

Introduction to CS 5114

T. M. Murali

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Course Information

- ▶ Instructor
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 - ▶ Office Hours: 3pm–5pm Mondays and by appointment
- ▶ Teaching assistant
 - ▶ Ajeet Singh, ajeets@vt.edu
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- ▶ Class meeting time
 - ▶ TR 12:30pm–1:45pm, McBryde 329

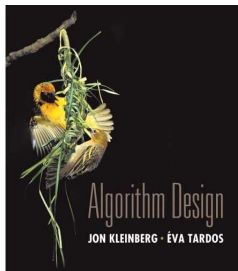
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- ▶ Keeping in Touch
 - ▶ Course web site
<http://courses.cs.vt.edu/~cs5114/spring2009>, updated regularly through the semester
 - ▶ Listserv: cs5114_11910@listserv.vt.edu

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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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 - ▶ Solution preparation recommended in \LaTeX .

Examinations

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

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- ▶ Examinations may change to be in class.

Grades

- ▶ Homeworks: ≈ 10 , 60% of the grade.
- ▶ Take-home midterm: 15% of the grade.
- ▶ Take-home final: 25% 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 through my body whenever I worked on CS 5114 homeworks.” – former CS 5114 student.

Problem Example

Find Minimum

INSTANCE: Nonempty list x_1, x_2, \dots, 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, \dots, 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)