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
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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

Prerequisite: a grade of C or better in CS 2604
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Required Course Textbook

- Algorithm Design
- Jon Kleinberg and Éva Tardos
- Addison-Wesley
- 2006
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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- Will be available on class web site.
- 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 website ≈ 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.
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: \( \approx 10 \), 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.

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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 \( x_1, x_2, \ldots, x_n \) 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 $(i, x_i)$