

CHRESTOMATHICS  
JIM COHOON  
JOANNE McGRATH COHOON

WWW.CS1X.INFO  
NSF BPC-DP GRANT 073925

Rethinking  
CS1



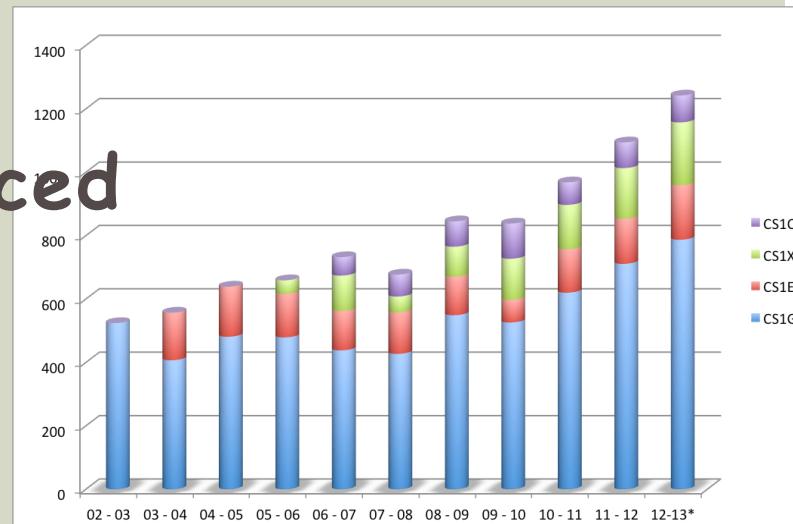
# EXECUTIVE SUMMARY

CS1 that attracts and retains diverse students in computing

- Under-represented minorities routinely match demographics
- Women's percentages rose from 12% to 18%
  - Peer university women's percentage near 12%

# THE CURIOUS COURSE CS 1

- Intro to programming for all Engr students
- Enrollment more than doubled over last ten years
- Range of experience
  - Women and minorities usually least experienced

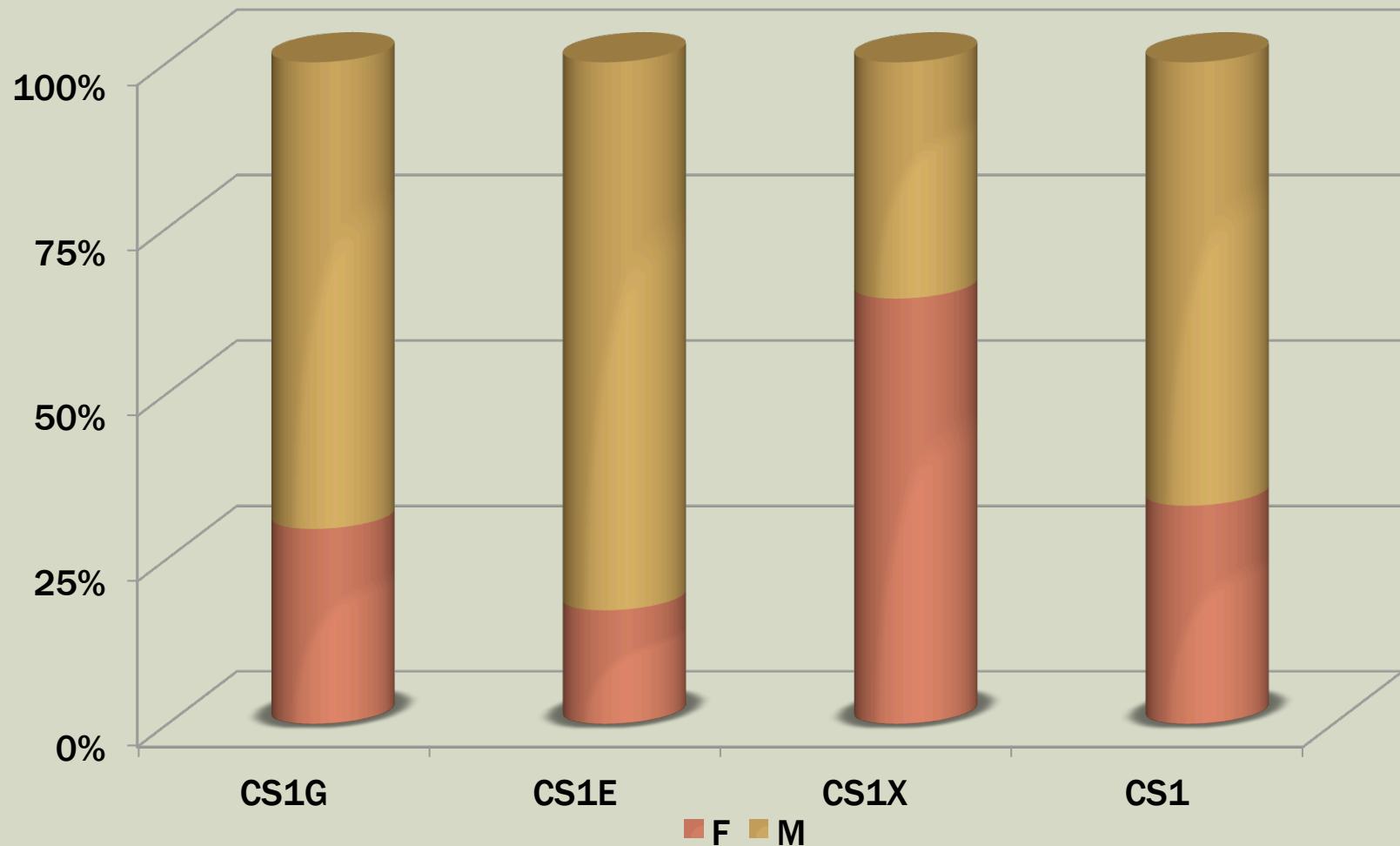


# MULTIPLE PATHWAYS

- *CS1G* - open to all
- *CS1E* - open to experienced
- *CS1X* - open to inexperienced
- *CS1C* - computational thinking for A & S



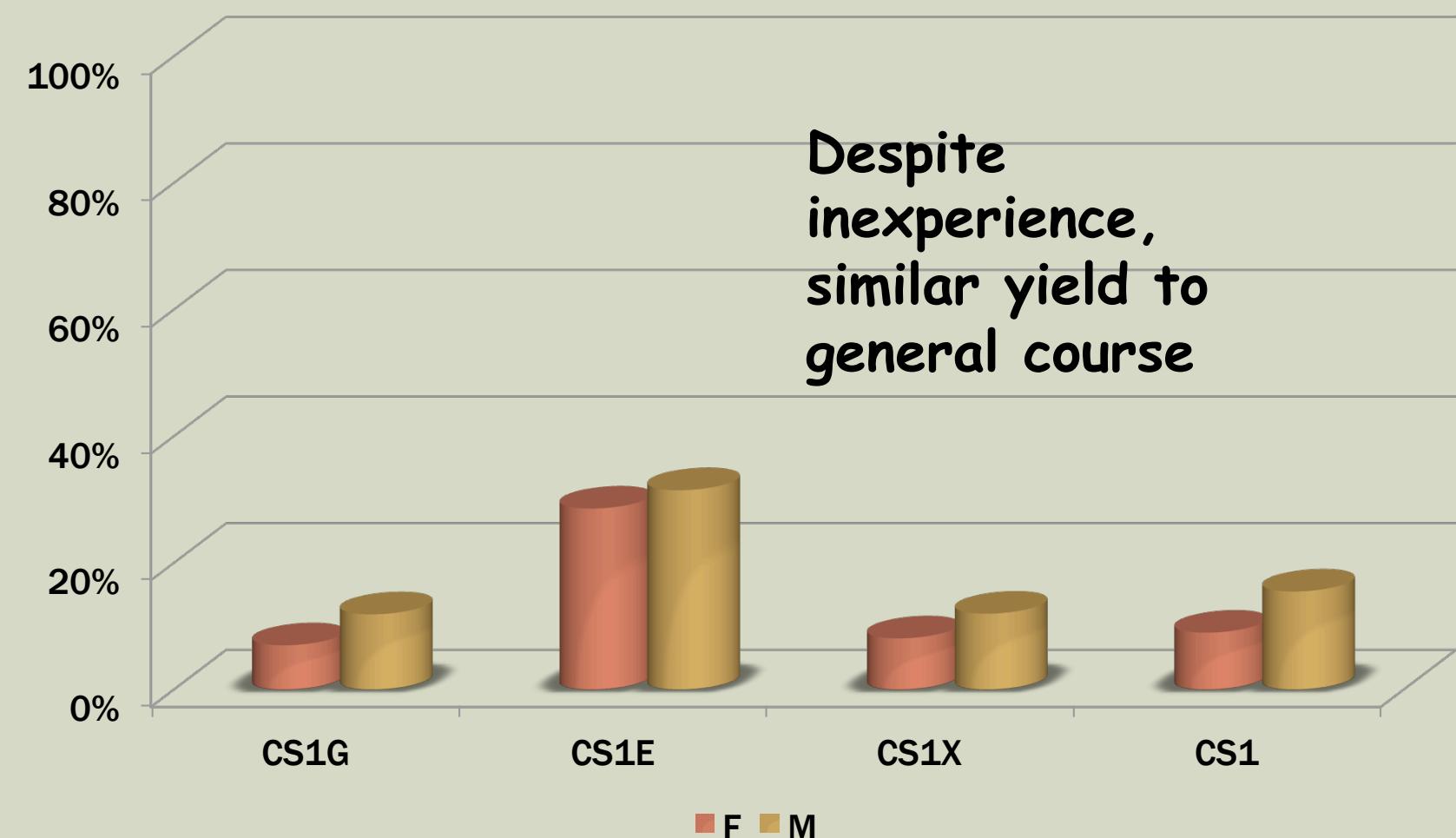
# UVA CS1 ENROLLMENTS BY GENDER



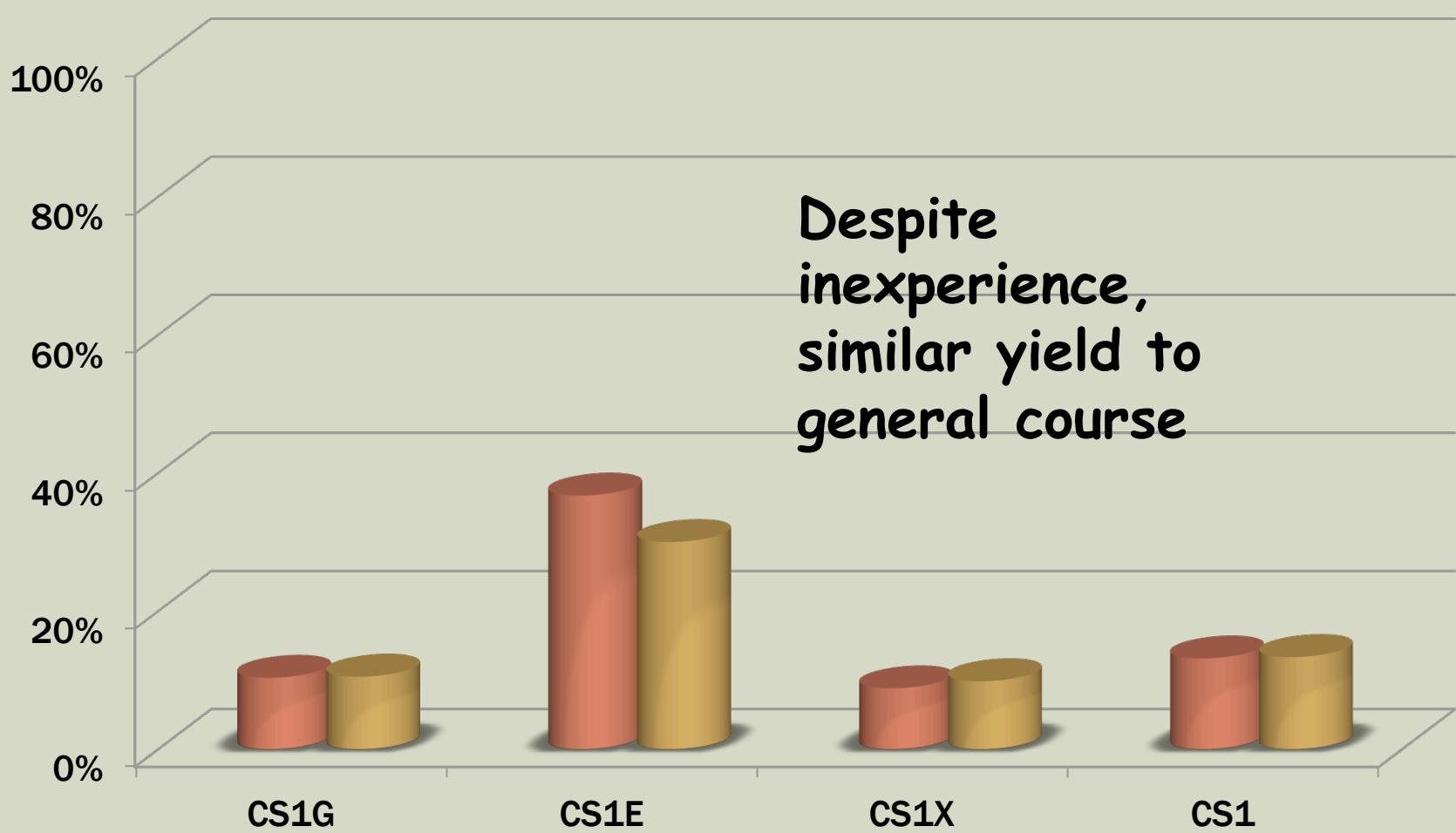
# UVA CS1 ENROLLMENTS BY ETHNICITY



# UVA COMPUTING MAJOR YIELD BY GENDER



# UVA COMPUTING MAJOR YIELD BY ETHNICITY



# CS1X ACHIEVEMENT & PERSISTENCE

Performance on first exam *CS 2*

More than 90% retention to graduation

- An ABD in *CS* at Vanderbilt
- Leadership roles



# COURSE DESIGNED TO PROMOTE

Interest

Confidence

Belonging

Identity



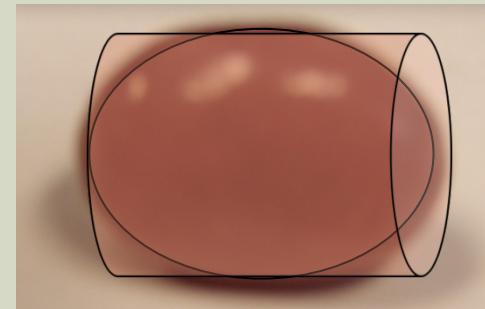
# IGNITE STUDENTS' INTEREST

Make computing worthwhile



# CS1X – CHRESTOMATHICS

Study and application of useful things and processes

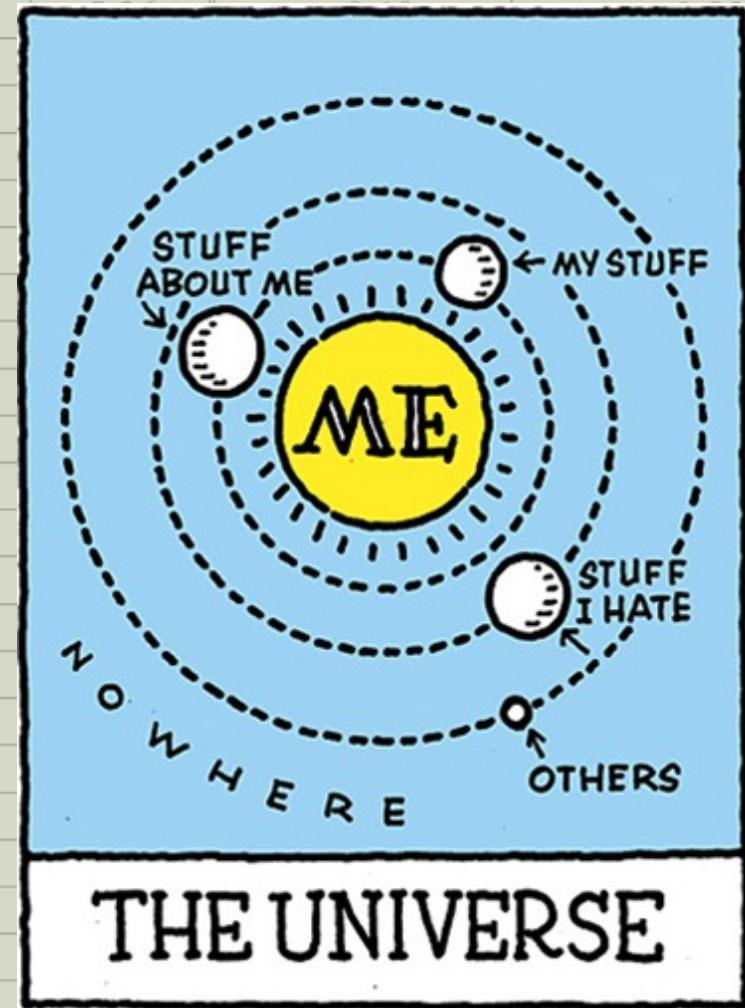


$$5 \cdot \pi \cdot a \cdot b \cdot c / 24$$



Table 8: Likert-Scale Ratings of CS1 Example Applications

MUTUAL INTEREST		CS Teacher	CS Student	Female Student	Male Student	Female – Male	Normalized Student – Teacher
Application							
Instant messaging	5.36	5.39	5.38	5.43	-0.05	0.47	
Music player	5.30	5.39	5.29	5.71	-0.42	0.53	
Photo manipulation	4.90	5.29	5.26	5.20	-0.06	0.50	
Card games	5.73	5.12	5.15	5.20	-0.05	0.53	
Medical diagnosis	3.95	5.14	5.21	5.20	-0.07	0.47	
Music library organizer	4.54	5.04	4.97	5.00	-0.03	0.53	
Battleship game	5.39	5.02	4.85	5.00	-0.15	0.53	
Connect four	5.33	4.92	4.85	5.00	-0.15	0.53	
Mad Libs	5.33	4.92	4.79	5.00	-0.21	0.53	
Sudoku	5.09	4.98	5.06	5.00	-0.02	0.53	
Password security	5.52	4.78	4.74	5.00	-0.22	0.53	
Fractals	5.21	4.78	4.74	5.00	-0.22	0.53	
Predator-prey	5.21	4.67	4.65	5.00	-0.33	0.53	
Travel routing	4.65	4.67	4.65	5.00	-0.33	0.53	
Video poker	5.21	4.96	4.62	5.00	-0.38	0.53	
Smart appliances	5.21	4.96	4.62	5.00	-0.38	0.53	
Language translation	4.73	5.06	5.24	5.00	-0.17	0.53	
Engineering applications	4.90	4.81	4.61	5.00	-0.19	0.53	
Tic-tac-toe	5.28	4.65	4.59	5.00	-0.41	0.53	
Heart monitor	5.30	4.63	4.65	5.00	-0.37	0.53	
Business applications	5.04	4.59	4.50	5.00	-0.49	0.53	
Photo manipulation	4.32	5.08	5.32	5.00	-0.24	0.53	
Exercise training zone	4.19	4.54	4.56	5.00	-0.41	0.53	
Personality typing	4.68	4.61	4.71	5.00	-0.30	0.53	
Photo viewer	5.00	4.77	4.73	4.88	-0.14	0.53	
Smart appliances	4.73	4.40	4.29	5.00	-0.33	0.53	
Virus protection	4.90	4.52	4.24	5.00	-0.28	0.53	
Body mass index	4.73	4.61	4.76	4.21	0.55	0.32	



# MUTUAL INTEREST

- 5.71 Encryption
  - 5.50 Instant messaging
  - 5.50 Password security
  - 5.39 Engineering
  - 5.38 Card games
  - 5.33 Virus protection
  - 5.21 Fractals
  - 5.21 Predator-prey
  - 5.21 Smart appliances
  - 5.17 Music player
  - 5.17 Connect four
  - 5.04 Daily jumble
  - 5.04 Medical diagnosis
  - 5.04 Photo manipulation
  - 5.04 Science applications
  - 5.00 Routing

Sudoku

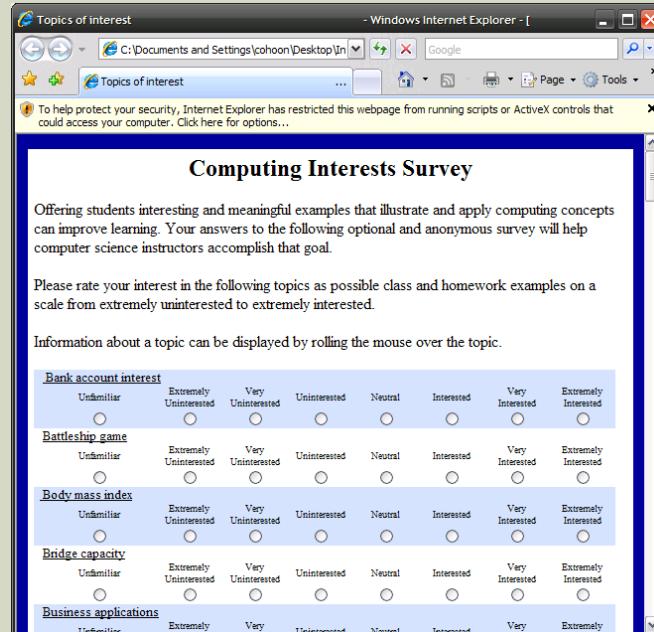
# Connect four

# Language translation

# Personality typing

# Daily Jumble

# Tic-Tac-Toe



# MESSAGES THAT SPARK INTEREST

## Inform and demonstrate

- Flexibility: industry, geography
- Socially relevant
- Work with others
- Job projections
- High salaries
- Satisfied professionals



# BUILD STUDENTS' CONFIDENCE

Successes

- Pedagogy

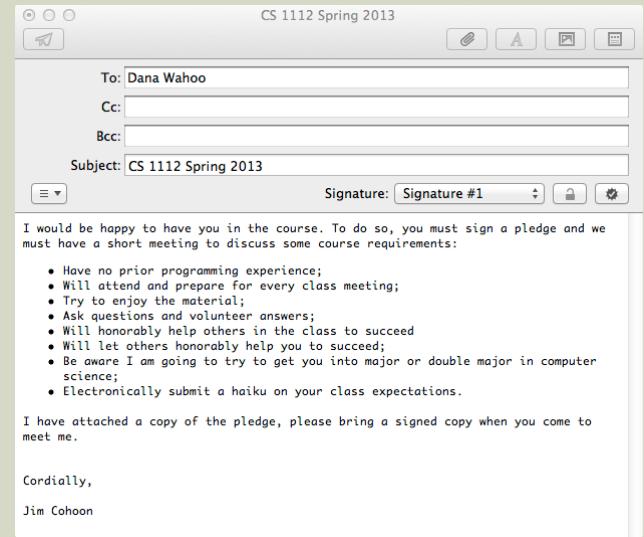
Encouragement

Peer role models



# CS 1X – MEANS

- Active and collaborative learning
- Guided discovery
- Integrated lab - instructor and TAs always there
- Regular acknowledgement
  - Culture of success
- Encouraging pedagogy and examples



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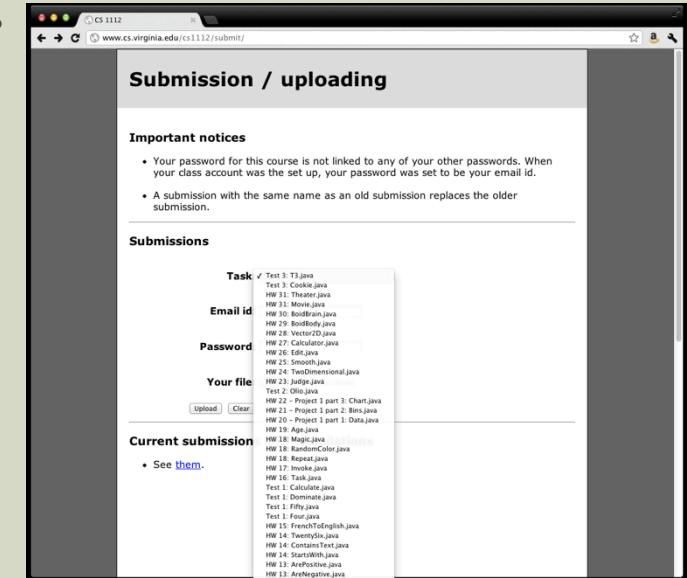
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The screenshot shows a web browser displaying the course website for CS 1112, Spring 2012. The URL is [www.cs.virginia.edu/cs1112/#class-13](http://www.cs.virginia.edu/cs1112/#class-13). The page has a dark header with the course name and year. On the left is a sidebar with links like Course, APIs, Assistance, Calendar, etc. The main content area shows a photograph of a building with "Walpurgisstraße" and "Technische Universität Berlin" signs. Below the photo is a list of class topics from Class 1 to Class 32. At the bottom, there are sections for Download (with Java files), Elsewhere (links to Rational, A3, RTester), and Agenda (with a yellow 'C' icon). There's also a section for "Interested in TA-ing next fall" with an Application link.

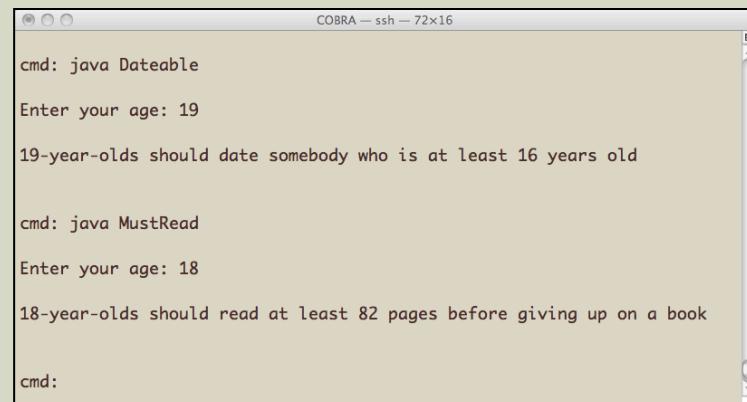
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```
COBRA — ssh — 72x16

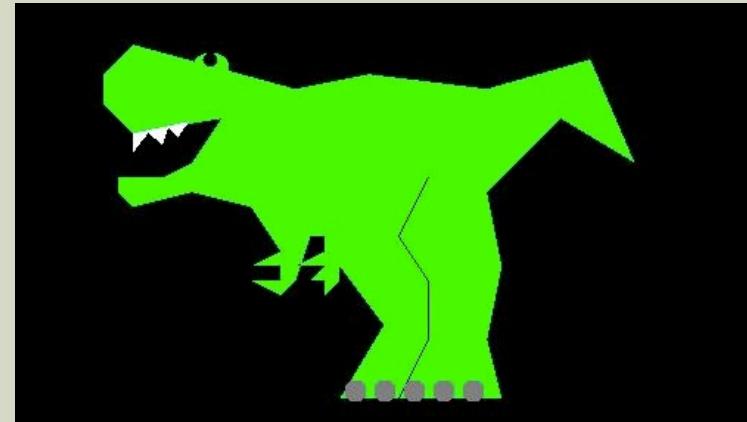
cmd: java Dateable
Enter your age: 19
19-year-olds should date somebody who is at least 16 years old

cmd: java MustRead
Enter your age: 18
18-year-olds should read at least 82 pages before giving up on a book

cmd:
```

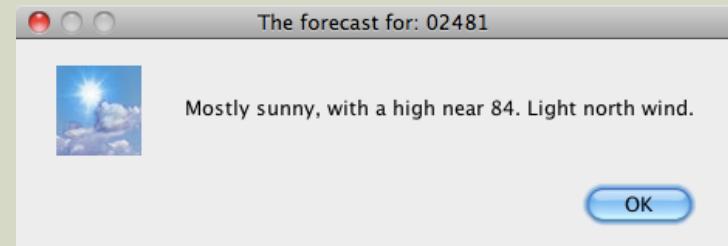
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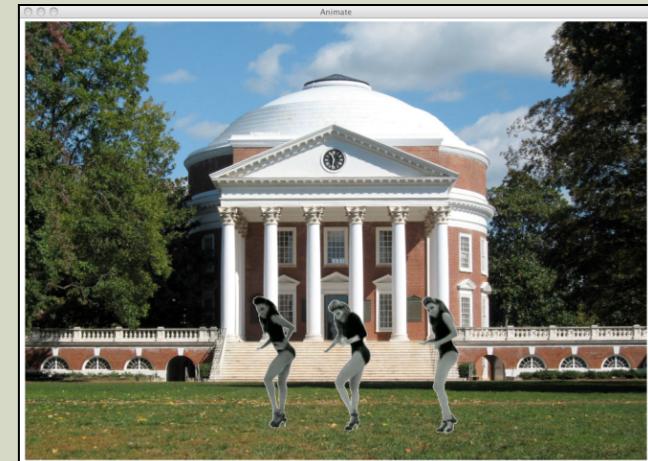
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# PROMOTE BELONGING

These are my peeps



What happens when hens eat Fruit Loops!



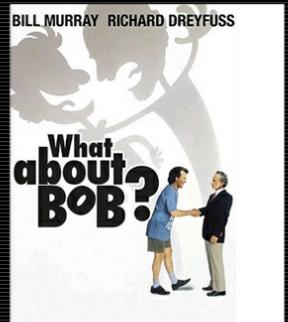
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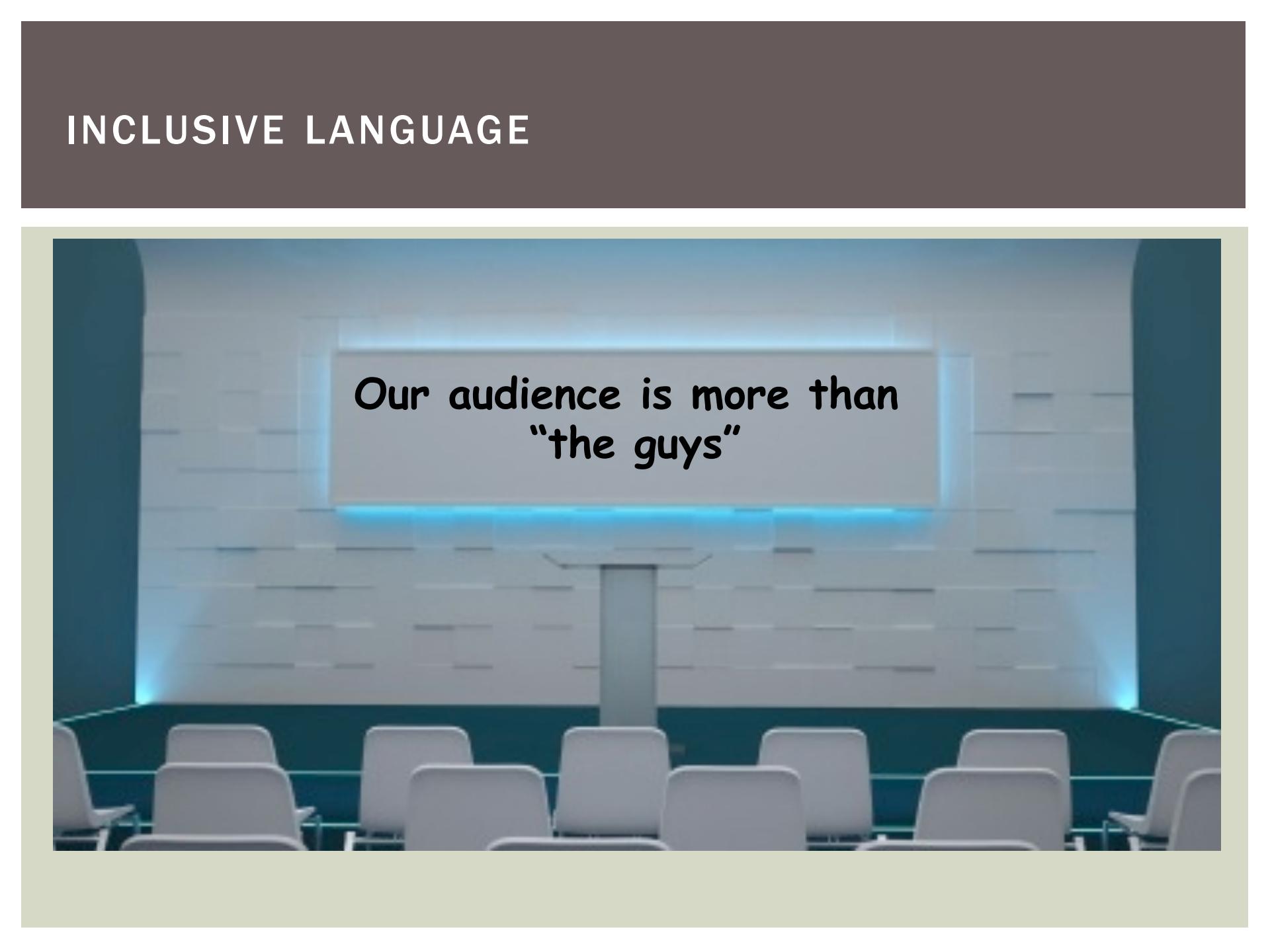
## The awesome story so far

### Story so far – truly awesome

- Computing systems and problem solving
- Variables
- Types
- Input and output
- Expressions
- Assignments
- Objects
- Pop up windows
- Decisions
- Iteration
- Files
- URLs



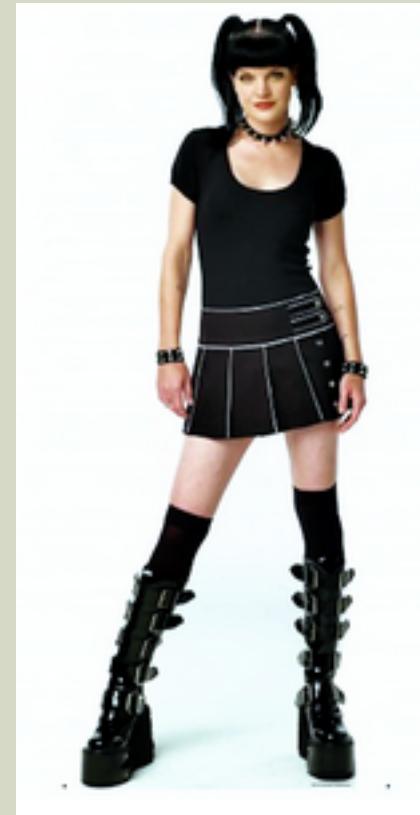
# INCLUSIVE LANGUAGE



Our audience is more than  
“the guys”

# IDENTITY

Try on the role of a computing person



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8. How helpful was it working with a partner?

- Very unhelpful
- Unhelpful
- Neutral
- Helpful
- Very helpful

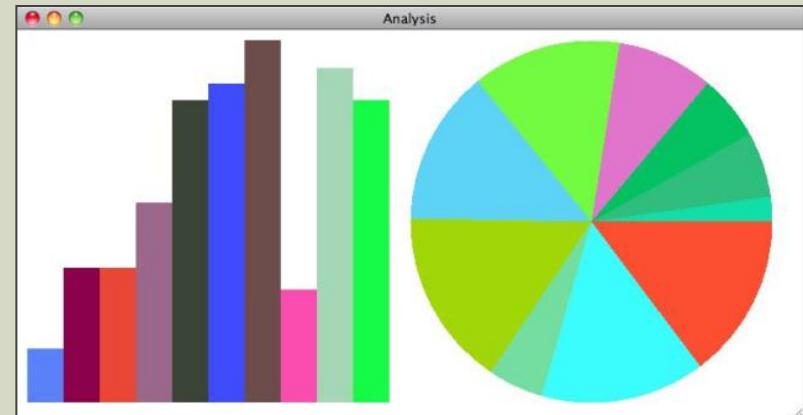
9. Should partnering be used in future assignments?

- Emphatically no
- No
- Neutral
- Yes
- Emphatically yes

10. Was working with a partner helpful in preparing you for the exam?

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Attractive to under-represented groups  
More likely to choose computing  
Attraction comparable to demographics  
Brought up to comparable levels  
More than comparable persistence to graduation



## OTHER CONTRIBUTORS AND RESOURCES

Luther Tychonievich  
Mary Lou Soffa

[www.cs1x.info](http://www.cs1x.info)

NSF BPC-DP grant 073925

# TAG PROJECT – TAPESTRY FOR ALL

Tapestry 3-day summer workshop geared for HS CS teachers and educators who want expand CS instruction

## Workshop components

- Demonstrate effective CS pedagogical practices for all students
- Recruiting strategies
- Provide materials that attendees can use to influence their schools and districts

# BEANCOUNT.JAVA

```
public class BeanCount {  
    public static void main( String[] args ) {  
        Scanner stdin = new Scanner( System.in );  
  
        System.out.print("Enter jelly bean length (cm): ");  
        double a = stdin.nextDouble();  
        System.out.print("Enter jelly bean width (cm): ");  
        double b = stdin.nextDouble();  
        System.out.print("Enter jelly bean height (cm): ");  
        double c = stdin.nextDouble();  
        System.out.print("Enter jelly bean loading factor (%): ");  
        double loading = stdin.nextDouble();  
        System.out.print("Enter jar size (mL): ");  
        double jar = stdin.nextDouble();  
  
        int count = (int) ( jar * loading / ( 5 * Math.PI * a * b * c / 24 ) );  
        System.out.println("beans: " + count);  
    }  
}
```

