

CS 100 M

Introduction to Programming

Spring 2005
(Also CIS121 / EAS121)
Professors D. Fan and C. Van Loan

Course Goals

- To develop a practical intuition about problem-solving with the computer.
- To develop a facility with the Matlab and Java programming environments.

Key: Algorithmic Thinking

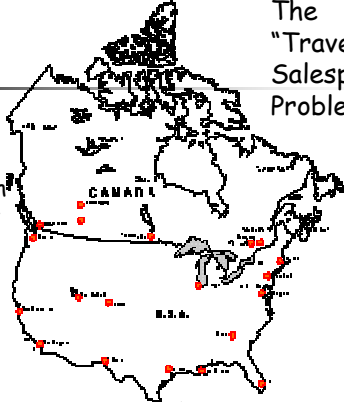
Algorithm:
A step-by-step procedure that takes you from a prescribed set of inputs to a prescribed set of outputs.

Etymology of "Algorithm"

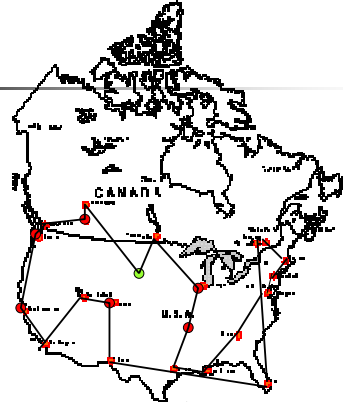
- Algorithm = Al-Khwarizmi = Islamic mathematician/astronomer
- Born Baghdad 780AD
- Developed methods for arithmetic with the "new" Hindu/Arabic place-value system.

The "Traveling Salesperson" Problem

Make a roundtrip visiting each city exactly once. Find the **shortest possible path**.



Algorithm: always go to the nearest unvisited city



How Good is the Route?

Will not generally give you the shortest path.

Is it "good enough"?

Can you prove that it is never more than twice the shortest route?

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Networks



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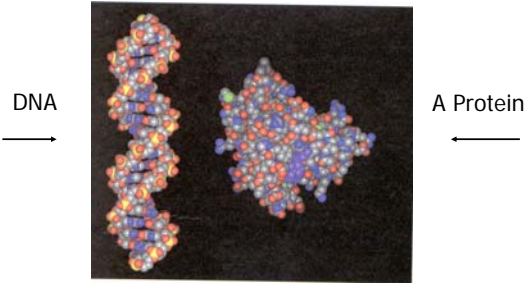
Engineering vs. Science

Building a network is engineering; finding a "shortest" path has engineering applications

Finding patterns in data; building models that explain the data—that is science

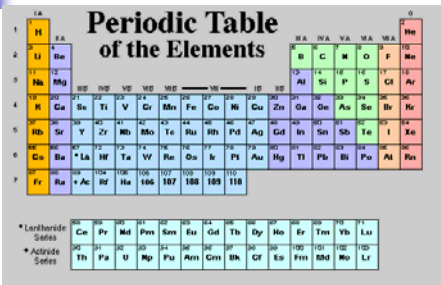
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Patterns in Genomic Data



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Build one of these for Proteins...



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The Challenge


The data is there.

("Tycho has cataloged the stars.")

Now make sense of it!

(Where are the "genomic Keplers"!)

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In Computing, Language is Important

3892 divided by 279 = ?

MMMDCCCXCII divided by CCLXXIX =?

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Course Goals (Again)

To develop a facility with the Matlab and Java programming environments.

To develop a practical intuition about problem-solving with the computer.


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Intuition

- If intuition is a sense of direction, then computational intuition is a sense of computational direction.
- Those who have it can find their way around the computational side of engineering and science.
- Success requires five keen senses.


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Do you have eyes for the geometric?

- The ability to visualize is very important to the computational scientist/engineer.
- Likewise, being able to reason in geometric terms.
- Sines, cosines, polygons, polyhedra, metrics, proximity.


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Do you have ears that can hear the "combinatoric explosion"?

- Many design and optimization problems involve huge search spaces with an exponential number of possibilities.
- It is important to be able to anticipate this complexity and to have the wherewithal to deal with it.

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Do you have a taste for the random?

- Many important processes have a random component.
- Having a sense of probability and the ability to gather and interpret statistics with the computer is vital.

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Do you have a nose for dimension?

- 3D simulations usually require much more computer time than in 2D simulations.
- Being able to think in higher dimensions is essential for effective, high-performance computing.

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Do you have a touch for what is finite, inexact, or approximate?

- Rounding errors, screen granularity, approximate derivatives, experimental data.
- Life in computational science is like this; you can't unravel in the presence uncertainty.
- Must walk the fence that separates the continuous from the discrete.

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Now some practical matters...

- 100M vs 100J
- 100 vs 211
- Grading
- Texts & Handouts
- Lecture Notes
- Sections, Labs, AEWs

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CS100: M or J?

| M | J |
|--|--|
| <ul style="list-style-type: none">■ No prior prog. experience■ 7 wks MATLAB, 7 wks Java■ One semester of Calculus■ Math & engineering type problems | <ul style="list-style-type: none">■ No prior prog. experience■ 12 wks Java, 2 wks MATLAB■ No Calculus■ More nonnumerical problems |

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CS100 or CS 211?

CS211

Computers & Programming


- Use Java
- Require Java (or C++) object-oriented programming experience

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Grading

- Best Five of Six projects (25%)
- Section/Lab Exercises (5%)
- Prelim 1 (10%)
- Prelim 2 (20%)
- Prelim 3 (20%)
- Final Exam (30%)
- Less $\min\{\text{Pre1}, \text{Pre2}, \text{Pre3}, \text{Final}\}/10$


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Course Material

- Notes on MATLAB will be available on the course website
- "Java Software Solutions, Java5 version" by John Lewis and William Loftus. **Required starting week 8.**

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Software

Optional (because of public labs):

- MATLAB Student Version R14
- DrJava


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After Each Lecture

- Powerpoint lecture slides will go on the website.
- Matlab scripts and functions used in the lecture will go on the website.
- Nevertheless, attend class.


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Consulting & Computing

- Consulting in Engineering Library Reading Room. (Check website for hours.)
- Some public CIT labs:
 - Upson B-7
 - Accel Lab (Carpenter Hall)
 - Stimson G-25


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Academic Excellence Workshops

- Small, collaborative classes parallel to course
- Classes begin next week in **CLCLCL** in Uris Library
- M 2:30 - 4:25 pm
W 7:30 - 9:25 pm


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What to do now?

- If necessary, add/drop lecture / section / AEW
- Absolutely full section:
Tue 1:25
- Space in:
Wed 10:10, 11:15, 7:30pm
- Attend lab this week.

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What to Do Now (Cont'd)

Go to the course website and

- download Matlab notes; read 1.4, 1.5
- find out where your lab meets and download this week's lab handout

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