Diversifying the Faces in Computing

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Duke University

Juniper Networks
June 27, 2023
San Jose, CA

Outline

- **About Me and My Journey**
- Diversifying Computing
- Programs for Change
- Recognition and Visibility
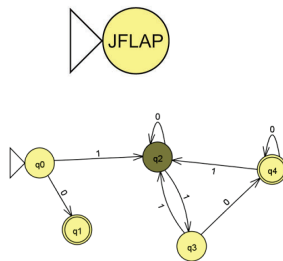

About Me

- Professor of the Practice of Computer Science, Duke University, since 1994
  - Teaching primarily
  - Research, write grants, supervise students
- Research Areas:
  - Computer Science Education
  - Visualization and Animation
  - Tools for learning CS
    - JFLAP used worldwide
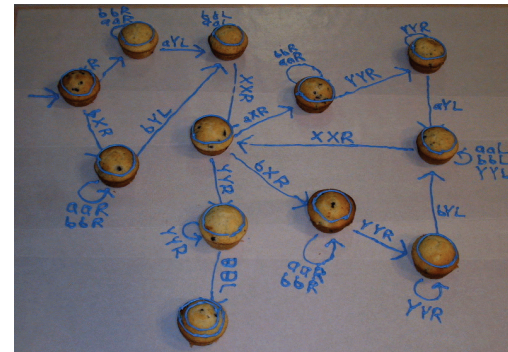 - Integrating computing into K-12
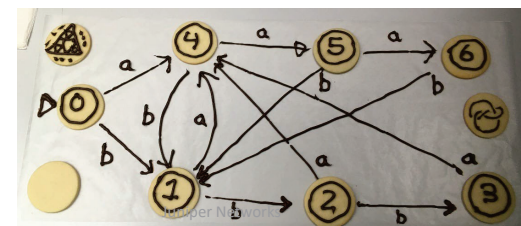

Hobby: Edible CS

Turing machine made out of blueberry muffins and icing

Finite State Machine made out of cookies and icing

My Journey to Full Professor

- Overcoming Struggles
- Lack of Diversity

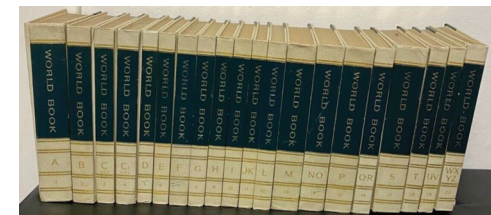## Starting way back

- Very shy
- Me and my sisters
- Liked math and puzzles
- No internet
- My World Wide Web

Where to go to College in 1979?

- Lived in Raleigh, NC
- Mother did not finish college
- Father had BS degree in Engineering

- Went to local university

College – North Carolina State University

- Took programming course first semester
  - PL/1
- Double major - Math, Computer Science
- Systems programmer in University Computing Center

```
Hello2: proc options(main);
    put list ('Hello, world!');
end Hello2;
```

Where to go next?

> You should go to Purdue

- No one in my family had a graduate degree
- Assumed I would get a job
- Undergraduate Research Assistant
  - David McAllister, Numerical Analysis

David McAllister

- Question led me to meet my Math Advisor
  - Dana Latch, Math Professor

Dana Latch

> You are going to graduate school, aren't you?

Applied for jobs and PhD programs

- Issue with my GRE score
  - Quantitative - 90%, high GPA
  - But Verbal - low score - 28%

> Huge Discrepency!

- Prof. Latch referred me to psychologist

> I would never have thought to do this

Applied for jobs and PhD programs

- Issue with my GRE score
  - Quantitative - 90%, high GPA
  - But Verbal - low score - 28%

> Huge Discrepency!

- Prof. Latch referred me to psychologist
  - Evaluation (Feb 1983):
    - "…Miss Rodger has a learning disability. … this disability is a subtle one and a discreet one that affects her ability to retain small bits of verbal information."
    - "I believe that deficits in both of these areas are primarily responsible for her low GRE Verbal score…
    - "present no reason to indicate that Miss Rodger's intellectual capacity would not be sufficient to handle graduate work in the area she will enter."

> Sent letter to graduate schools

Graduate School at Purdue

- Purdue admitted me conditionally
  - Demonstrate proficiency in English Composition

> Nailed that first month!

- Completed PhD in Algorithms 1989
  - Advisor: Greg Frederickson
- What was the diversity like?
  - Few women there
  - Only female student in some courses
  - One year only female PhD student
  - Only one female faculty member my first year
  - Two female faculty the rest of the time

Greg Frederickson

Assistant Professor
Rensselaer Polytechnic Institute

Rensselaer

- 1989-1994
- Continued research in algorithms
- Fell in love with teaching

- Diversity?
  - 1989 - Hired only two women faculty in dept – me and Ellen Walker
  - No other women hired while I was there

Ellen Walker

Assistant Professor of the Practice
Duke University

- Since 1994
- Assistant -> Associate -> Professor of the Practice
- Diversity?
  - There was one female faculty there when I came in 1994, Carla Ellis
  - Two women faculty were hired in 1994 – me and Xiaobai Sun
  - 1994 – 3 women faculty – 12%
  - 2008 Ellis retired, Hired Xiaowei Yang
  - 2015 Hired Sudeepa Roy and then more
  - 2023 now have 12 women, 27 men – 30%

Carla Ellis

Xiaobai Sun

Only 3 women faculty for 21 years

Xiaowei Yang

That is my journey
What about my disability?

What about My Disabilty?

- Diagnosed as heading to Graduate School
- Never got accommodations in Graduate School
- Never got any accommodations as a Professor
- It has been hard!
- Takes me longer to do things
  - Writing
  - Organizing thoughts
- November 2021

Nice to have names for my disabilities

  - Diagnosed with high-functioning Autism and verbal-based disability
- Been easier to talk about with several organizations

AccessComputing   ncwit.org   CRA-WP Computing Research Association Widening Participation

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- Programs for Change
- Recognition and Visibility

How did we get from 12% women CS faculty at Duke for 21 years, to 30%?

- All science depts had 0 to 3 women faculty
  - Created Senior Women in Science in 2004
  - Met with the Dean regularly
  - Got funding to bring in outside women speakers and other initiatives
    - Hired one of the speakers
    - Clare Booth Luce Assistant Professorship – for women only
- Now all science depts have 8+ women faculty

CRA Taulbee Survey 2022
There are a lot of students in CS!

Figure B1. BS Production (CS & CE)
CRA Taulbee Survey 2022
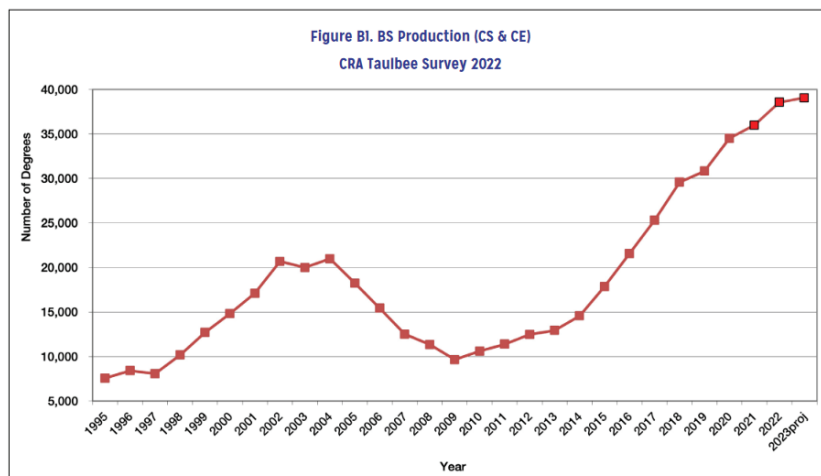
Are there women in CS?

- Computing Research Association (CRA)
  - Taulbee Survey 2020-21
    - 22% female PhD's granted in computing
    - 26% female PhD's current enrollment
    - 31% female MS graduated
    - 23% female BS graduated

We need to do better!

Missing underrepresented groups in Computing

- Computing Research Association (CRA)
  - Taulbee Survey 2020-21
    - 1.7% Black/AfA PhD's granted in computing
    - 1.7% Hispanic PhD's granted in computing
    - 1.9% Black/AfA PhD's enrolled
    - 2.1% Hispanic PhD's enrolled
    - 1.9% Black/AfA MS graduated
    - 2.8% Hispanic MS graduated
    - 3.9% Black/AfA BS graduated
    - 9.6% Hispanic BS graduated

These numbers are really dismal!

If they don't know about computing or see themselves in computing, they won't choose it as a field

Alice programming
Program 3D objects – drag and drop

- alice.org – by Randy Pausch, CMU

Alice programming
Program 3D objects – drag and drop

- alice.org – by Randy Pausch, CMU

My Alice efforts

- 2002 – added Alice to one section of a course, was favorite part of course!
- 2005 – Created a Non-majors course on Alice programming
  - Course attracts around 50% females
- 2006 – Duke Femmes program
  - Taught Alice to 4th to 6th grade girls
- Realized need to
  - Get into K-12
  - Teach teachers

Adventures in Alice Programming
www.cs.duke.edu/csed/alice/aliceInSchools

- 2-week Teacher workshops
  - Over 500 teachers, middle school, high school, some elementary
  - First week Teach Alice, Practice
  - Second week - Develop Lesson Plans
  - All disciplines: math, science, history, language arts, foreign language, art, music, business
  - Summers 2008-2017
- Main Sites:
  - Duke University, Durham, NC
  - Charleston/Columbia, SC
  - San Jose, CA
  - Lincoln, Nebraska
- THANKS IBM and NSF

Created online Coursera course
Introduction to Programming and Animation in Alice
Launched in January 2020, with Steve Cooper
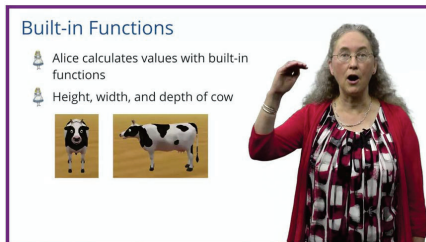
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Grace Hopper Celebration on Women in Computing

- Anita Borg, co-founded GHC conference in 1994 (with Telle Whitney), 500 attendees
- She died in 2003, Brain cancer
- GHC: 1994, 1997, 2000, 2002, 2004, 2006, then annually
- Now run by the Anita Borg Institute
- 2010 (2000 attendees), 2019 (25,000 attendees)
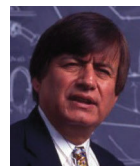- Mentoring talks, See many people like yourself – Empowering!

Anita Borg

Grace Hopper Celebration on Women in Computing

THE WORLD'S LARGEST GATHERING OF WOMEN AND NON-BINARY TECHNOLOGISTS

GRACE HOPPER CELEBRATION

SEPTEMBER, 26–29, 2023 | ORLANDO, FL

Anita Borg

- 2010 (2000 attendees), 2019 (25,000 attendees)
- Mentoring talks, See many people like yourself – Empowering!

Richard Tapia Celebration of Diversity in Computing

- Founded by Valerie Taylor and others, sponsored by ACM and CMD-IT
- Named after Richard Tapia, Mathematics Professor at Rice, leader in education and outreach
- Connect with common backgrounds, race, ethnicities, disabilities and gender to create communities.

Valerie Taylor

CMDiT
Center for Minorities and People with Disabilities in IT
Fostering Innovation Through Inclusion

Richard Tapia

Richard Tapia Celebration of Diversity in Computing

TAPIA CONFERENCE

SEPTEMBER 13-15, 2023

GAYLORD TEXAN RESORT DALLAS, TEXAS

Valerie Taylor

CMDiT
Center for Minorities and People with Disabilities in IT
Fostering Innovation Through Inclusion

- Connect with common backgrounds, race, ethnicities, disabilities and gender to create communities.
- Started in 2001, with 164 attendees
- 2001, 2003, 2005, 2007, 2009, 2011, 2013 now annual
- In 2019, 1920 attendees

Richard Tapia

Computing Research Association – Widening Participation (CRA-WP)
https://cra.org/cra-wp/

- Mission: Increasing the success and participation of populations underrepresented in computing research
- Been a Board member since 2009 and currently Co-Chair
- Since 1991, over 30 years!
- Formerly CRA-W (Women)

CRA-WP Programs - Undergraduates
(Computing Research Association Widening Participation)
(Previously CRA-W, for Women)

- DREU – Summer undergraduate Research program with Faculty at another university
- Mentoring at Grace Hopper Conf and Tapia Conferences
- UR2PHD – new research program to increase more women to graduate school (with CRA-E (education))

CRA-WP Programs – Grad Students
(Computing Research Association Widening Participation)
(Previously CRA-W, for Women)

- Grad Cohort Workshop for Women – Mentoring workshop for women grad students
  - 2-days in person in April annually
- Grad Cohort Workshop for Inclusion, Diversion, Equity, Accessibility and Leadership Skills (IDEALS)
  - 2-days in person in March annually
- CSGrad4US Fellowship
  - Mentorship for a year while you apply to PhD program to go back to school (BS degree in computing before 2021), plus Fellowship to attend (must be US Citizen or perm resident)

CRA-WP Programs – Faculty/Researchers
(Computing Research Association Widening Participation)
(Previously CRA-W, for Women)

- Early Career Mentoring Workshop (CMW)
  - For Postdocs, Assistant Professor or equivalent level in Industry/Gov labs
- Mid-Career Mentoring Workshop (CMW)
  - For Associate professors or equivalent level in Industry/Gov labs
- Both are:
  - 2-day Mentoring workshops with senior leaders
  - For women and underrepresented researchers in computing
  - Nov 2-4, 2023 in Chicago, IL — Apply now by July 10!
 - https://cra.org/cra-wp/mentoring-workshop/

National Center for Women and Technology (NCWIT)

ncwit.org

- Network of change leaders focused on advancing innovation by correcting underrepresentation in computing
- Three main alliances
  - K12, Academic, Workforce
- Example of Workforce Alliance resource:
  - Resources on recruiting and retaining employees, being inclusive, etc
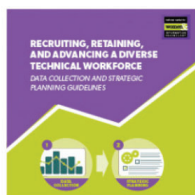
RECRUITING, RETAINING, AND ADVANCING A DIVERSE TECHNICAL WORKFORCE
DATA COLLECTION AND STRATEGIC PLANNING GUIDELINES

Recruiting, Retaining, and Advancing a Diverse Technical Workforce: Data Collection and Strategic Planning Guidelines

Published on 01/21/2015 | SKU #6013

Developing a diverse workforce must be treated like any other critical business issue. Use this guide to help you collect important data and develop a strategic plan for increasing the meaningful participation of diverse groups in your organization.

Learn how to implement the "The Action to Catalyze Tech (ACT) Report" recommendations: https://ncwit.org/CatalyzeTech.

Access Computing

Access Computing

- Mission: Increasing the participation of people with disabilities in computing fields
- Undergraduates and Graduate students can connect with mentors and professionals.
- Undergraduate research program
- Resources
  - Disability- and Neurodiversity-Focused Employment Websites

National Science Foundation (NSF) BPC and INCLUDES Alliances

- "broad coalitions of academic institutions, K-12 schools, government, industry, professional societies and other not-for profit organizations that design and carry out comprehensive programs addressing underrepresentation in computing disciplines"

NSF Alliances

- Access Computing – people with disabilities
- AIICE – Alliance for Identity Inclusive Computing Education
- CAHSI – Computing Alliance of Hispanic Serving Institutions
- CRA-WP – Computing Research Association Broadening participation
- CSforAll – Resource for CS in K-12 education
- NCWIT – National Center for Women and Technology – create resources, they have a Workforce Alliance
- And many more…

Access Computing

AIICE ALLIANCE FOR IDENTITY INCLUSIVE COMPUTING EDUCATION

CAHSI Computing Alliance of Hispanic-Serving Institutions

CRA-WP Computing Research Association Widening Participation

CSforALL

ncwit.org

Cultural Competence in Computing (3C's) Fellows

https://identity.cs.duke.edu/

- National Program for Computing faculty and professionals
  - To learn more about social science topics (identity, intersectionality, racism, bias and discrimination) and how they impact computing environments
  - To develop some deliverable
- Lot of homework/reading books (6 months)
- Virtual meetings for 6 months of discussion
- My project: developing an online Python Coursera course that is culturally relevant

For Example: Bob Moses – Interactive Techniques for Algebra

- 1960's - Civil Rights Activist
  - Organizer Black voter registration drive in Mississippi
  - Fighting the use of law to oppress the black vote
- 1982 – MacArthur Genius Award
- 80's – Closing the gap with algebra
  - No algebra in 8th grade in his kids' school
  - First step – get all kids to be able to take algebra
  - Second step – How to empower students, start with a train trip
  - Algebra as a gateway to higher level math/science
  - Huge movement! Interactive approach increased pass rates
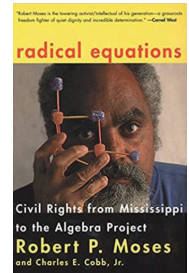
Strongly recommend his book

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Recognition

- Nominate those underrepresented in computing for awards
- Example 1, Duke Distinguished Professor
  - No women in science had received the award
  - Once pointed out, they started receiving it
- Example 2, Triangle Distinguished speakers – Duke, UNC, NCSU
  - 9 speakers annually, 3 to each university
  - Some years no female speakers

How Visible are Notable Women in Computer Science?

- Pondered this question in early 2012
- Looked at Wikipedia
  - The internet encyclopedia
  - Who writes those pages?
  - Why did some notables have pages and others not?
- Turing Award Winners
  - Only two women at that time
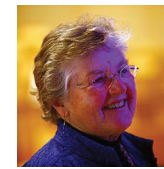
Fran Allen

- School teacher – got a job at IBM
- Compilers and Optimization Technology
- IBM Fellow – First Women
- Turing Award (2006) – First Woman
- The Turing Award was announced on Feb. 21, 2007
- Her Wikipedia page was created on…
  - Feb. 6, 2007
- On Feb 21, 2007 the Turing Award was added to her Wikipedia page.

Here is that first page for Fran Allen

Her Wikipedia page now

What about other Notable Women in Computer Science?

- ACM Fellows
  - Noticed few women, and most did not have a Wikipedia page

Investigate: Write Wikipedia pages for Notable women in Computing

- How hard is it to write a Wikipedia page?
  - Lots of rules you have to follow
- Another area with few women
  - 2013 study – 16% of Wikipedia writers are female

Wrote a Wikipedia page

- We had no idea what we were doing….
- In April 2012, at a CRA-W Board meeting …

Mary Jane Irwin

- Professor at Penn State University
- VLSI Architecture and Automated Design
- Board Level Designs
  - Arithmetic Cube, MGAP, and SPARTA
- Architecture, Logic & Circuit Design Tools
  - ARTIST, PERFLEX, LOGICIAN, DECOMPOSER
- Awards
  - National Academy of Engineering
  - ACM Fellow, IEEE Fellow
- No Wikipedia page!

In writing her Wikipedia page,

Here is what happens when you don't know what you are doing…

Checked her page two weeks later…

Spent some time figuring out basics of how to write a biography page

- Checked out other pages
- Did some edits on pages

- Then tried again

Mary Lou Soffa

- Professor at University of Virginia
- Programming languages
- Compiler technology
- Software Engineering
- Ken Kennedy Award, 2012
  - "provided analytical and experimental models for understanding, predicting and verifying the optimization of software"
- ACM Fellow, 1999
- IEEE Fellow, 2012
- Presidential Award for Excellence in Science, Math and Engineering Mentoring, 1999
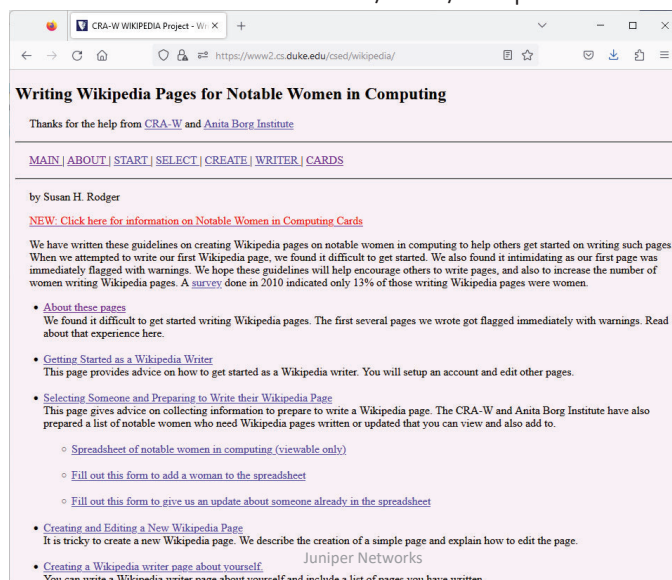
I think I figured out how to do it.
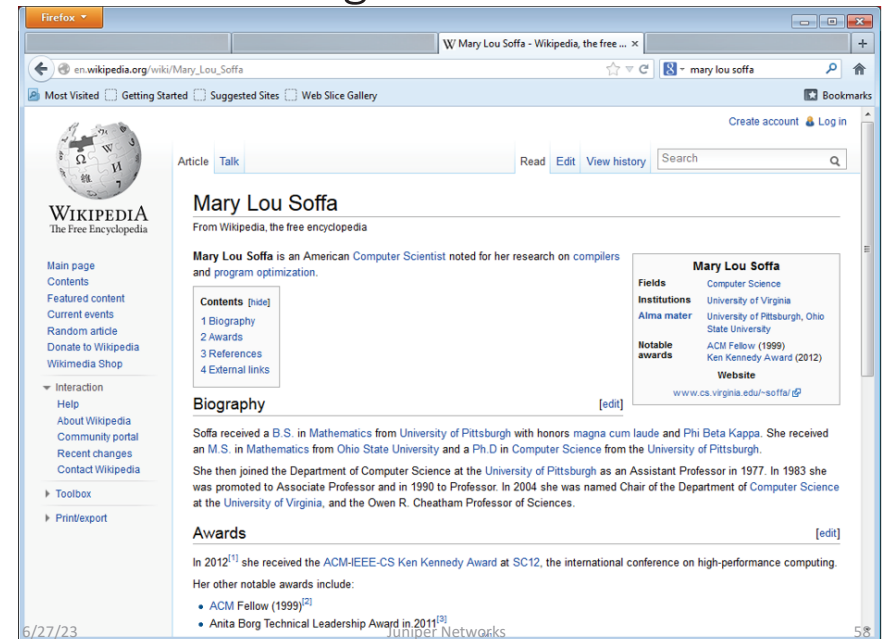
Wrote a Guide on How to Write Wikipedia Biography

www.cs.duke.edu/csed/wikipedia

Our Wikipedia Guide

www.cs.duke.edu/csed/wikipedia

- Shorter and more focused then Wikipedia Guide
- Getting Started
  - Get an account
  - Edit some pages
- Select someone to write about
  - Make sure they don't already have a page
  - Use our template and fill it in

Our Database of Notable Women in CS
www.cs.duke.edu/csed/wikipedia

- Over 300 women
- Why notable
- Status of their Wikipedia page
- Forms for adding women and updating status

Title/Position	Web page	Prestigious Award or why notable	Wikipedia page?
Professor of Human-Computer Interaction, CS	http://www.daimi.au.dk/~bodke	Member, CHI Academy	no page
Founder	http://anitaborg.org/about/histor	WITI Hall of Fame, Fellow ACM, EFF Pioneer	has a page
Professor	http://polaris.gseis.ucla.edu/cb	ACM Fellow	has a page, needs work

To Share These Achievements....
www.cs.duke.edu/csed/wikipedia

- August 2014, with Katy Dickinson and Jessica Dickinson Goodman....
- Created Notable Women in Computing playing cards
  - 54 cards
- You can
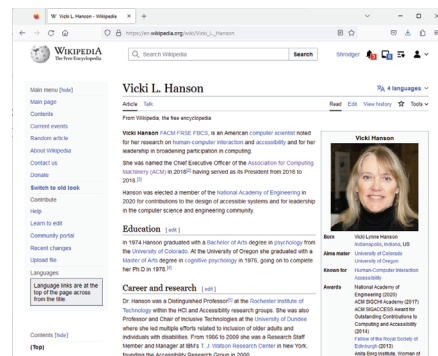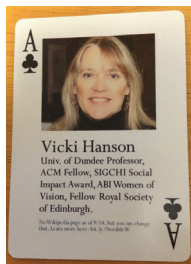 - Print a deck
  - Print a poster

Vicki Hanson
Had no Wikipedia page, now does

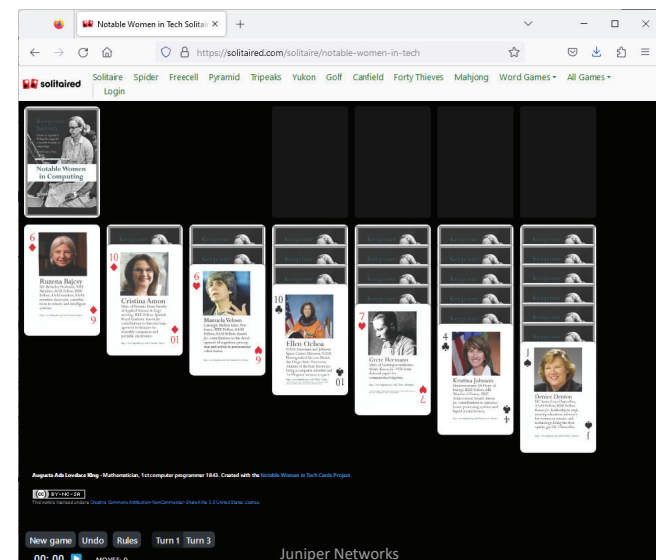- 4th edition of deck (2019), same women, but updated as everyone now has a Wikipedia page

Play Solitaire online with NWC cards
https://solitaired.com/solitaire/notable-women-in-tech

What can you do to get more underrepresented people into computing?

- Make Change Happen
  - Create those conversations
  - Point out discrepancies
  - There is recognizing problems, and there is action!

- Mentorship and Guidance

- Recognize Achievements

Thank you!