Introduction to CS 5114

T. M. Murali

January 14, 2008

Course Information

- Instructor
  - T. M. Murali, 2160B Torgerson, 231-8534, murali@cs.vt.edu
  - Office Hours: 10am–12pm Mondays and Wednesdays
- Teaching assistant
  - Corban G. Rivera, cgrivera@vt.edu
  - Office Hours: to be decided

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- Keeping in Touch
  - Course web site `http://courses.cs.vt.edu/~cs5114/spring2008`, updated regularly through the semester
  - Listserv: cs5114_11787@listserv.vt.edu

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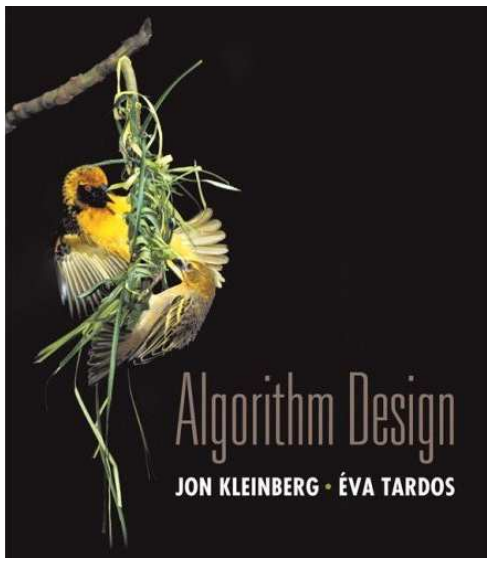
- Prerequisite: a grade of C or better in CS 2604

Required Course Textbook



- Algorithm Design
- Jon Kleinberg and Éva Tardos
- Addison-Wesley
- 2006
- ISBN: 0-321-29535-8

Course Goals

- Learn methods and principles to construct algorithms.
- Learn techniques to analyze algorithms mathematically for correctness and efficiency (e.g., running time and space used).
- Course roughly follows the topics suggested in textbook
  - Measures of algorithm complexity
  - Greedy algorithms
  - Divide and conquer
  - Dynamic programming
  - Network flow problems
  - NP-completeness
  - Coping with intractability
  - Approximation algorithms
  - Randomized algorithms

Required Readings

- Reading assignment available on the website.
- Read **before** class.

Lecture Slides

- Will be available on class web site.
- Usually posted just before class.
- Class attendance is extremely important.

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- Usually posted just before class.
- Class attendance is extremely important. Lecture in class contains significant and substantial additions to material on the slides.

Homeworks

- Posted on the web site $\approx$ one week before due date.
- Prepare solutions digitally but hand in hard-copy.

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- Prepare solutions digitally but hand in hard-copy.
  - Solution preparation recommended in LaTeX.
  - Submission must be in PDF format.

Examinations

- Take-home midterm.
- Take-home final (comprehensive).
- Prepare digital solutions (recommend LaTeX).

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- Take-home final (comprehensive).
- Prepare digital solutions (recommend LaTeX).
- Examinations may change to be in class.

Grades

- Homeworks: ≈ 10, 50% of the grade.
- Take-home midterm: 20% of the grade.
- Take-home final: 30% of the grade.

What is an Algorithm?

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Chamber's A set of prescribed computational procedures for solving a problem; a step-by-step method for solving a problem.

Knuth, TAOCP An algorithm is a finite, definite, effective procedure, with some input and some output.

Origin of the word "Algorithm"

1. From the Arabic *al-Khwarizmi*, a native of Khwarazm, a name for the 9th century mathematician, Abu Ja'far Mohammed ben Musa.

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Origin of the word "Algorithm"

1. From the Arabic *al-Khwarizmi*, a native of Khwarazm, a name for the 9th century mathematician, Abu Ja'far Mohammed ben Musa. He wrote "Kitab al-jabr wa'l-muqabala," which evolved into today's high school algebra text.
2. From Al Gore, the former U.S. vice-president who invented the internet.
3. From the Greek *algos* (meaning "pain," also a root of "analgesic") and *rythmos* (meaning "flow," also a root of "rhythm"). "Pain flowed throughout my body whenever I worked on CS 5114 homeworks." – former CS 5114 student.

Problem Example

Find Minimum

INSTANCE: Nonempty list $x_1, x_2, \ldots, x_n$ of integers.

SOLUTION: Pair (i, x_i) such that $x_i = \min\{x_j \mid 1 \leq j \leq n\}$.

Algorithm Example

Find-Minimum$(x_1, x_2, \ldots, x_n)$

1 $i \leftarrow 1$

2 **for** $j \leftarrow 2$ **to** n

3 **do if** $x_j < x_i$

4 **then** $i \leftarrow j$

5 **return** (i, x_i)