

CS141: Intermediate Data Structures and Algorithms

Introduction

Instructor: Amr Magdy

TAs: Xiaolin Jiang, Samriddhi Singla

Computer Science and Engineering

Welcome to CS 141

- › **Instructor:** Amr Magdy
Office: Tomas Rivera Library, 159B
<http://www.cs.ucr.edu/~amr/>
Email: amr@cs.ucr.edu
(Include [CS141] in the subject)
Office hours: MW: 2:00 - 4:00 PM

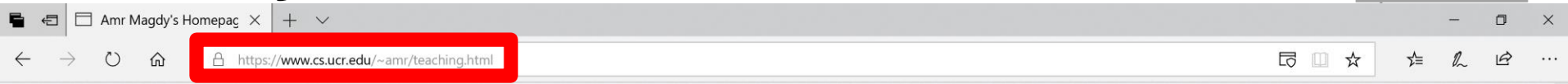


- › **TAs:**

- › Xiaolin Jiang Office hours: Thursday: 1:00 – 3:00 PM
Email: xjian049@ucr.edu Office: Chung Hall, room 463
- › Samriddhi Singla Office hours: Tuesday: 9:00 – 11:00 AM
Email: ssing068@ucr.edu Office: Chung Hall, room 368
(Include [CS141] in the subject)

- › Course Website: <https://www.cs.ucr.edu/~ssing068/18FCS141/>

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Jul 2017

Co-chair and sponsorship chair for ACM SIGSPATIAL LENS 2017

CS 141
Intermediate Data Structures and Algorithms

Course Information

Syllabus

Grading and Policies

Schedule

Assignments

CS 141 - Intermediate Data Structures and Algorithms

Time: Section 001: M W F - 4:10 PM to 5:00 PM

Section 002: M W F - 1:10 PM to 2:00 PM

Location: Section 001: [Humanities & Social Sciences Building - Room 1501](#)

Section 002: [Olmsted Hall - Room 1208](#)

Instructor: Amr Magdy - amr@cs.ucr.edu - Office Hours: [159B Tomas Rivera Library - Monday & Wednesday 2:00 PM - 4:00 PM](#)

TA: [Xiaolin Jiang](#) - Office Hours: [463 WCH - Thursday 1:00 PM - 3:00 PM](#)

[Samridhi Singla](#) - Office Hours: [368 WCH - Tuesday 9:00 AM - 11:00 AM](#)

Textbook: Introduction to Algorithms - Third Edition by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein - ISBN 9780262033848 [Amazon](#) - [UCR Bookstore](#) - [MIT Press](#)

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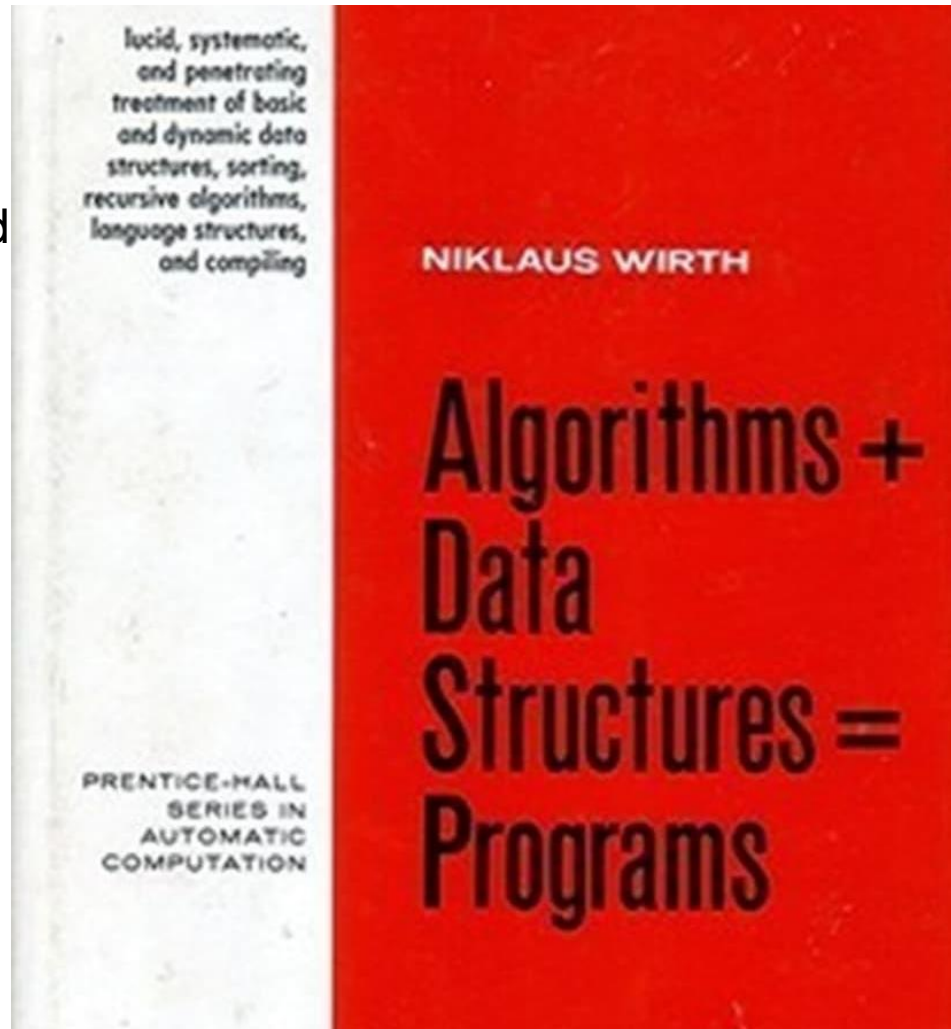
Introduction to Computational Algorithms



Computer Programs

- › Algorithms + Data Structures = Programs
 - › By Niklaus Wirth, Turing award winner 1984

- › Note: this is not the course textbook. The textbook is provided later.



What is Algorithm?

- ▶ According to Merriam-Webster dictionary
 - ▶ a procedure for solving a mathematical problem (as of finding the greatest [common divisor](#)) in a finite number of steps that frequently involves repetition of an operation;
broadly : a step-by-step procedure for solving a problem or accomplishing some end especially by a computer.

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 - ▶ Stemmed from the name of “Muhammad ibn Musa al-Khwarizmi”, an influencer mathematician
- ▶ “*Al-khorezmi his background, his personality his work and his influence*” by Heinz Zemanek, Springer LNCS, 1979, Algorithms in Modern Mathematics and Computer Science, pp 1-81



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How algorithms rule the world

The NSA revelations highlight the role sophisticated algorithms play in sifting through masses of data. But more surprising is their widespread use in our everyday lives. So should we be more wary of their power?

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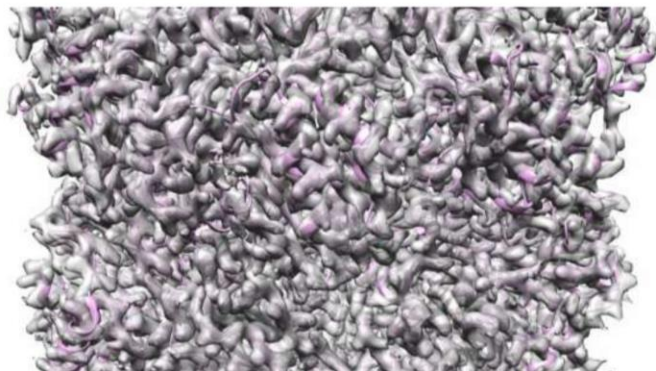
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An economy of algorithms

ComputeFest 2017 tackles the future of the computational economy

By Leah Burrows | January 27, 2017



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By Aaron Hand, Executive Editor, on July 7, 2016



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Algorithms Probably Caused a Flash Crash of the British Pound

Trading software may have overreacted to tweets about the French president's comments on Brexit.

by Jamie Condliffe October 7, 2016



Overnight, the British pound dropped by 6 percent, to \$1.13. Analysts are pointing the finger at an increasingly familiar financial scapegoat: the algorithm.

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Scope of Computational Algorithms



Computability

Complexity

Scope of Computational Algorithms

Computability

Decide on problem computability:

- › What problems can be solved by a computer?
- › Can a computer solve any problem, given enough time and storage space?

Complexity

A computationally infeasible problem



input n

assume $n > 1$

while ($n \neq 1$) {

 if (n is even) $n = n/2$

 else $n = 3*n+1$

}

A computationally infeasible problem

input n

assume $n > 1$

```
while ( $n \neq 1$ ) {  
    if ( $n$  is even)  $n = n/2$   
    else  $n = 3*n+1$   
}
```

- › Is this problem terminates for all possible $n > 1$?

A computationally infeasible problem

input n

assume $n > 1$

```
while ( $n \neq 1$ ) {  
    if ( $n$  is even)  $n = n/2$   
    else  $n = 3*n+1$   
}
```

- ▶ Is this problem terminates for all possible $n > 1$?
 - ▶ We cannot write a computational algorithm to answer this question

Scope of Computational Algorithms

Computability

Decide on problem computability:

- › What problems can be solved by a computer?
- › Can a computer solve any problem, given enough time and storage space?

Complexity

Analyze a computational algorithm performance:

- › How fast can we solve a problem using a computer?
- › How little storage space can we use to solve a problem?
- › Design better algorithms.

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Correct Algorithm

- ▶ A correct algorithm has two conditions:
 - ▶ Halts/terminates
 - ▶ Produces a correct output set for all possible input sets

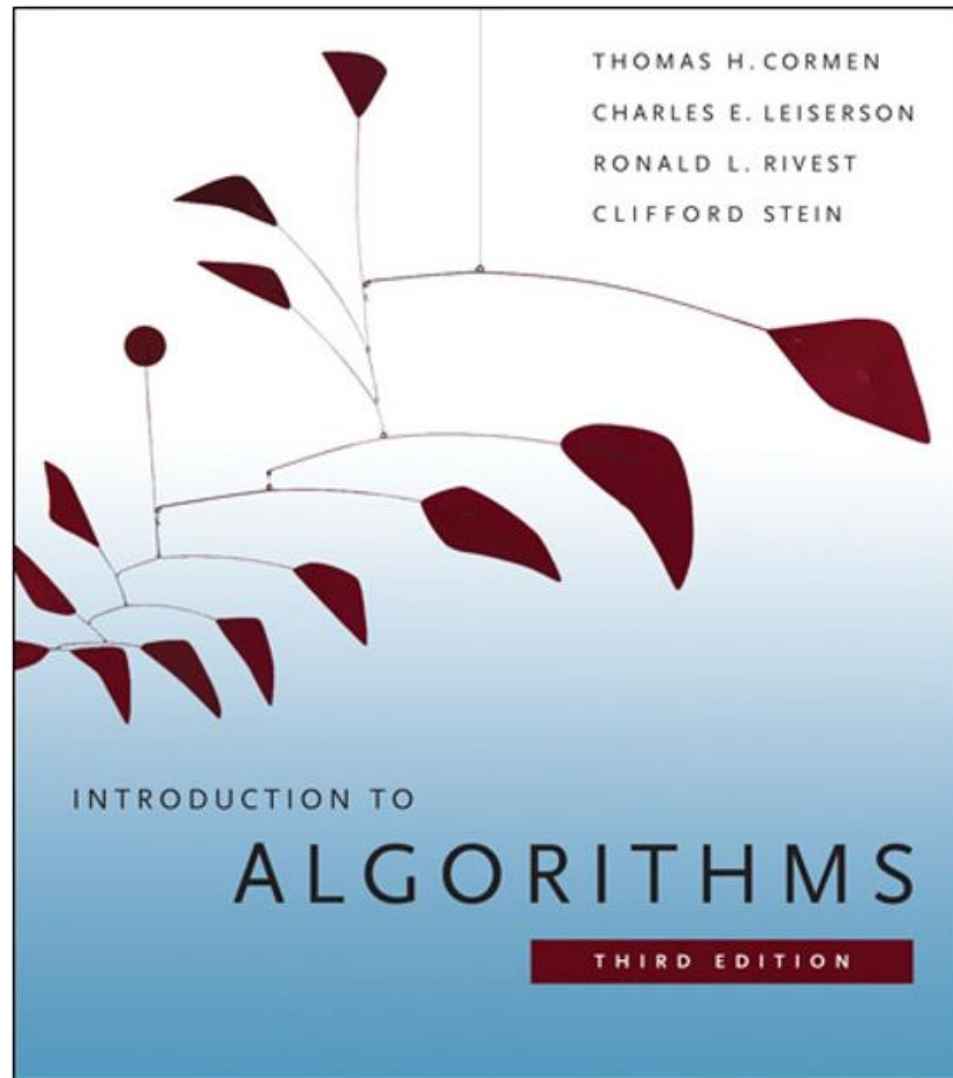
- ▶ Will detail later on analyzing correctness of algorithms.

Grading and Policies

- ▶ Course work
 - ▶ Five homework assignments (33%)
 - ▶ Two quizzes (33%)
 - ▶ Final inclusive exam (34%)
- ▶ Delivery policies:
 - ▶ The default late policy: submission allowed for 20% penalty for a calendar day.
 - ▶ Assignments should be computer-typed.
- ▶ Cheating is not allowed and will be reported
 - ▶ If you are using any external source, you must cite it and clarify what exactly got out of it.
 - ▶ You are expected to understand any source you use and solve problems in your own.

Reference Book

- Introduction to Algorithms, 3rd Edition, 2009, Thomas Cormen et. al.



Course Content

- › Introduction to Computational Algorithms
- › Analysis of Algorithms
- › Design of Algorithms
 - › Divide and Conquer
 - › Greedy Algorithms
 - › Dynamic Programming
- › Advanced Data Structures: Graphs
- › Introduction to Advanced Topics: NP-Completeness

Credits

- › Prof. Guy Blelloch notes
 - › <https://www.cs.cmu.edu/~guyb/papers/Qatar17.pdf>
- › Prof. Donald Knuth book
 - › The Art of Computer Programming, Volume 1
- › Prof. Madhusudan Parthasarathy notes
 - › [https://courses.engr.illinois.edu/cs373/sp2010/lectures/slides-
lec1.pdf](https://courses.engr.illinois.edu/cs373/sp2010/lectures/slides-lec1.pdf)