CSE 599 Elevator Pitch Competition

How does the material in this class relate to what I'll do in upper division classes?

How does the material in this class relate to industry? [[ Bonus: "non-obvious" example.]]

How do I know if I'm on the right track with this algorithm design / proof / … ?

Favorite fact / piece of technology / theoretical construction?
# 3 Areas (Software Engineering relates to industry)

<table>
<thead>
<tr>
<th></th>
<th>Software Engineering</th>
<th>Programming</th>
<th>Project Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The software lifecycle, tools and models for software development.</td>
<td>Writing code for real customers.</td>
<td>Collaborative teamwork skills.</td>
</tr>
<tr>
<td></td>
<td>Notation using UML. Agile methods. Information systems, databases, and UI.</td>
<td>Learning a new technology (quick ramping up, coding for release)</td>
<td>Handling different types of customers.</td>
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<td></td>
<td></td>
<td></td>
<td>Communication, leadership, negotiation, personal organization and risk management.</td>
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</tbody>
</table>
How do I know if I'm on the right track with this algorithm proof?

- Prove it terminates
- Pick some progress measure
- Give an upper bound on runtime
- Measure strictly progresses towards a finite limit e.g. set of vertices and edges
- Loops and recursions

- Prove correctness and completeness
- Explore all possible execution paths
- Naturally, DQ and DP by induction, greedy by exchange or stays-ahead
- For any input, returns expected output
- Other methods: contradiction, construction, contraposition, etc.
My favorite fact about Computer Science: Computing is part of everything we do.
What is the point?
How Microsoft Handles Implicit Bias

Angie Nguyen
Virtual Reality: What’s the Hype!!

Applications

Military (Flight/war simulations)
Education (Astronomy)
HealthCare (Surgery)
Construction
Fashion
Sports
Gaming
Impact of Software Engineering in Industry

- Highly Organized
- Decreases Risk.

- High chances of failure
- No documentation

- BUT it's easy.
- High chances of failure
- Expensive and time consuming processes are involved

Software Development in College

- Maybe Fail / Maybe Successful
- Find people who can be your partner.

Software Development in Industry

- Design Specifications
- Design/Development Test Software
- Start Coding
- Discuss vaguely about what needs to be developed.

CSE 110 : Software Engineering
What we learnt in class:
Karnaugh maps, simple method for logic structures with few inputs
→ global maximum

Industry:
➢ Espresso minimizer
heuristic method which finds the local minimum for large circuit.
  ➢ minterm manipulation
  ➢ efficient two level implementation
  ➢ sharing between different outputs

➢ Patrick’s method
a branch and bound technique which can be implemented efficiently and can find all the minimum solution.
So the simple algorithm that we learnt in class can be extended to deal with highly complex circuits.
Compressed Sensing: A 60 second primer

a. Shepp-Logan phantom: standard test image in image reconstruction algorithms (Original image)

b. Sampling of the Discrete Fourier Transform along 22 approximately radial lines

Exact recovery with a sampling rate 1/50 the Nyquist rate.

Shannon-Nyquist theorem violated?! No!

Shannon-Nyquist is a sufficiency condition.

In slightly hand wavy terms: exact recovery of sparse signals is possible by usually solving a l-1 minimization problem in effect giving us a non linear sampling process.

a. Minimum energy reconstruction: (2-norm, standard least squares)

b. Minimum total variation norm: Exact Reconstruction!

Reference:
http://home.ustc.edu.cn/~zhanghan/cs/Candes%20et%20al.06.pdf
How to save memory with C:
(and be obnoxious)

#define struct union
How will this class help me in grad school?

Class: CSE 216 - Interaction Design Research

Skills learned:

- Reading, synthesizing, and discussing research papers
- How to design and conduct a research experiment

(Cristin) Ailie Fraser
How does the material in this class relate to industry?

- It guides you to start your own company, make it successful and REVOLUTIONIZE the industry!
- It gives you a better understanding of how the industry works - The non-technical aspects: Sales, Marketing, Legal aspects, Intellectual Property, Acquiring and Retaining Customers, Finance.

And if you’re going for a job at a big corporation after taking this class:

- You can practice **intrapreneurship**: set up and implement new Projects within your corporation.
Computer Graphics in Movie Production
Conditional Probability

Joint Probability Relation

\[ P(A/B) = \frac{P(A, B)}{P(B)} \]

Bigrams

Bigrams - sequence of two adjacent string tokens

Joe, Manley

Computer, Science

Application

Dictionary, Searches

Joe, (Manley ?)

Computer, (Science ?)

Not just words: letters, sentences -> automated responses
The Importance of PA3 (Encoder/Decoder) for future CSE courses

Answering 2 Important Questions:

- How do I make this? (Design, Implement)
- How do I break this? (Debug, Test)
Why Big-Oh?

- Industry is moving towards enormous aggregates of data
  - The cloud
- Algorithms must scale
  - Big-Oh as a starting point
  - Design without needing access to compute clusters
- Constant factors can still be important though!
Graphical ordering of Systems

Optimized decision making in Vision based Coral classification system using Graph search
How does 120 help me with upper division classes?

from CSE 120, you know:

What is file system?
What’s its purpose?
How is a file structured?
...

VERY BASIC!!

from CSE 221, you know:

There are so many file systems!

Log-structured file system:
What’s the idea behind this?
Design and implementation details.

Without basic knowledge from 120, you will get lost!!
Asimov’s Laws Of Robotics

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
   Debunk -> Military usage, Drone Tech

2. A robot must obey the orders given to it by human beings except where such orders would conflict with the First Law.
   Debunk -> You only want it to obey you.

3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.
   Debunk-> Smarter AI, Fictional references

Does it limit what robots can do? Where do you draw the line over safety / ethics?
How does the material in CSE 110 relate to what I'll do in upper division classes?

- Prepare you for high paced, complex projects
- Not only the final product, it’s also the process that matters!
- Team Work - not just for upper division, but also industry
- Prepare you for CSE 210 (if you may)!
Favorite facts about Computer Science

- Evaluated by implementation
  - Idea is cheap, show me your code!
- Creative, challenging and exciting
  - Solve real complex problems
- Fundamental to many other fields
  - Physics, Math, Medicine, etc
- There are tons of jobs
  - Large demand for the computer scientist in the market
- Highly paid
  - Although not a reason to choose this major
## Data Integration and Industry

<table>
<thead>
<tr>
<th></th>
<th>Data cleaning and preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All analytics engines require clean data to be fed into their prediction algorithms.</td>
</tr>
<tr>
<td></td>
<td>My course teaches many document classification, schema matching and mapping techniques.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Growing data size and user-base</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>The data that companies have is increasing exponentially day by day.</td>
</tr>
<tr>
<td></td>
<td>Hence, new sources have to be added to accommodate new data.</td>
</tr>
<tr>
<td></td>
<td>These sources have to communicate and answer generic queries.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Mergers and acquisitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Mergers and acquisitions are constantly happening in the industry.</td>
</tr>
<tr>
<td></td>
<td>Different companies have different ways to store the same information.</td>
</tr>
<tr>
<td></td>
<td>All these sources should be integrated.</td>
</tr>
</tbody>
</table>
Robots are used for assembling products, handling dangerous materials, spray-painting, cutting and polishing, inspection of products. The number of robots used in tasks as diverse as cleaning sewers, detecting bombs and performing intricate surgery is increasing steadily, and will continue to grow in coming years.

Even with primitive intelligence, robots have demonstrated ability to generate good gains in factory productivity, efficiency and quality. Beyond that, some of the "smartest" robots are not in manufacturing; they are used as space explorers, remotely operated surgeons and even pets.

Using robots also will reduce the risk of human error or contamination.
Deep Neural Networks
void levelorder(node * & head)
{
    if (head == NULL) return;
    queue<node*> Q;
    Q.push(head);
    while(!Q.empty())
    {
        node * current = Q.front();
        if (current->left != NULL) Q.push(current->left);
        if (current->right != NULL) Q.push(current->right);
        cout<<current->number<<endl;
        Q.pop();
    }
}
● A combined discipline of computer and electrical engineering, that forms the base of all electronics.
● Microprocessors, GPUs, Merchant silicon chips, FPGAs etc.
● Industry worth tens of billions of dollars.
● Design circuits that have less footprint. An Intel quad-core i7 processor has 731 million transistors in 263 mm²!
● Design circuits and have less computation delays. Speed matters! Time = Money.
Test your code!!

Calculate \( n! = n \times (n-1) \times (n-2) \times \ldots \times 1 \)

Start small

What is the answer for...
- 4! ?
- 5! ?

Check your edge cases

Does your code work for...
- 1! ?
- 0! ?

Have fun!!
How does the material in this class relate to industry? (CSE141L: Project in Computer Architecture)

- A very common question from CS students, why a Hardware course?
- Innards of computer system:
  - Processor architecture
  - Memory Hierarchy (Caches)
- Opens up avenues in both:
  - **Software Industry**: Write a more efficient code, exploiting the best performance with knowledge of the hardware.
  - **Hardware Industry**: Realizing hardware functionality, describing it in software (CAD) and Debugging.
- Bonus: Prepares for handling projects, planning and teamwork
Rami Gökhan Kıcı

λ?
How the material in CSE 21 (Discrete Math for Computer Science) relates to upper division courses

• CSE 21 explores the mathematical concepts needed to analyze algorithms and systems.

• Example - It covers the working of different sorting algorithms, the number of comparisons each of them make and the methods to prove the correctness of the algorithms.

• These would be useful as a pre-requisite for courses like Algorithms Design and Analysis, Theoretical Computer Science etc.

Ramkishore S
A53089745
How does pipelining apply to industry?

- Within the computer engineering realm, almost all modern processors make use of pipelining
  - Different implementations of pipelining
  - Pipelining is continuously evolving (e.g. Intel pipeline)

- Increasingly relevant to other optimization problems
  - Assembly lines
  - Delivery services
  - Managerial services
Course:
Intro To Robotic Software

Let’s Put ROS on Wheels …
- Model Driven Development
- Cross-platform portable
- Inter-node communications
Selection Sorting

Step:

1. select the smallest element among \( \text{data}[i] \) to \( \text{data}[	ext{data.length-1}] \);
2. swap it with \( \text{data}[i] \);
3. if not finishing, repeat 1&2

Diagram:

- Initial: 20 8 5 10 7
- After swap: 8 5 20 10 7
- After swap: 7 8 20 10 8
- After swap: 7 8 10 20
- Final: 5 7 8 10 20
How do I know if I'm on the right track with Synchronization?

<table>
<thead>
<tr>
<th>1</th>
<th>Understand the Basics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify the shared resource needing Mutual exclusion.</td>
<td></td>
</tr>
<tr>
<td>Hardware provided support -</td>
<td></td>
</tr>
<tr>
<td>1. Atomic instructions</td>
<td></td>
</tr>
<tr>
<td>2. Disable &amp; enable interrupts</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2</th>
<th>Sync Problem 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mutual exclusion of shared resource</td>
<td></td>
</tr>
<tr>
<td>1. Locks</td>
<td></td>
</tr>
<tr>
<td>2. Binary Semaphores</td>
<td></td>
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</tbody>
</table>

<table>
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<tr>
<th>3</th>
<th>Sync Problem 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coordinating access to the shared resource</td>
<td></td>
</tr>
<tr>
<td>1. Semaphores</td>
<td></td>
</tr>
<tr>
<td>2. Condition variables (with locks)</td>
<td></td>
</tr>
</tbody>
</table>
Relevance of CSE123 in the Industry

- Provides you the fundamental knowledge required to work as a network engineer in the IT industry.

- Companies in the IT industry primarily work on building computer networking infrastructures which are used for transmitting data across communications networks.

- Helps you prepare for interviews. The course covers the basic concepts asked by interviewers.
Pointers Demystified ... !
THIS IS

AUTOMATA!!!
Name: SWETHA KRISHNAKUMAR
TA for: Successful Entrepreneurship
Elevator pitch: How my course helps in industry?
My course contributes 1% (Seriously!!!!)

At the end of Masters:
- Expected to have good knowledge in subjects
- Good research/project experience
- Dream Jobs
To sum up: SUCCESS!

But what my course gives:
- Personal Experience
- Contacts
- Stories about failures
To sum up: It redefines my ATTITUDE!

19+21+3+3+5+5+19+19 = 99%
1+20+20+9+20+21+4+5 = 100%
How 8a helped me

I’m not bob!

Ujjwal Gulecha
Curiosity

Processors: Single core - Deca-core and more

Transistors - touchpad systems

David Hilbert’s quest - IBM Watson’s feat in Jeopardy

Migration

Twinkle Twinkle Little Star...
CSE218/118 Team Project

Experience through “controlled” chaos 😊

- **Diversity** (experience, knowledge)
- **Communication** (large team, dispersed)
- **Technology** (hardware, software)
- **Change** (feedback, grades)

- **Leadership** (grad students)
- **Ownership** (features, vision)
- **Deadlines** (hard & soft)
- **Agility** (delivery)

**Agile Teams**

*Self-organizing*
CSE 110: Software Engineering

How does the material in this class relate to industry?
Favorite fact about CS major

We create all possibilities!
Probability and Statistics

Probability
Given model, predict data

Statistics
Given data, predict model

Biased Coin
Fair Coin

Zhen Zhai
How does the material in computer networks relate to industry?
Wrap up

and the winners are ...
Call for volunteers

Next quarter: CSE 599 wants you!

Have a great rest of the quarter & winter break.