Introduction to CS 5114

T. M. Murali

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Course Information

▶ Instructor
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  ▶ Office Hours: 10am–12pm Mondays and Wednesdays

▶ Teaching assistant
  ▶ Corban G. Rivera, cgrivera@vt.edu
  ▶ Office Hours: to be decided
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- **Class meeting time**
  - MW 2:30–3:45pm, Wallace 244
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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
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).
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- Examinations may change to be in class.
Grades

- Homeworks: $\approx 10$, 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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3. From the Greek *algos* (meaning “pain,” also a root of “analgesic”) and *rythmos* (meaning “flow,” also a root of “rhythm”).
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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 throughout my body whenever I worked on CS 5114 homeworks.” – former CS 5114 student.
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’il-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 $(i, x_i)$