Algorithm Design and Analysis

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Campus Virtual: https://cv.upt.ro/course/view.php?id=1642

Goal:

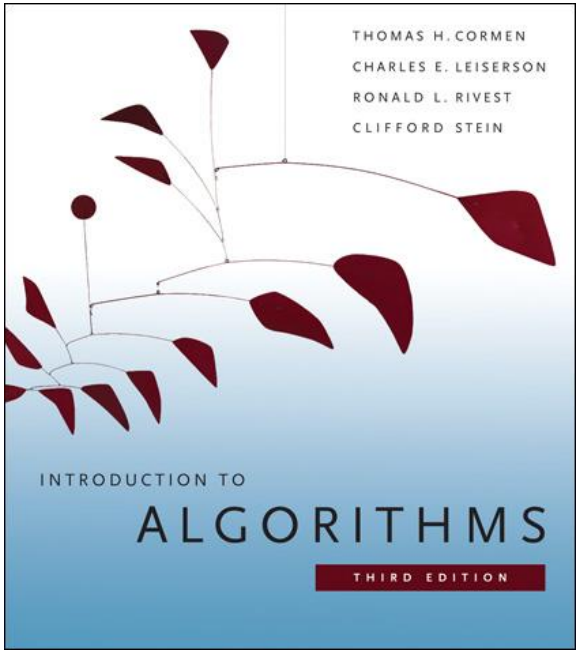
design
and
implement
solutions
that are
correct
and
efficient

with focus on
a specific range of problems

solutions = algorithms+data structures

Algorithms – two schools

[Sedgewick]
implementing algorithms
and solving
problems with them
Princeton
Coursera



[CLRS]
Rigorous, mathematical approach
to algorithms,
analysis, proofs
MIT
OpenCourseware

This course

- Intermediate-level course
- Programming and problem solving with applications
- Hands-on with coding
- Prerequisites:
  - Programming
  - Java: we use it as expository language
    - Take advantage of object-oriented concepts in the implementation of new data structures and abstract data types
    - Take advantage java libraries providing implementations of many fundamental abstract data types (stacks, queues, lists)
    - Solidify your OO programming knowledge

Lectures schedule

W1	Review: Data structures and algorithms. Transition to Object oriented style.
W2	New Object oriented concepts: Generics
W3	
W4	Trees.
W5	Search trees and other applications.
W6	Data compression
W7	
W8	Graphs.
W9	Shortest paths;
W10	Minimum spanning trees;
W11	Connectivity properties and applications
W12	
W13	Analysis of algorithms: formal techniques for analysis
W14	

Examination and Grading

- Final grade = 2/3 final exam + 1/3 work during the semester
- Final exam:
  - Short (theoretical) questions and Algorithm problems (design and implementation), paper-based exam
- Work during the semester:
  - Each lecture topic is followed by an associated lab session: read lecture materials before lab!
  - Lecture activity: Bonus points by short test
  - Each lab has a lists of exercises: classwork, homework
  - Lab tests: computer-based tests. Implementation language: Java

Bibliography and Other Resources

- Main textbook: [Sedgewick]: Algorithms, 4th Edition by Robert Sedgewick and Kevin Wayne
- Other textbooks:
  - [CLRS]: Cormen, Leiserson, Rivest, Stein, Introduction to Algorithms 4th Edition
  - [Goodrich]: Goodrics, Tamassia, Goldwasser: Data Structures and Algorithms in Java, 6th Edition
- Official website of the [Sedgewick] textbook, a few materials free available:
  - https://algs4.cs.princeton.edu/home
- Coursera – video lectures by Robert Sedgewick (free enrolment!)
  - https://www.coursera.org/learn/algorithms-part1
  - https://www.coursera.org/learn/algorithms-part2
- Other sources:
  - Avoid random website with questionable content!
  - Some good practice problems and solutions:
    - https://leetcode.com/tag/graph/
    - https://www.geeksforgeeks.org/fundamentals-of-algorithms/