A Course on Algorithm Design & Analysis

CS 4/56101 Design and Analysis of Algorithms

Kent State University
Dept. of Math & Computer Science
www.rnet.kent.edu/~javediose/ALG0087
Today's Topic

Unit background and administrivia

Introduction to Algorithms

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WED 2:00 - 4:00 p.m. & 7:30 - 8:00 p.m.
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TA

to be announced.

Web Page:
http://www.mcs.kent.edu/~javed/class-ALGO02/
Books


- Introduction to Algorithms, T. Cormen.

Course Format

- Class Lectures
  - The concept of algorithm design and analysis will be explained in the class.
  - You need to carefully follow the presentation and participate.
  - Carefully listening is more important than taking detail notes!

- Live Demonstration
  - Some of the topics will be explained with live demos.

- Random Quiz
  - There will be random quizzes to test your alertness in the classes on topics covered in the same day.

- Projects
  - Three individual class projects/experiment.
  - Estimated time requirement: 20+20+40=80 hours.
What is Expected Out of You?

- At least 12 hours per week (to pass)
- Learning by doing
- Questions and exercises
- Reading the book
- Taking active part in class discussions
  - Read/Listen Think Do Ask

Grading

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Weight</th>
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<tbody>
<tr>
<td>End Term Exam</td>
<td>1</td>
<td>20%</td>
</tr>
<tr>
<td>Mid Term Exam</td>
<td>1</td>
<td>20%</td>
</tr>
<tr>
<td>Take Home Assignments</td>
<td>4-5</td>
<td>20%</td>
</tr>
<tr>
<td>Unannounced Quizes</td>
<td>3-5</td>
<td>20%</td>
</tr>
<tr>
<td>Programming Projects</td>
<td>3</td>
<td>20%</td>
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</tbody>
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Class Mechanics

- "ALG@bristi.facnet.mcs.kent.edu".
- Need to send email to the above with subject-field set to "ALG2000S" to obtain further instruction.
- To be sent by email:
  - A random course id (CID) will be mailed to you by TA. All your grades will show this ID.
  - Reports preferably in Computer.

Honor Policy

- We assume that you will follow the honor code.
- All projects, assignments have to be done individually by you.
- A ny copy will result in zero grade for both parties.
- Also, you should not copy from web.
Why you should take a course on Design and Analysis of Algorithms?

Why Algorithm?

- Engineers use parts and components to build bridges, automobiles, aircraft.
- Computer Engineers use 'algorithms' to build software systems.
- All solutions are not equal!
- The difference between an amateur and a professional is the knowledge and perfection of the 'parts'.
Why Algorithm?

- This class will equip you with a set of basic 'parts' that you will frequently need for the rest of your life.
- In this class you will also learn the techniques for building, selecting, or even designing the best parts for your systems, and the techniques for obtaining the best assembly.
- You will learn how to write efficient programs.

This class will change forever how you will develop a computer program.

Introduction
Problems of Large Programs

1. The patchwork approach
2. Problem specification
3. Program organization
4. Data organization and data structures
5. Algorithm selection and analysis
6. Debugging
7. Testing
8. Maintenance

Game of Life

The neighbors of a given cell are the eight cells those touch it vertically, horizontally, or diagonally. Every cell is either living or dead.
Rules for the Game of Life

- A living cell stays alive in the next generation if it has either 2 or 3 living neighbors;
- it dies if it has 0, 1, 4, or more living neighbors.
- A dead cell becomes alive in the next generation if it has exactly three neighboring cells, no more or fewer, that are already alive.
- All other dead cells remain dead in the next generation.
How to Implement
Algorithm for Game of Life

- Initialize an array called map to contain the initial configuration of living cells.
- Repeat the following steps for as long as desired: For each cell in the array do the following:
  - Count the number of living neighbors of the cell.
  - If the count is 0, 1, 4, 6, 7, or 8, then set the corresponding cell in another array called newmap to be dead; if the count is 3, then set the corresponding cell to be alive; and if the count is 2, then set the corresponding cell to be the same as the cell in array map (since the status of a cell with count 2 does not change).
- Copy the array newmap into the array map.
- Print the array map for the user.

Code Game of Life V.1
Simplifying Neighbors Count

- Code

Demo

\[
\begin{array}{c|c|c|c|c}
0 & 0 & 0 & 0 \\
1 & 2 & 3 & 2 & 1 \\
1 & 1 & 2 & 1 & 1 \\
1 & 2 & 3 & 2 & 1 \\
0 & 0 & 0 & 0 & 0 \\
\end{array}
\]

23, 32, 34, 43

32, 33, 34