one week of the homework's deadline

In particular, homework solutions copied from the Internet are not allowed. The only help allowed is the textbook and the notes. If I have evidence that the work submitted is not your own, I will report to `academichonesty@iit.edu` and make a decision in consultation with the Designated Dean for Academic Discipline. In the past, this likely meant zero points on the specific problem and a record in the Dean's database, for the first occurrence, Whenever in doubt, ask first if some action is allowed or not. Moreover, the students must submit the signed Academic Integrity Pledge before 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)

7 Administrative Matters

Reasonable accommodations will be made for students with documented disabilities. In order to receive accommodations, students must obtain a letter of accommodation from the Center for Disability Resources and make an appointment to speak with me [the instructor] as soon as possible. The Center for Disability Resources (CDR) is located in IIT Tower, telephone 312-567-5744 or `disabilities@iit.edu`.

Illinois Techs Sexual Harassment and Discrimination Information:

Illinois Tech prohibits all sexual harassment, sexual misconduct, and gender discrimination by any member of our community. This includes harassment among students, staff, or faculty. Sexual harassment of a student by a faculty member or sexual harassment of an employee by a supervisor is particularly serious. Such conduct may easily create an intimidating, hostile, or offensive environment.

Illinois Tech encourages anyone experiencing sexual harassment or sexual misconduct to speak with the Office of Title IX Compliance for information on support options and the resolution process.

You can report sexual harassment electronically at `iit.edu/incidentreport`, which may be completed anonymously. You may additionally report by contacting the Title IX Coordinator, Virginia Foster at `foster@iit.edu` or the Deputy Title IX Coordinator at `eespeland@iit.edu`.

For confidential support, you may reach Illinois Techs Confidential Advisor at (773) 907-1062. You can also contact a licensed practitioner in Illinois Techs Student Health and Wellness Center at verb+student.health@iit.edu+ or (312)567-7550

For a comprehensive list of resources regarding counseling services, medical assistance, legal assistance and visa and immigration services, you can visit the Office of Title IX Compliance website at `https://www.iit.edu/title-ix/resources`.