Addressing the Diversity Crisis in Computing

Dr. Michael S. Kirkpatrick
Department of Computer Science
March 16, 2015
What is Computer Science and why should you care?
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Top 10 Best Jobs in America 2015*

1. Software Architect
2. Video Game Designer
3. Landman
4. Patent Agent
5. Hospital Administrator
6. Continuous Improvement Manager
7. Clinical Nurse Specialist
8. Database Developer
9. Information Assurance Analyst
10. Pilates/Yoga Instructor

Economic possibility

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Defining computer science

Computer science is...
Defining computer science

Computer science is...

the systematic study of the **feasibility**, **structure**, **expression**, and **mechanization** of the methodical procedures (or algorithms) that underlie the acquisition, representation, processing, storage, communication of, and access to **information**
Defining computer science

Computer science is...
Defining computer science

Computer science is...

a foundational skill for the 21st Century that has many implications for social and economic justice
Today’s demographics
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Usability mantra:

Know thy users for they are not thyself.
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http://ncwit.org/
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http://ncwit.org/

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Data source: nces.ed.gov/programs/digest/2013menu_tables.asp
Author: Randy Olson (randalolson.com / @randalolson)
Note: Some majors are missing because the historical data is not available for them
“Ancient” and recent history
Ada Lovelace

1815 - 1852
• English mathematician
• Notes on Charles Babbage’s Analytical Engine recognized as the first automated algorithm
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World’s first programmer
Hedy Lamarr

1914 - 2000
• American actress
• Co-invented frequency-hopping spread-spectrum to avoid jamming of radio-controlled torpedos in WWII
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Technology still used in Bluetooth
Grace Murray Hopper

1906 - 1992
• American mathematician
• U.S. Navy Admiral
• Programmer of Harvard Mark I (first general-purpose computer)
• Invented the first compiler
• Popularized the term “bug” to refer to software error
• Pioneered for standards in computer systems
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Required for ALL modern software
Bletchley Park

World War II

- UK Government Code & Cipher School
- Broke secret communications of the Axis Powers
- Home of the world’s first programmable computer
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80% of the 12,000 workers were women
Barbara Liskov

1939 -
• American computer scientist
• Led development of an early OS
• Created first high-level language for distributed computing
• Her work led to creation of object-oriented programming
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The dominant style for modern software
Radia Perlman

1951 -

• American computer scientist
• Developed a language to teach toddlers programming
• Invented spanning-tree protocols, techniques for routing when under attack
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“Mother of the Internet” (but don’t call her that)
Honorable mentions

**Many others...**
- Fran Allen
- Annie Antón
- Jean Bartik
- Sue Black
- Anita Borg
- Tracy Camp
- Lynn Conway
- Dorothy E. Denning
- Joan Feigenbaum
- Adele Goldberg
- Shafi Goldwasser

**Others...**
- Betty Holberton
- Susan Horwitz
- Sister Mary Kenneth Keller
- Maria Klawe
- Daphne Koller
- Susan Landau
- Marissa Mayer
- Tal Rabin
- Susan Rodger
- Ruth Teitelbaum
- Janie Tsao
- Jeannette Wing
What went wrong
Obstacles and debacles

1980s “golden age”

- Introduction of PC
- Rise of gaming/nerd culture
- Hackers as idols
- Marketing changes
Obstacles and debacles

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Prior experience = no level playing field
Obstacles and debacles

2000s dot com bust, aftermath, recovery

• Fears of outsourcing
• CS1 stringency, “geek genes” mythology
  • Emphasis on individual programming
• Pervasive security threats
  • Glorification of “genius hackers”
• Rise of Web 2.0
  • *The Social Network*
Obstacles and debacles

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  • The Social Network
Obstacles and debacles

Girls’ choices are constrained

• Steered away by parents, teachers, others
  • Computing is for boys
• Underrepresentation is a vicious cycle
  • Lack of role models
• Girls systematically underrepresent their abilities
  • Accurate feedback is critical
• Girls anticipate work-family conflicts
• Discrimination limits opportunities
• Punished for exhibiting competence

Obstacles and debacles

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“One category of reactions that I receive all the time as a programmer that presents as feminine is: No one believes I am a programmer. I can’t tell you how many people, when meeting me and hearing my profession, tell me that I look like a designer, someone in accounting, someone in marketing, anything but a programmer.”

Obstacles and debacles

The leaky pipeline:

"The pipeline is leaky and full of acid. The pipeline leads to a sewage treatment plant. The pipeline ends in a meat grinder."

-Julie Pagano*
Obstacles and debacles

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“The pipeline is leaky and full of acid. The pipeline leads to a sewage treatment plant. The pipeline ends in a meat grinder.”

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*Diversity for Sale (http://juliepagano.com/blog/2015/02/07/diversity-for-sale/)
Obstacles and debacles

Overt misogyny
• Titstare application fallout
• Strip show at Black Hat
• Julie Ann Horvath’s departure
• Brogrammer culture
• Ellen Pao vs. Kleiner Perkins
• Whitney Wolfe as Tinder co-founder
• #gamergate
Obstacles and debacles

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“Titstare is an app where you take photos of yourself staring at tits.”
Obstacles and challenges

Overt misogyny
• Titstare application fallout
• Strip show at Black Hat
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“Titstare is an app where you take photos of yourself staring at tits.”

“It is not misogyny to tell a sexist joke, or to fail to take a woman seriously, or to enjoy boobies.”
Obstacles and debacles

**Overt misogyny**
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Kleiner Perkins excluded women from client meetings because they “killed the buzz.”
Obstacles and debacles

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Having a woman on the board “makes the company seem like a joke.”
Obstacles and debacles

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“I’m honestly trying to understand why anyone says that females are ‘needed’ in the tech industry. The tech community works fine without females, just like any other mostly male industry. Feminists probably just want women making more money.”
Obstacles and debacles

**Overt misogyny**
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“It's difficult to even get a modicum of respect. They talk down to you. They belittle you.”
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“This is an industry filled with sociopaths who cannot see another individual as a human being.”
“It's difficult to even get a modicum of respect. They talk down to you. They belittle you.”

“I was told by one interviewer, why don't I apply for a role that was lower level than where I was [because I have a hearing disability].”

“This is an industry filled with sociopaths who cannot see another individual as a human being.”
“It's difficult to even get a modicum of respect. They talk down to you. They belittle you.”

“This is an industry filled with sociopaths who cannot see another individual as a human being.”

“I was told by one interviewer, why don't I apply for a role that was lower level than where I was [because I have a hearing disability].”

“This is exactly what it's like being black in industry. Exact same subtleties, exactly.”
Subcultures

hacking

start-up

gaming

Computer Science
What is being done
What NOT to do
What NOT to do
What NOT to do
Goal: 10,000 high school CS teachers

- Exploring Computer Science
  - Human Computer Interaction, Problem Solving, Web Design, Intro to Programming, Computing and Data Analysis, Robotics

- CS Principles
  - Abstraction, Algorithms, Creativity, Data, Impact, Internet, Programming

http://cs10kcommunity.org/
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Code.org advocacy

Expand CS education in schools

• Code Studio
  • Free, online K-8 course
• Hour of Code
• Teacher training
  • CS in Algebra
  • CS in Science
  • Exploring Computer Science
  • AP CS Principles
• Make CS count!
Code.org advocacy
Code.org advocacy
Code.org advocacy

Levels completed by age, data until 11/13/2014

<table>
<thead>
<tr>
<th>age / levels completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>with teacher</td>
</tr>
<tr>
<td>without teacher</td>
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</tbody>
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Code.org advocacy

Levels completed by age, data until 11/13/2014

- with teacher
- without teacher

Studying alone
- 65%
- 35%

With a classroom teacher
- 54%
- 46%

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Code.org advocacy

Levels completed by age, data until 11/13/2014

- With teacher
- Without teacher

Ethnic diversity across Code.org’s Code Studio students in U.S. classrooms:

- White/Caucasian: 45%
- Hispanic American: 22%
- Black/African American: 15%
- Other: 8%
- Asian: 8%
- Native American: 2%

Studying alone: 65%
With a classroom teacher: 54% (Male), 46% (Female)
http://appinventor.mit.edu/
Activity 6

Battleships—*Searching Algorithms*

Summary
Computers are often required to find information in large collections of data. They need to develop quick and efficient ways of doing this. This activity demonstrates three different search methods: linear searching, binary searching and hashing.

Curriculum Links
- ✓ Mathematics: Number Level 3 and up. Exploring numbers: Greater than, less than and equal to
- ✓ Geometry Level 3 and up. Exploring shape and space: Co-ordinates

Skills
- ✓ Logical reasoning

Ages
- ✓ 9 years and up

Materials
Each child will need:
- ✓ Copy of battleships games
  - 1A, 1B for game 1
  - 2A, 2B for game 2
  - 3A, 3B for game 3
- ✓ You may also need a few copies of the supplementary game sheets, 1A', 1B', 2A', 2B', 3A', 3B'.
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http://csunplugged.org/
What we are doing at JMU

**CS curriculum and outreach**

- **Assume students are new to computing**
  - Two-semester CS1 sequence with no prerequisites
- **Inclusive, collaborative teaching style**
  - Pair programming, POGIL, TBL
- **Assessing impact of grade prerequisite change**
  - Monitoring for changes in demographics
- **Content Teaching Academy**
- **Summer coding camp/REU**
- **Faculty recruiting**

http://www.ncwit.org/resources/top-10-ways-engage-underrepresented-students-computing/
What we are doing at JMU

**CS curriculum changes**

- **CS 101 Introduction to Computing**
  - Overview of CS and context/relevance
- **Systems curriculum redesign**
  - Replaced CS 350/450/460 with CS 261/361 + 450/456/470
  - Emphasis on *building* systems and relevant principles
  - Flexible scheduling for VCCS transfers
  - Theme: *Computing is not about the machine*
- **CS 330 Societal and Ethical Issues in Computing**
What YOU can do

Be a role model
• Learn to code and encourage others to do so
• Demonstrate computational skills
• Encourage young girls to code
• Support efforts to bring computing into K-12
  • Ask your children’s schools about Hour of Code
• Help efforts to make CS count
• Talk about women in technology
Inspiration

ane @lordvoldemot
@EmWatson my dad says I can't be a engineer 'cause it's a "men profession" what do I do to change that? #Heforshe @HeforShe #Davos

Emma Watson @EmWatson
@lordvoldemot @HeforShe Become an engineer.
6:29 AM - 23 Jan 2015
7,957 RETWEETS 12,356 FAVORITES
Questions?
Resources

Where to go for more information

- National Council for Women & Information Technology (http://www.ncwit.org/)
- ACM’s Women in Computing (ACM-W) (http://women.acm.org/)
- CS10K Project (http://cs10kcommunity.org/)
- Code.org (http://code.org/)
- Anita Borg Institute (http://anitaborg.org/)
- Girls Who Code (http://girlswhocode.com/)
- Black Girls Code (http://blackgirlscode.com/)
- Model View Culture (https://modelviewculture.com/)
- Learn to write Python code:
  - http://learnpython.org/
Resources

Where to go for more information

- Alice (http://alice.org/)
- AppInventor (http://appinventor.mit.edu/)
- Computer Science Unplugged (http://csunplugged.org/)
- Finch Robots (http://finchrobot.com/)
- Lightbot (http://lightbot.com/)
- Scratch (http://scratch.mit.edu/)
- Snap! (Build Your Own Blocks) (http://snap.berkeley.edu/)