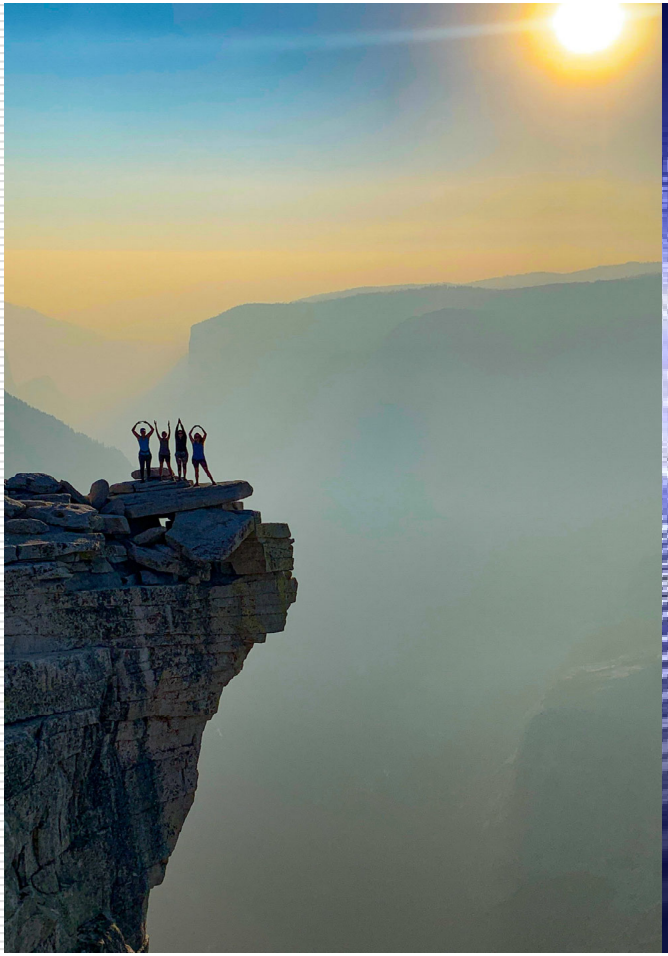
Dr. Paul Sivilotti
sivilotti.1@osu.edu

Computer Science @ OSU

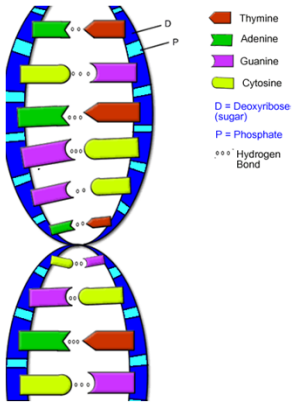
Computer Science and Engineering ■ College of Engineering ■ The Ohio State University

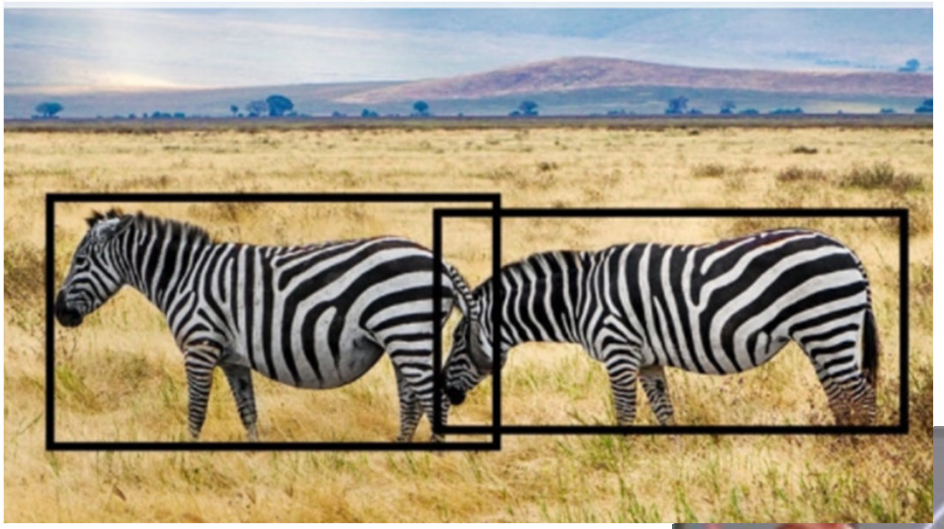


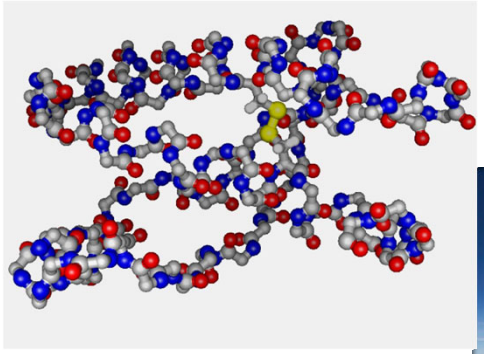
Where is Computer Science?

Where is Computer Science?

Computer Science is Also…





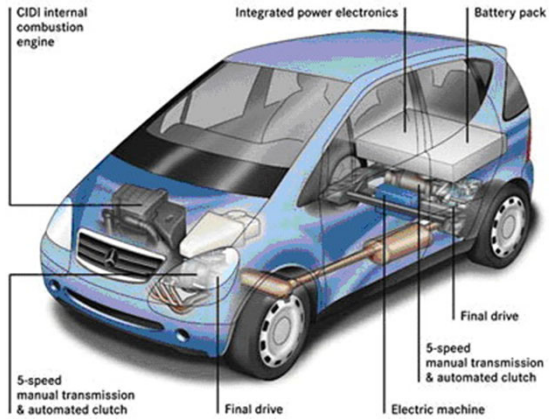


A Survey of First-Year Students

Medical students
"Why did you choose this field?"

Law school students:
"Why did you choose this field?"

Engineering the Physical World



CS: Engineering "Thought Stuff"


```
import java.util.Stack;

public class SlowBigNatural implements BigNatural {

    // Private Fields
    private Stack<Integer> stackNum;
    private final int RADIX = 10; // Avoid hard-coding "10" into the problem.

    // Private (local) Methods
    private void incrementRecurse(Stack<Integer> theStack, int radix) {
        // Grab the least significant digit from the number (represented by a
        // stack).
        int digit;
        digit = theStack.pop();

        // Determine if this digit can be simply incremented, or if has to be
        // set to 0 and and next digit has to be incremented.
        if (digit < (radix - 1)) {
            digit++;
        } else {
            digit = 0;
            if (!theStack.empty()) {
                // If the next digit exists (if there is something left in the
                // stack) make a recursive call to this method. Otherwise, push
                // the value 1 onto the stack.
                this.incrementRecurse(theStack, radix);
            } else {
                theStack.push(1);
            }
        }

        // Push the digit back onto the stack, restoring the original
        // representation.
        theStack.push(digit);
    }

    private void decrementRecurse(Stack<Integer> theStack, int radix) {
        // Remove the least significant digit and decrement it.
        int digit;
        digit = theStack.pop();
        digit--;

        // If the stack is empty, and the digit is not a zero, push it back on.
        // If the stack is empty and the digit is a zero, then it is a leading
        // zero. In this case, do nothing (and it just goes away).
        // If the stack is not empty, push the digit back on unless it was
        // originally zero, in that case set it to radix - 1 and make a
        // recursive call to decrement the next digit.
        if (theStack.empty()) {
            if (digit > 0) {
                theStack.push(digit);
            }
        } else {
            if (digit < 0) {
                digit = radix - 1;
                this.decrementRecurse(theStack, radix);
                theStack.push(digit);
            } else {
                theStack.push(digit);
            }
        }
    }

    private String toStringRecurse(Stack<Integer> theStack) {
        // Remove a digit, and make a recursive call if there is more left to
        // read. Use the 'toString' method of Integer to form the return string,
        // simply as all digits concatenated together as strings.
        int digit;
        String subString;
        digit = theStack.pop();

        if (!theStack.empty()) {
            subString = this.toStringRecurse(theStack)
                    + Integer.toString(digit);
        } else {
            subString = Integer.toString(digit);
        }

        // Push the digit back onto the stack, restoring the representation.
        theStack.push(digit);

        // Return the string representing the number;
        return subString;
    }

    // Constructors
    public SlowBigNatural() {
        // Instantiate a stack of Integers and set the initial representation to
        // 0 by pushing 0 onto the stack.
        this.stackNum = new Stack<Integer>();
        this.stackNum.push(0);
    }

    public SlowBigNatural(int number) {
        // Calls the SlowBigNatural(String numAsString) constructor, after
        // converting the value of the integer to a string.
        this(Integer.toString(number));
    }

    public SlowBigNatural(String numAsString) {
        // Instantiate a stack of Integers.
        this.stackNum = new Stack<Integer>();

        // Loop to iterate over the string, reading it character by character
        // into the stackNum field.
        for (int i = 0; i < numAsString.length(); i++) {
            int digit = Character.getNumericValue(numAsString.charAt(i));
            this.stackNum.push(digit);
        }
    }

    public SlowBigNatural(BigNatural other) {
        // Calls the SlowBigNatural(String numAsString) constructor, after
        // converting the value of the BigNatural object "other" to a string.
        this(other.toString());
    }

    public void decrement() {
        // Call the local "helper" method decrementRecurse, passing in the stack
        // representation of the number and the radix. The local method has to
        // be separated in order to easily remove leading zeros.
        this.decrementRecurse(this.stackNum, this.RADIX);

        // If the stack comes back empty, push a 0 onto it.
        if (this.stackNum.empty()) {
            this.stackNum.push(0);
        }
    }

    public void increment() {
        // Call the local "helper" method incrementRecurse, passing in the stack
        // representation of the number and the radix. The local method has to
        // be separated due to Resolve convention.
        this.incrementRecurse(this.stackNum, this.RADIX);
    }

    public String toString() {
        // Call the local "helper" method toStringRecurse, passing in the stack
        // representation of the number. The local method has to be separated
        // due to Resolve convention.
        return this.toStringRecurse(this.stackNum);
    }
}
```

School Spirit: O-H-I-O

Wouldn’t it be great if…

O-H-I-O App for iPhone/iPod

O-H-I-O! the iPhone App

Download Now

Hey Buckeyes, the "O-H-I-O!" app makes it easy to share your "O-H-I-O" photos taken anytime, anyplace. Share your Buckeye pride to become part of the phenomenon: From Paris to Kilimanjaro, the Arctic Circle to Lane Avenue, thousands of Ohio State fans have already participated.

O-H!

http://www.osu.edu/O-H-I-O/

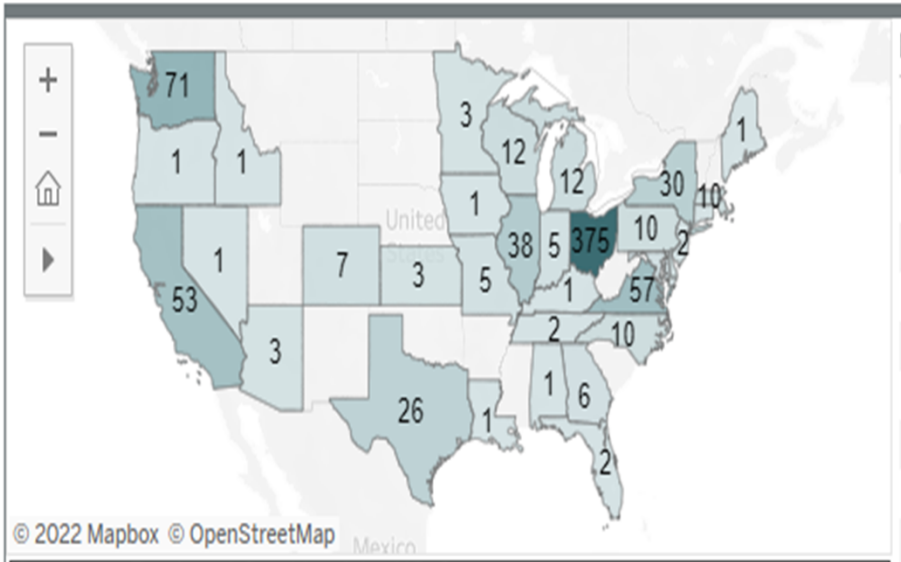
Companies that Hire Our Grads

- Computing
  - Amazon, Google, Facebook, Expedia, Twitter
  - Microsoft, Apple, IBM, Cisco, Intel, AMD, NVIDIA
- Financial
  - JP Morgan Chase, Capital One, JP Morgan Chase, Fidelity, Liberty Mutual
- Healthcare
  - Cardinal, CoverMyMeds, Epic
- R&D, Defense
  - GE, General Motors, Batelle
  - DoD, Air Force, Army, Harris, Lockheed Martin
- Energy, Manufacturing, Entertainment, …
  - Marathon, P&G, Muirfield, Bloomberg, Deloitte, Walt Disney,
- Placement: 77% industry (11% grad school)

OSU CSE Grads BS: 2019-21

Hiring Companies/Further Education Schools

Sort By: Numeric



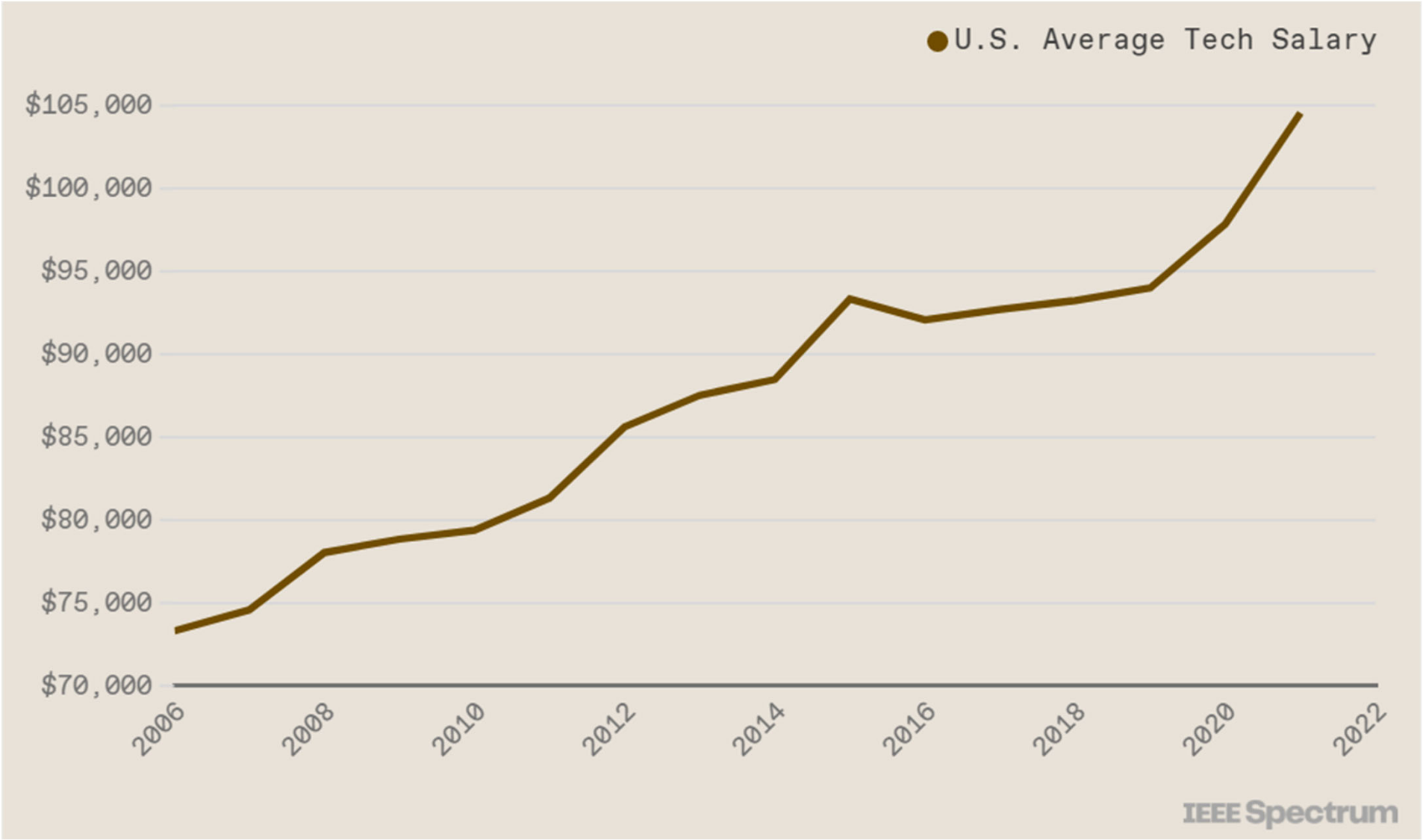
Graduates Employed Outside of the US: 9
Graduates Employed Without Location Information Reported: 56

Hiring Companies	
JPMorgan Chase & Co.	82
Capital One	57
Amazon	39
Microsoft	33
Nationwide	25
Northrop Grumman Corporation	11
Epic	10
Google, Inc.	10
Progressive Insurance	10
Tata Consultancy Services	10
Facebook	9
Ohio State University, The	8

Further Education Schools	
Ohio State University, The	34
University of Illinois at Urbana-	5
University of Southern California	5
New York University	4
University of Michigan	4
Georgia Institute of Technology	3
American Academy of Dramatic Arts,	2
Carnegie Mellon University	2
Duke University	2
Northeastern University	2
Purdue University	2
Rice University	2

From: https://ecs.osu.edu/post-graduate-outcomes

Salary Trends (Since 2006)



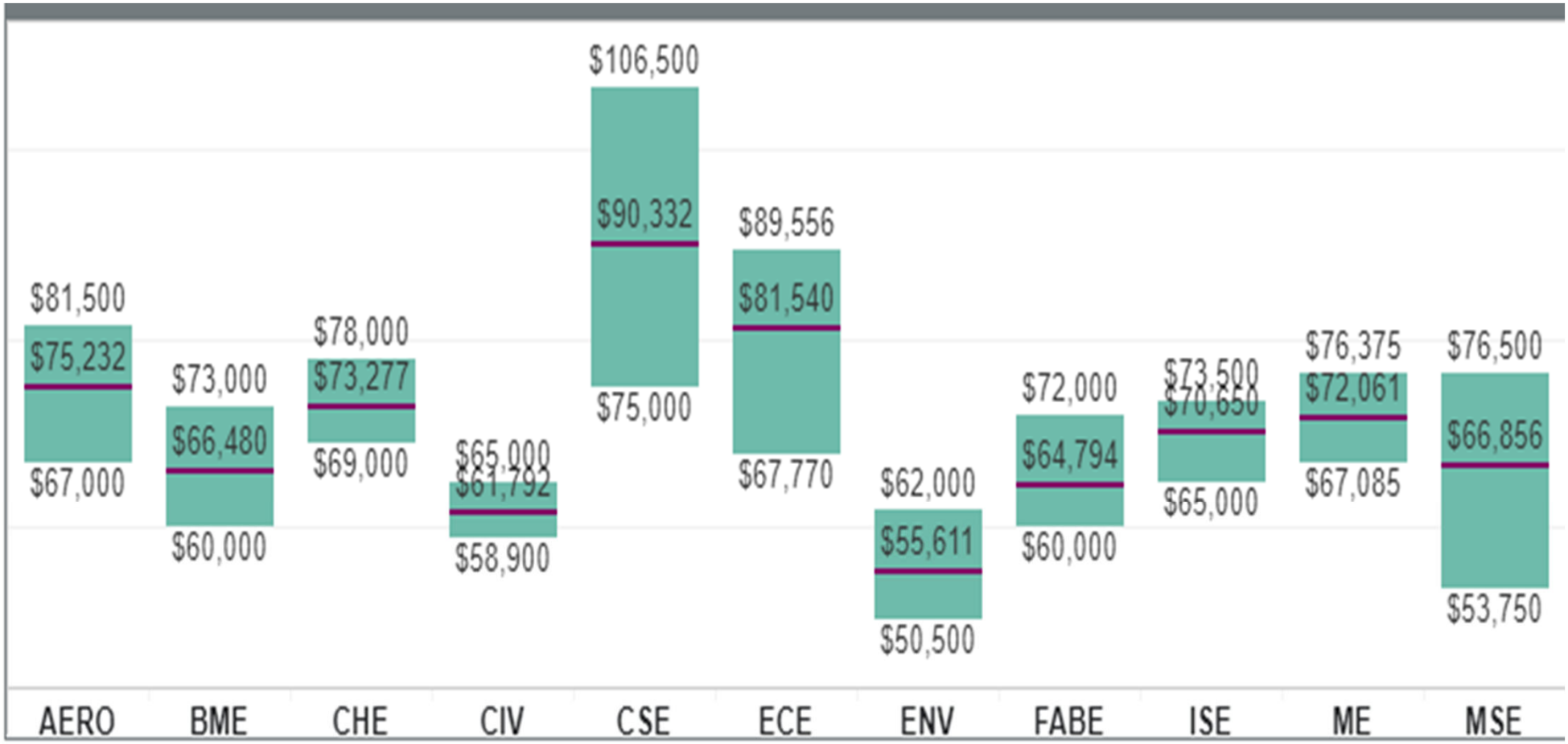
Salary Snapshot (2020-21 grds)

Degree	Avg Offer	75th %
BS CSE/CIS	$ 86,613	$ 105,000
MS CS	$122,333	$150,000
PhD CS	$149,778	$160,000

Intern/Co-op	Avg Wage	75th %
BS CSE/CIS	25.06 $/hr	27.50 $/hr
MS CS (*)	28.80 $/hr	32.75 $/hr

From: ecs.osu.edu/wages-salaries-major
(viewed on 10/1/2022)

OSU Engineering Dashboard



Some Things You Might Not Know about CS (at OSU)…

Classes are Small

- Most CS classes capped at 40 students
  - Honors classes capped at 25
  - Frequent, flexible scheduling

Combine CS Major With…

- Entrepreneurship
  - Newpath = Entrepreneurship minor + Internships + Practicum
- Security
  - CAEIAE = National Center of Excellence in Information Assurance Education (DoD)
- Research
  - EUROPA = Undergrad Research Forum
  - Combined BS/MS degree
- Scholarships
  - University, College, Department

Choice of Degree Programs

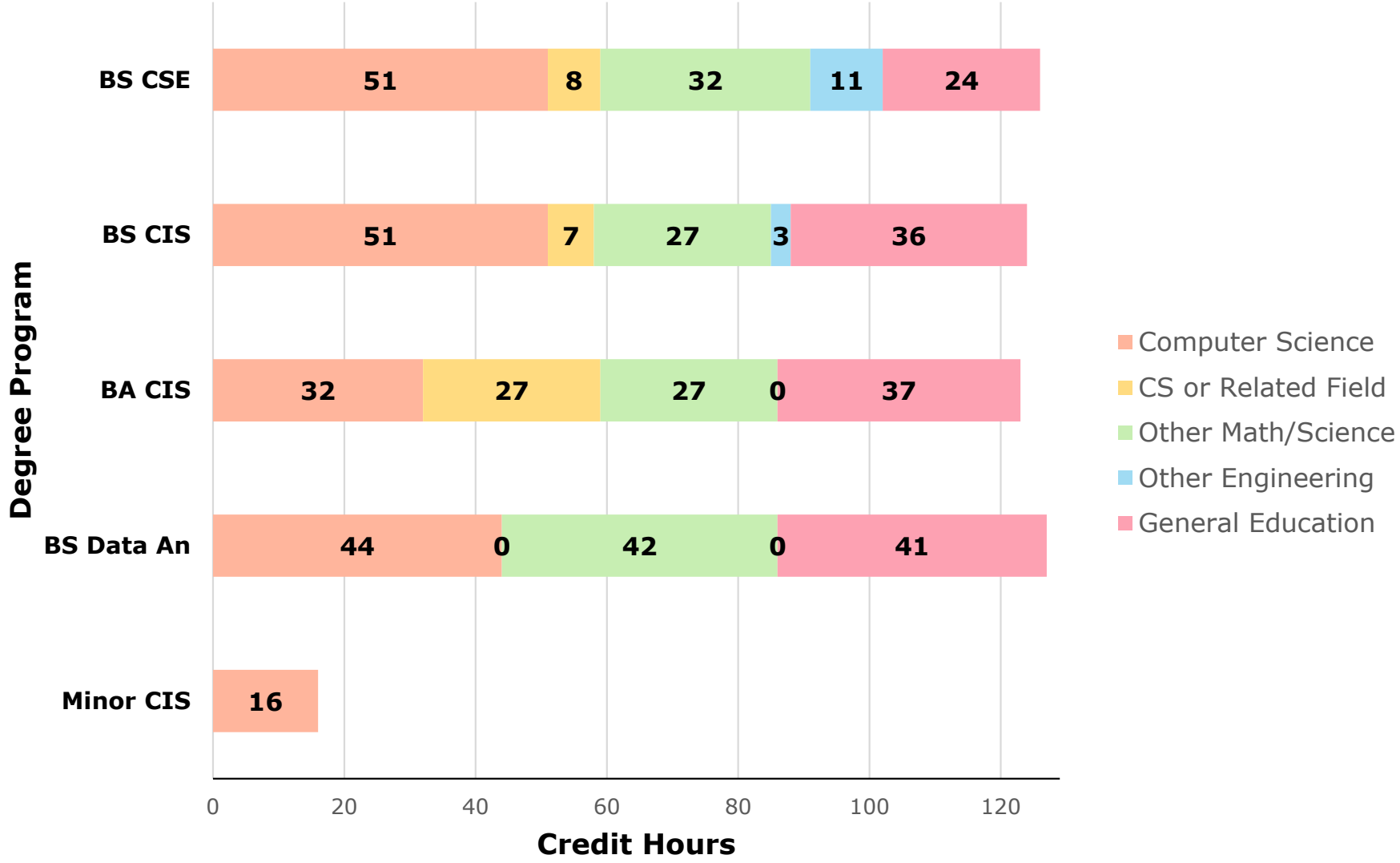
Engineering (CSE)

- Computer science
  required – 25 hrs
  pick list – 17 hrs
  options – 9-17 hrs
- Other Engineering courses – 13 hrs
- ABET-accredited since 1999

Arts & Science (CIS)

- Computer science
  required – 25 hrs
  pick list – 17 hrs
  options – 9-16 hrs
- Semi-flexible requirements in natural & social sciences, foreign languages, etc.

Comparing Programs



Sample Curriculum: CSE

Year	Autumn (1st Semester)			Spring (2nd Semester)		
1	Engr 1100	Engineering Survey	1	CSE 2221	Software I	4
	Math 1151	Calculus I	5	Math 1172	Engineering Calculus II	5
	Phys 1250	Physics I	5	Science	Bio, Chem, or Phys II	5
	Engr 1181	Fundamentals of Engineering I	2	Engr 1182	Fundamentals of Engineering II	2
	Gen Ed	Writing	3			
	Gen Ed	Launch Seminar	1			
		Total	17		Total	16
2	CSE 2231	Software II	4	CSE 2331	Foundations II	3
	CSE 2321	Foundations I	3	CSE 2421	Systems I	4
	Stat 3470	Probability & Statistics	3	Math 3345	Discrete Math	3
	Math 2568	Linear Algebra	3	ECE 2060	Digital Logic	3
	Gen Ed	Literary, Vis, Performing Arts	3	Gen Ed	History	3
		Total	16		Total	16
3	CSE 2431	Systems II	3	CSE 32x1	Software: Soft Eng / Databases	3
	CSE 390x	Project	4	CSE 34x1	Systems: Architecture / Networks	3
	ECE 2020	Analog Circuits	3	CSE 35x1	Applications: AI / Graphics	3
	Math/Stats	Math or Stats Elective	3	CSE 2501	Professionalism and Ethics	1
	Gen Ed	Social Science	3	Gen Ed	Theme: Citizenship, Justice	4
		Total	16		Total	14
4	CSE 3341	Programming Languages	3	CSE 591x	Capstone Design	4
		Tech Elective	3		Tech Elective	3
		Tech Elective	3		Tech Elective	3
		Tech Elective	3		Tech Elective	2
	Gen Ed	Diversity	3	Gen Ed	Theme: Choice	4
		Total	15		Total	16

Sample Curriculum: CIS

Year	Autumn (1st Semester)			Spring (2nd Semester)		
1	ASC 1100	A&S Survey	1	CSE 2221	Software I	4
	Math 1151	Calculus I	5	Math 1152	Calculus II	5
	Phys 1250	Physics I	5	Science	Bio, Chem, or Phys II	5
	Gen Ed	Writing	3	Gen Ed	Literary, Vis, Performing Arts	3
	Gen Ed	Launch Seminar	1			
		Total	15		Total	17
2	CSE 2231	Software II	4	CSE 2331	Foundations II	3
	CSE 2321	Foundations I	3	CSE 2421	Systems I	4
	Stat 3470	Probability & Statistics	3	Math 3345	Discrete Math	3
	Lang	Foreign Language I	4	Lang	Foreign Language II	4
				Gen Ed	History	3
		Total	14		Total	17
3	CSE 2431	Systems II	3	CSE 32x1	Software: Soft Eng / Databases	3
	CSE 390x	Project	4	CSE 34x1	Systems: Architecture / Networks	3
	ECE 2060	Digital Logic	3	CSE 35x1	Applications: AI / Graphics	3
	Lang	Foreign Language III	4	CSE 2501	Prof. and Ethics	1
	Gen Ed	Social Science	3	Gen Ed	Theme: Citizenship, Justice	4
		Total	17		Total	14
4	CSE 3341	Programming Languages	3	CSE 591x	Capstone Design	4
		Tech Elective	3		Tech Elective	3
		Tech Elective	3		Tech Elective	3
		Tech Elective	3		Tech Elective	1
	Gen Ed	Diversity	3	Gen Ed	Theme: Choice	4
		Total	15		Total	15

Sample Curriculum: BA CIS

Year	Autumn (1st Semester)			Spring (2nd Semester)		
1	ASC 1100	A&S Survey	1	CSE 2221	Software I	4
	Math 1151	Calculus I	5	Math 1152	Calculus II	5
	Gen Ed	Natural Science	5	Gen Ed	History	3
	Gen Ed	Writing	3	Gen Ed	Literary, Vis, Performing Arts	3
	Gen Ed	Launch Seminar	1			
		Total	15		Total	15
2	CSE 2231	Software II	4	CSE 2421	Systems I	4
	CSE 2321	Foundations I	3		Related Field Core	3
		Related Field Core	3		Science Elective	5
	Stat 2450	Probability & Statistics	3	Lang	Foreign Language II	4
	Lang	Foreign Language I	4			
		Total	17		Total	16
3	CSE 390x	Project	4		Related Field Core	3
		Related Field Core	3		Tech Elective	3
	Math/Stats	Math or Stats Elective	3		Tech Elective	3
	Lang	Foreign Language III	4	CSE 2501	Prof. and Ethics	1
	Gen Ed	Social Science	3	Gen Ed	Theme: Citizenship, Justice	4
		Total	17		Total	14
4		Tech Elective	3		Tech Elective	3
		Tech Elective	3		Tech Elective	3
		Tech Elective	3		Tech Elective	3
		Tech Elective	3	Gen Ed	Theme: Choice	4
	Gen Ed	Diversity	3	Gen Ed	Reflection Seminar	1
		Total	15		Total	14

Admission to CSE/CIS Major

- New first-year student arrives as a *pre-major*
  - Join major at end of first year (by application)
- Starting Au 2023:
  - Only students admitted to the university as CSE/CIS pre-majors can apply for the CSE/CIS major

Areas of Excellence at Ohio State and in Computer Science and Engineering

Excellence at Ohio State

- National prominence
  - 17th in public universities (USNWR '21)
  - 15th in total R&D expenditures (1.2 Billion)
  - 5th in industry-sponsored R&D
  - "Best Value Colleges" top 50 list (Princeton Review '22)
- Freshman class '22: 71,000 applications
  - 71% of freshmen from top 10% of HS class
    - 98% in top 25% of HS class
  - Middle 50%: ACT 27-32 / SAT 1270-1430
    - Average: 29.5 / 1347 (29-33 in Eng)
  - First-year retention: 93.4%
  - Graduation rate: 72% 4-year, 88% 6-year

Excellence in Engineering

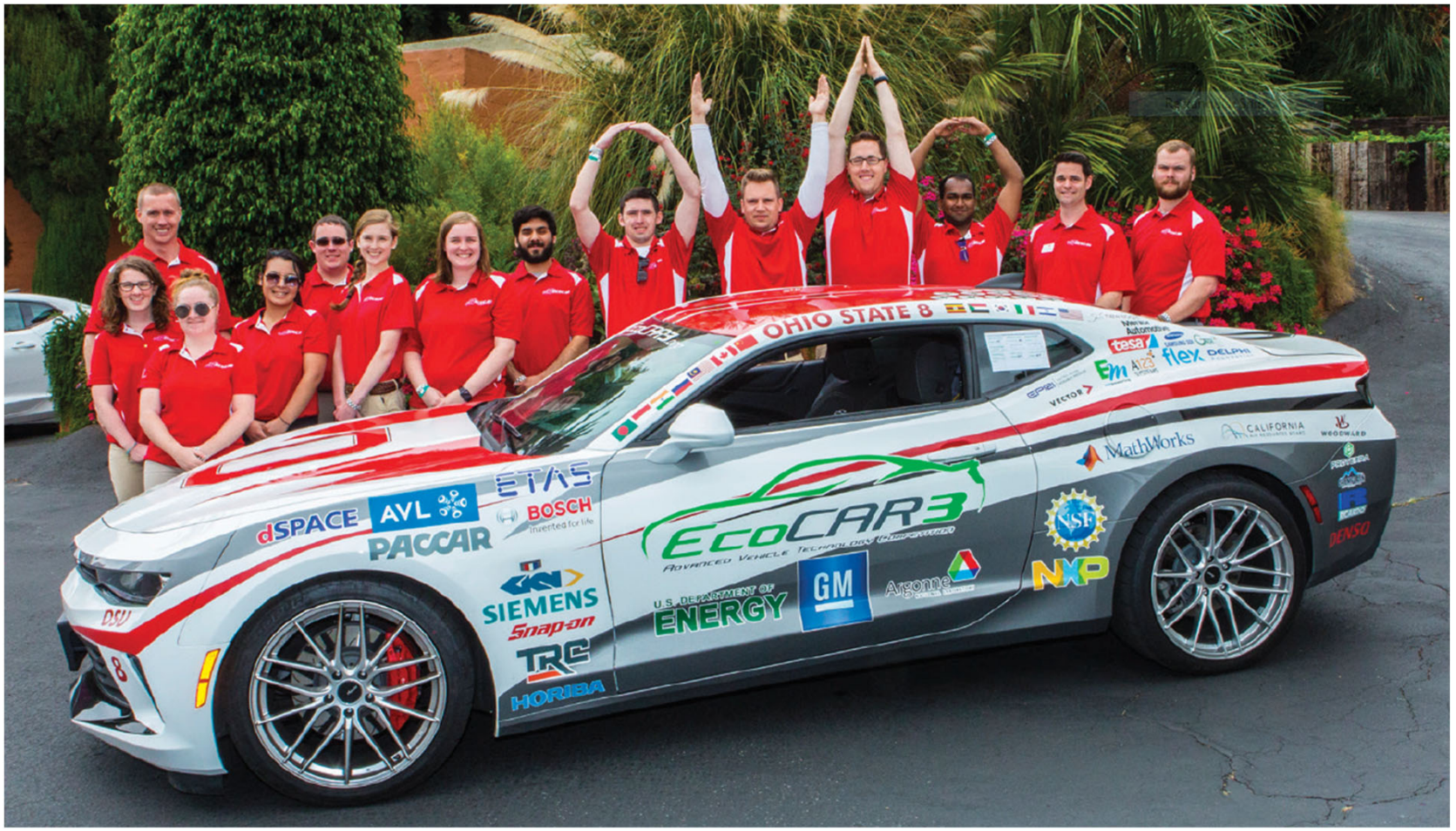
- National prominence
  - 19th among publics (USNWR '21)
  - 12th overall according to recruiters (WSJ '11)
  - 11 members of National Academy of Eng.
- Employment opportunities
  - Sept. expo: 225 companies for engineers
  - 71% of students do co-op experience

Student Project Teams

Buckeye Bullet

Solar Decathalon

More Student Project Teams



EcoCar Challenge

More Student Project Teams…

Aerial Robotics
Baja Buckeyes
Environment. Design
ChemE Car
Concrete Canoe
Design/Build/Fly
Steele Bridge
Underwater Robotics
Engineers Without Borders
Community Service
EcoCar
Electric Motorcycle
FIRST Robotics
Formula Buckeyes
Solar Car

plus a dozen more…

CSE Student Organizations

Open Source Club
at The Ohio State University

Mobile App Club.
Every Wednesday at 7:00pm
220 Caldwell Labs | The Ohio State University

Buckeye Hackers

ACM - W

plus a bunch more…

OHI/O Hackathon (2022)

video

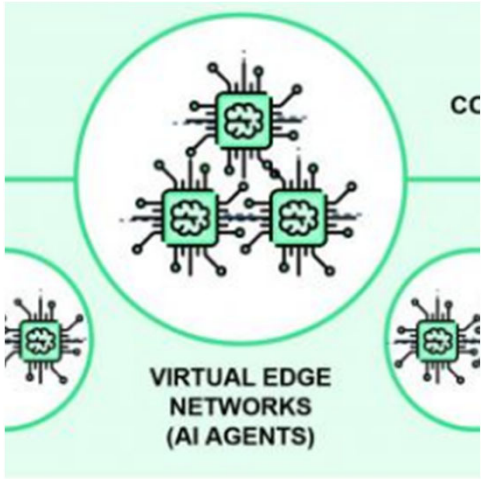
engineering.osu.edu/news/2022/01/students-companies-win-annual-hackathon

Excellence at Computer Science

- 18th CS dept. among public universities in US (30th overall, USNWR 2018)
  - Steadily rising
  - Doubled research activity in last 10 years
  - Students 7th out of 110 teams at ACM Regionals
- Many faculty awards
  - Career, PECASE, PYI (35)
  - Fellows of IEEE, ACM, AAAI (15)
- Education awards for intro sequence
  - National: IEEE Undergrad Teaching Award (2000)
  - State: Ohio Faculty Innovator Award (2009)
  - Many university and college-level awards

New NSF Institutes

- ICICLE: Cyberinfrastructure for AI
  https://icicle.osu.edu/



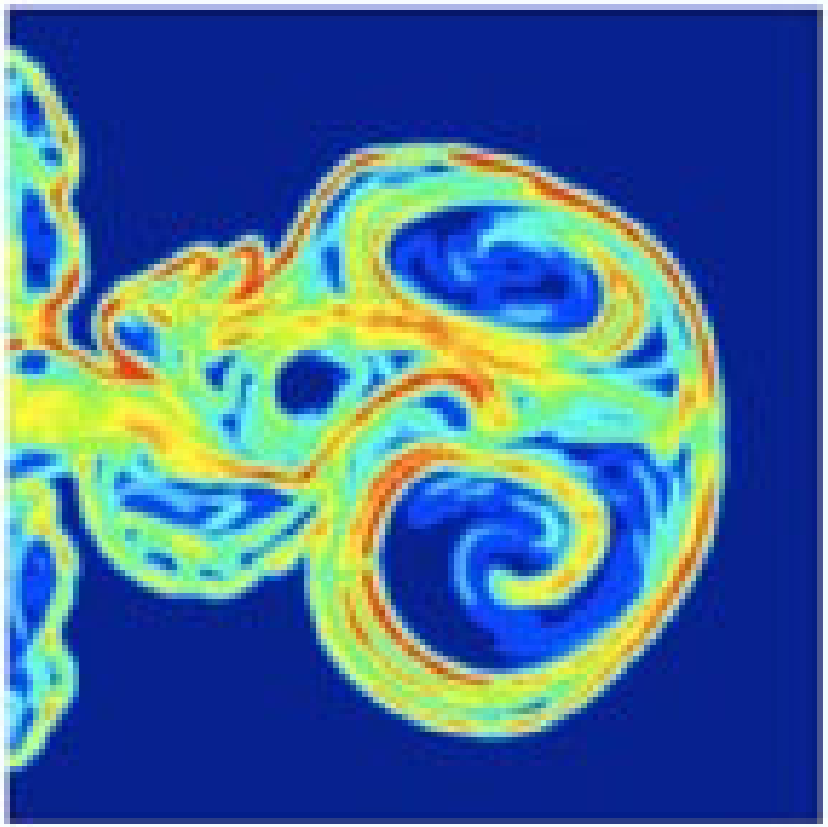
- AI-EDGE: AI in the Network
  https://aiedge.osu.edu/

- Imageomics:
  https://imageomics.osu.edu/

- QuSTEAM: Quantum computing
  https://qusteam.org/

Graphics

- Animation
- Scientific visualization
- Rendering
- Computational geometry, topology

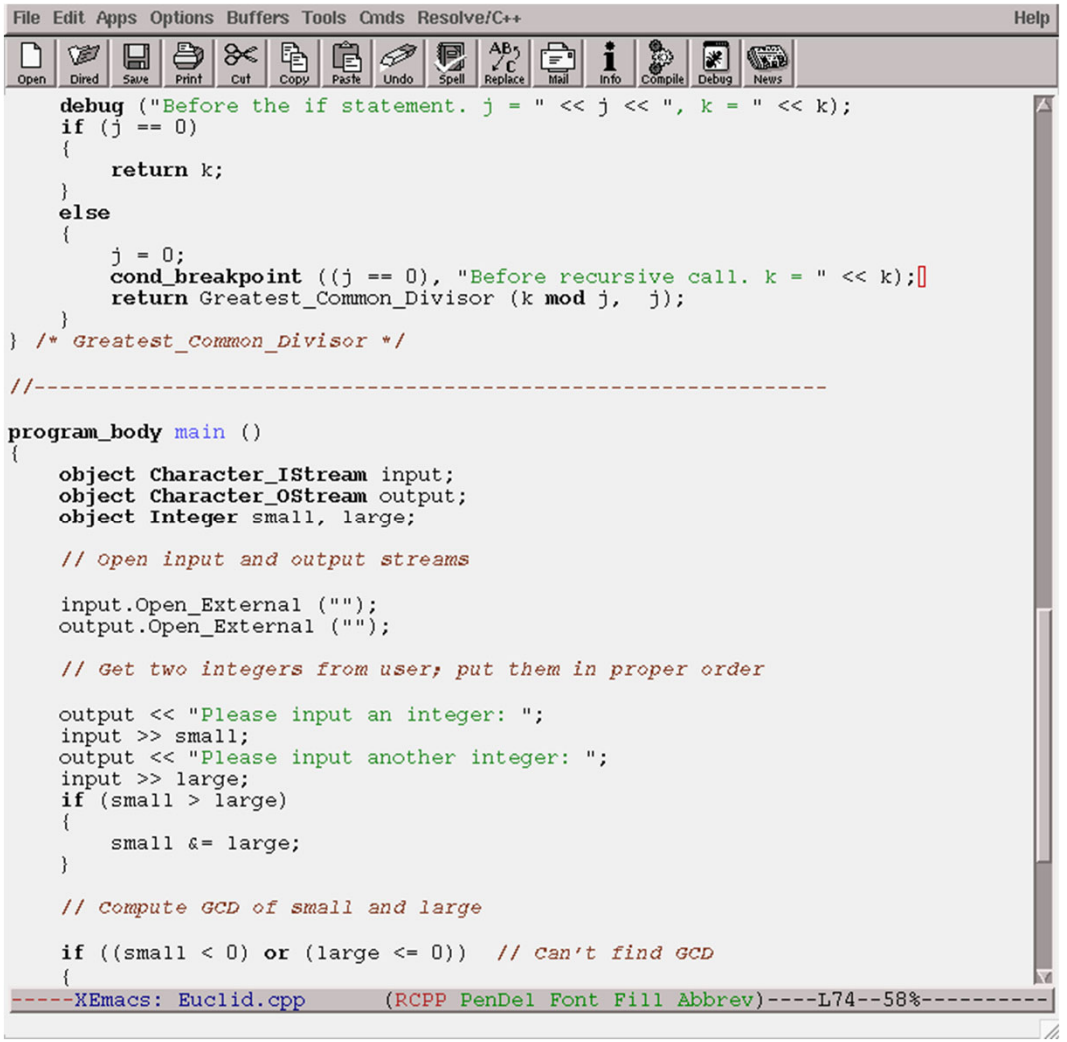


Artificial Intelligence

- Machine learning
- Neural networks
- Speech processing
- Text analysis
- Vision and pattern recognition

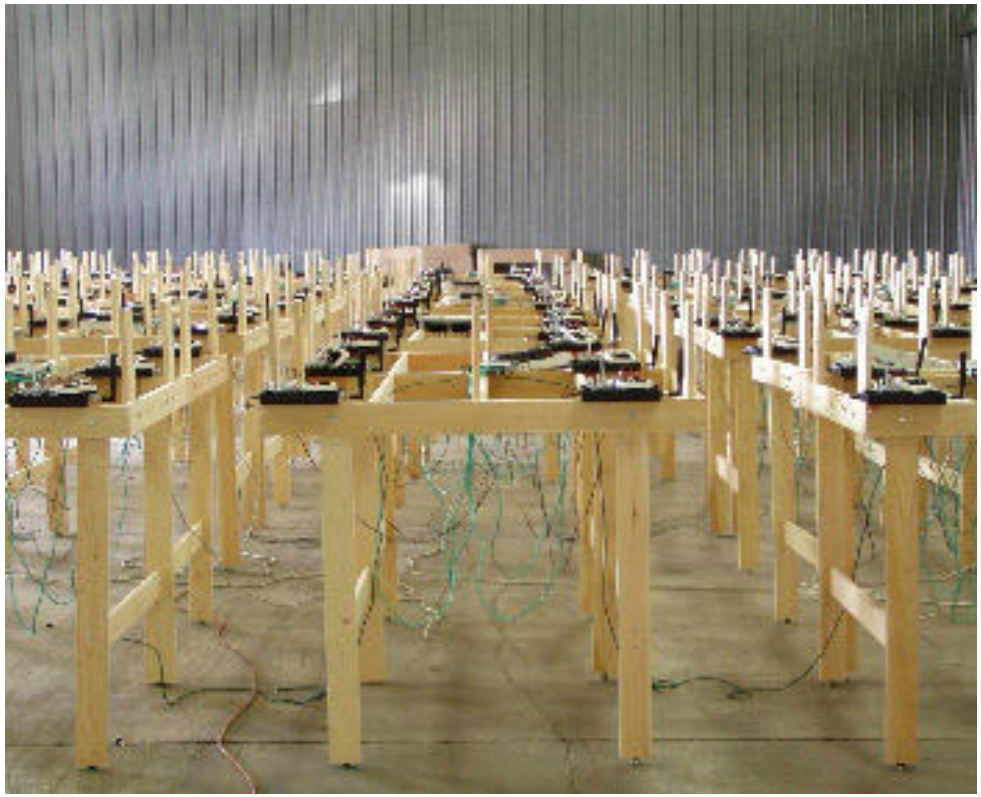
Software Engineering

- Automatic verification
- Static analysis
- Testing
- Debugging
- Fault tolerance
- Comprehension
- Compiler optimizations



Networking

- Sensor systems
- Security
- Wireless, ad hoc
- Self-stabilization



High-Performance Systems

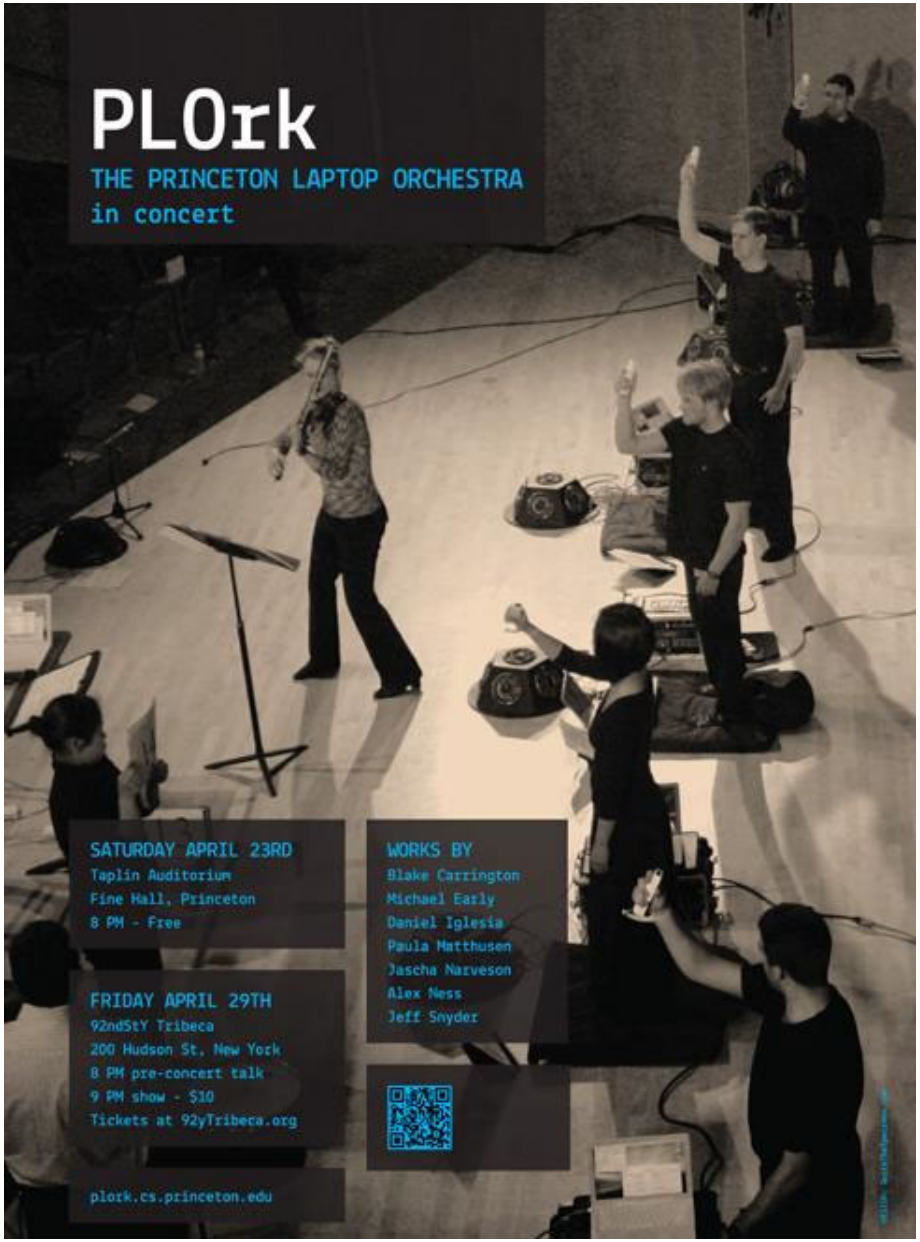
- Cluster-based computing
- Cloud and grid computing
- Massively parallel systems
- Databases
- Scientific computing

Doug Roble: A CSE Alum

Steve May: A CSE Alum

Ryan Geiss: A CSE Alum

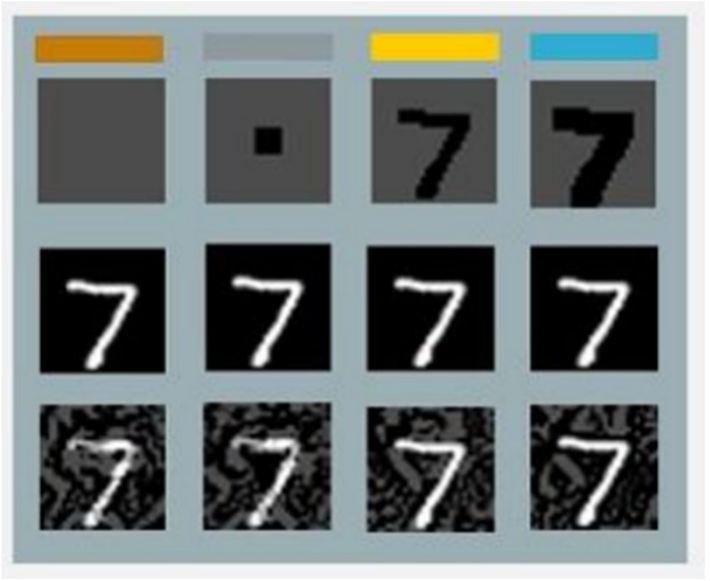
Rebecca Fiebrink: A CSE Alum



Ben Gilbert: A CSE Alum

SeizeTheDay

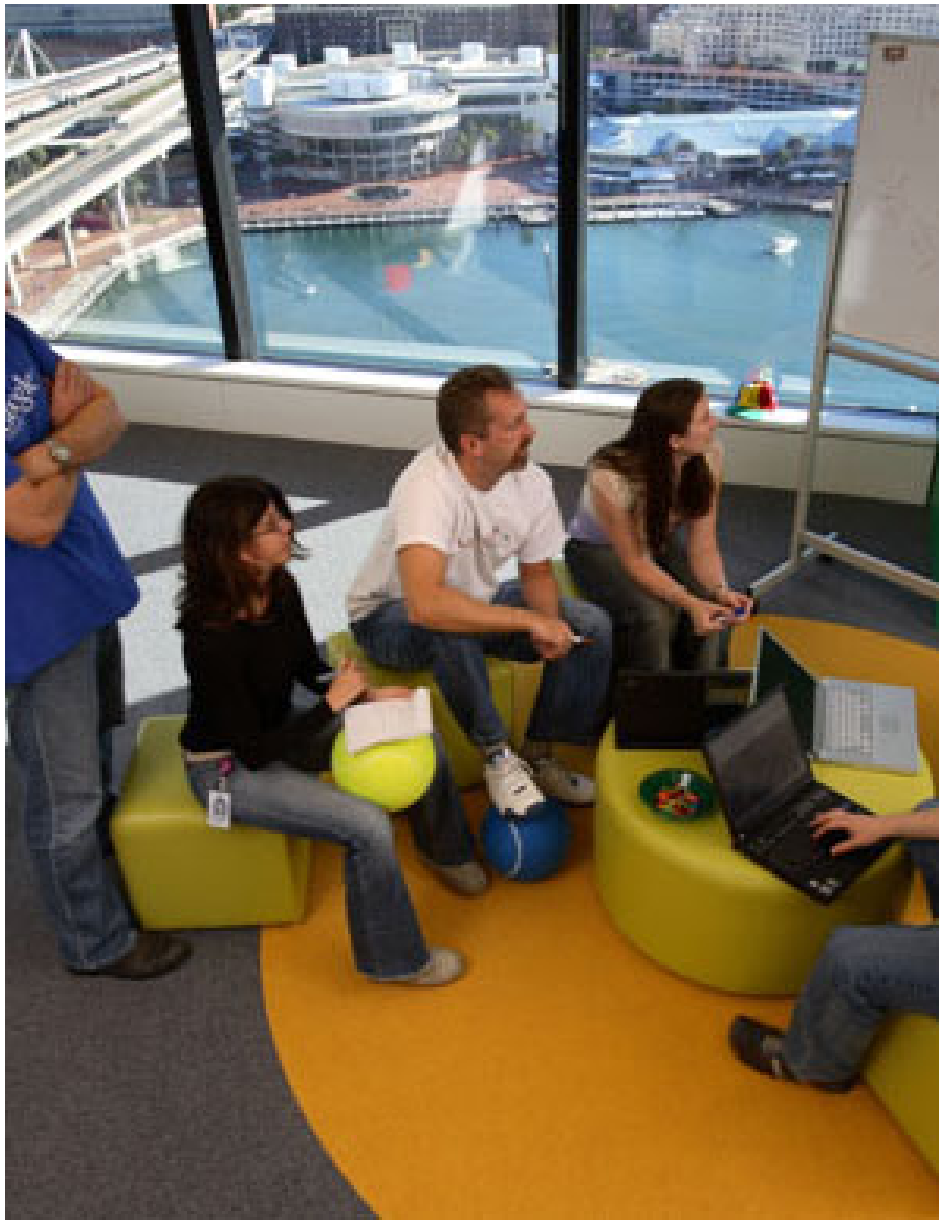
Eitan Rothberg: A CSE Alum



Goldwater winner, 2020

Summary

- CS is everywhere; changing our world
- CS is "imagineering"
- Choice of degree programs: CSE & CIS
- Job prospects are excellent



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