EFFECTIVE TEACHING TACTICS

Cynthia Lee, Stanford University
Susan Rodger, Duke University

CRA-W.org
@CRAWomen

bit.ly/cra-teaching-2018

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What does CRA-W do?

Individual & Group Research Mentoring

Undergrads: Undergraduate Research Experiences

Undergrads: Distinguished Lecture series/role models

Grad Cohort: Group mentoring of graduate students

Grad Students: Discipline Specific Research workshops

Academics/PhD Researchers: Group mentoring for early and mid career @ CMW, Grace Hopper, and Tapia

2400+ students & PhDs a year

Stay in touch: CRA-W.org, @CRAWomen,
Facebook: CRA-W, Linked-in: CRA-Women

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CRA-W Events at Grace Hopper

Visit the CRA-W Booth in the EXPO to learn more (#2050)

Attend another CRA-W Session
Thursday (2 more) or Friday (1)

Visit a CRA-W Table at the Student Opportunity Lab on Friday
(Undergrads)

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Here is a slide for the first day…

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Classroom rule:

NO SITTING IN THE LAST FOUR ROWS!

Come join the rest of us!

Get students closer to you

Quick Poll: Who's in the room?

Current instructors?

Average class size?

TAs?

Students who plan to teach someday?

High school teachers?

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Susan Rodger

Intro #1: The Technical Me…

- NCSU - BS Math & CS
- Purdue - PhD
- Rensselaer - Assist Professor
- Duke - Professor of the Practice
- Research: Visualization, algorithm animation, CS education

Intro #2: Non-Technical Me

- Married
- Kids: Two boys (grown)
- 3 cats, over 200 fish
- Other fun: swimming, running, write Wikipedia pages, baking

Cynthia Lee

Intro #1: The Technical Me…

- Lecturer at Stanford
- PhD in high-performance computing at UCSD
- Peer Instruction enthusiast

Intro #2: Non-Technical Me

- Rock climbing
- “Like a cat lady, but for chickens”
- Cooking (not the pet chickens)

Brainstorm: 3 verbs for what students are doing in this photo

Think - Pair - Share

Collaborative Learning Strategy

- First answer question individually
- Partner with peer to develop answer
- Share answer with class

Advantages:

- Increases classroom participation
- Higher confidence in reporting ideas to class
- More productive classroom discussions

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Adding active learning to your classroom:

A spectrum from tiny tweaks to significant overhaul

Got workshop new idea fatigue?

Don't beat yourself up!

Choose the amount of change you're ready to make:

Minor tweaks — Significant overhaul

More traditional — Pervasive active learning

- Every little bit helps! The more active learning, the more students benefit.
  - Chi, Michelene T. H. & Ruth Wylie [The ICAP Framework: Linking Cognitive Engagement to Active Learning Outcomes]. Educational Psychologist Vol. 49 , Iss. 4,2014

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Ways to Select students to answer questions

Problem – same students always eager

How do you get other students to participate?

- Randomly call on them (card for each student)
- Keep track of who has spoken already
- Work in groups – call on group
- Assigned groups – call on group numbers

Read the book

Read before coming to class

- Ready to work in class

Reality

- Run out of time to read, not prepared

Bring on – Reading quizzes

- Online (Sakai, Blackboard, etc)
- Turn off when class starts

Question 4 of 8

What is the output of the following:

```
alist = [6, 3, 4, 9]

del alist[1]

print alist
```

- A. [6]
- B. [3, 4, 9]
- C. [6, 3, 4]
- D. [6, 4, 9]

Reset Selection

Have an engaging book….

Runescape (Brad Miller)

Here is the program in activecode. Note that the function definition is the same as it was before. All that has changed is the details of how the squaring is done. This is a great example of "black box" design. We can change out the details inside of the box and still use the function exactly as we did before.

Run Save Load Show in Codelens

```
def square(x):
    runningtotal = 0
    for counter in range(x):
        runningtotal = runningtotal + x

    return runningtotal

toSquare = 10
squareResult = square(toSquare)
print("The result of", toSquare, "squared is", squareResult)
```

ActiveCode: 1 (sq_accum1)

Pair Programming

Students work on problem with one computer in pairs

- “Driver” and “navigator” - rotate often
- Shown to improve student learning outcomes and retention

Interactive Lecture Notes and Handouts

Create two versions of lecture notes

- Slides with missing parts
- Release complete slides later

Instant Feedback in Lecture

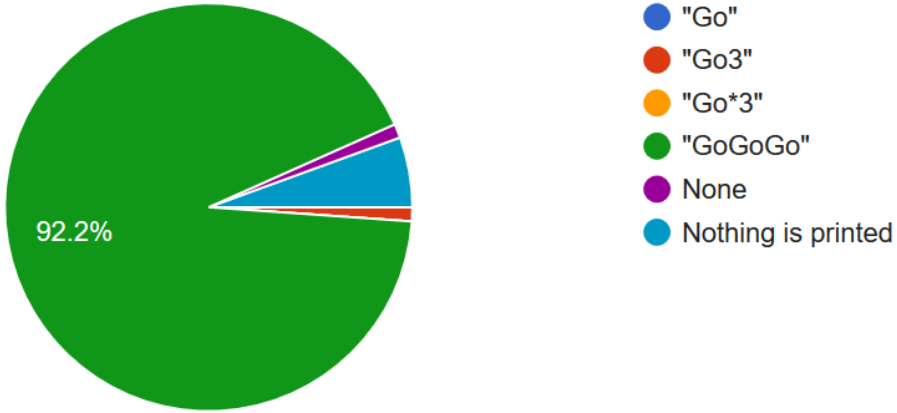
Clickers

Google forms

What's printed from the first statement under main numbered # 1? *

- "Go"
- "Go3"
- "Go*3"
- "GoGoGo"
- None
- Nothing is printed

(180 responses)

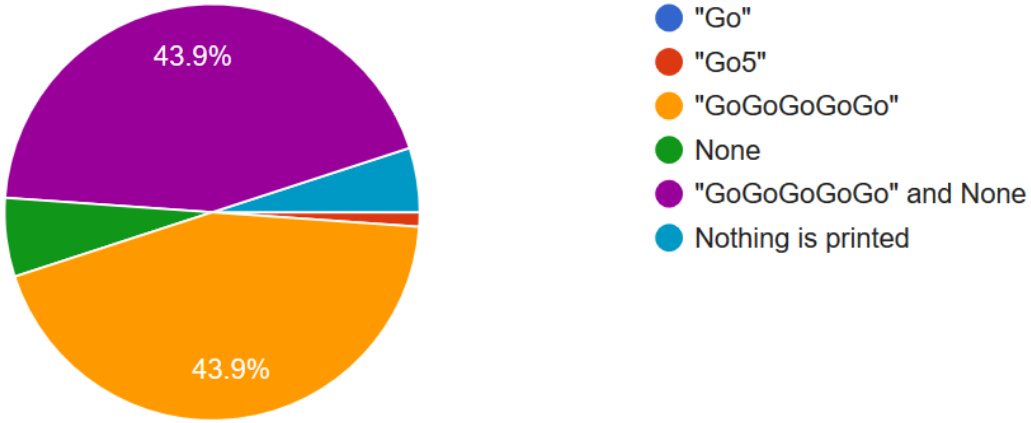


Instant Feedback in Lecture

What's printed from the second statement under main numbered # 2? *

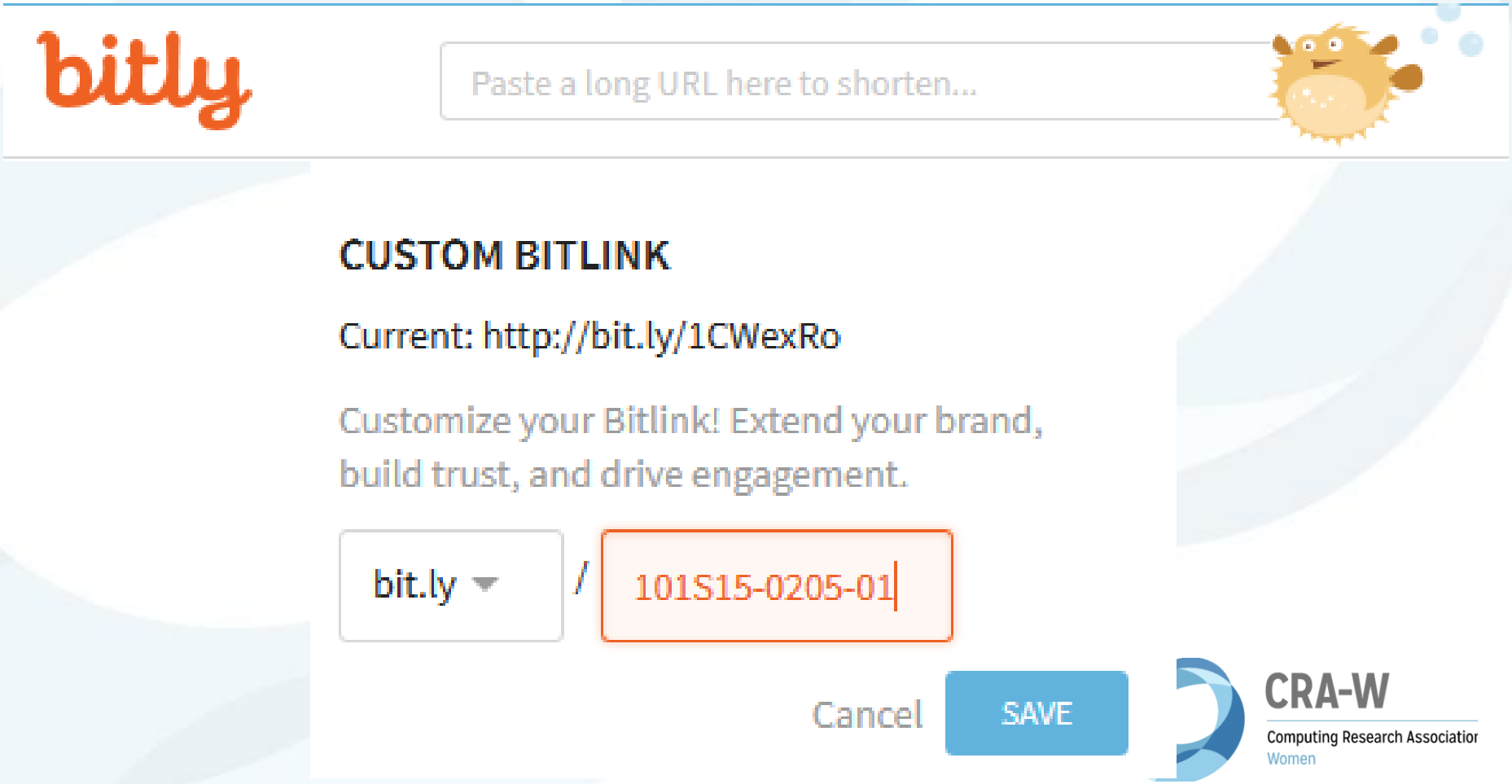
(180 responses)

- "Go"
- "Go5"
- "GoGoGoGoGo"
- None
- "GoGoGoGoGo" and None
- Nothing is printed



Setting up Google Forms

Make it easy for students to get the form



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What else have you tried in your classes? What else *could* you do?

Think - Pair - Share

Every little bit helps! The research shows the more active learning, the more students benefit.

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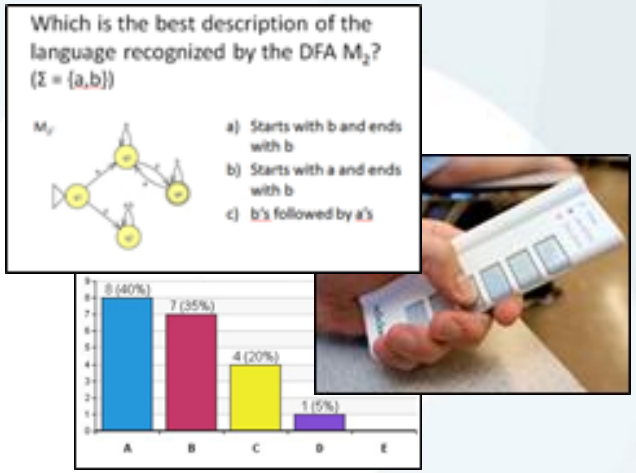
Peer Instruction: scalable active learning for large (and small) lectures

Lecture consists of a series of modules:

1. Ask a multiple choice question
   a. Students consider and VOTE



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Peer Instruction: scalable active learning for large (and small) lectures

Lecture consists of a series of modules:

1. Ask a multiple choice question
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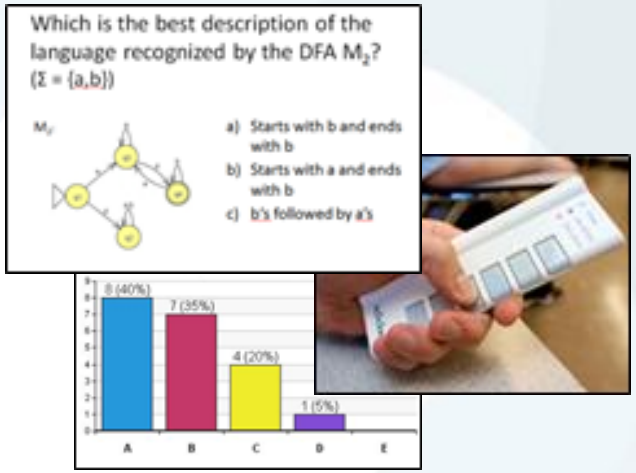
2. Then have students discuss in groups of 3-4
   a. Come to a jury-like consensus
   b. Why is the right answer right?
   c. Why are other responses wrong?
   d. VOTE again



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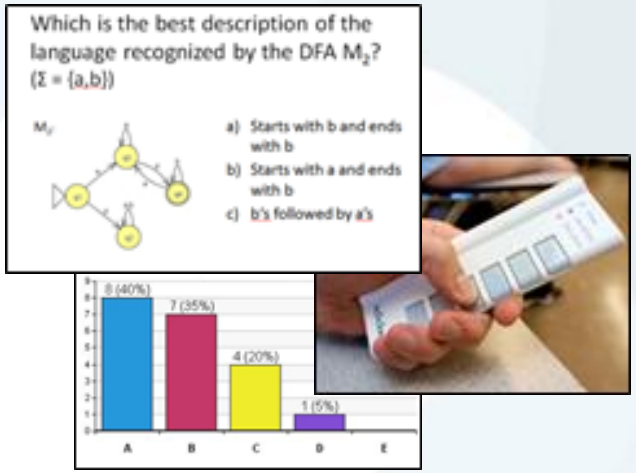

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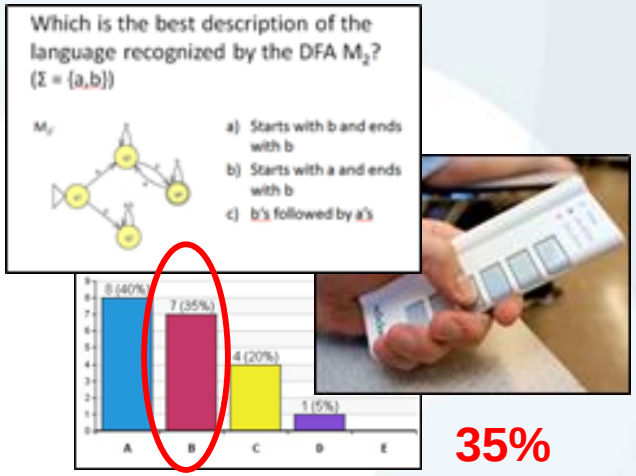

35% correct

80% correct

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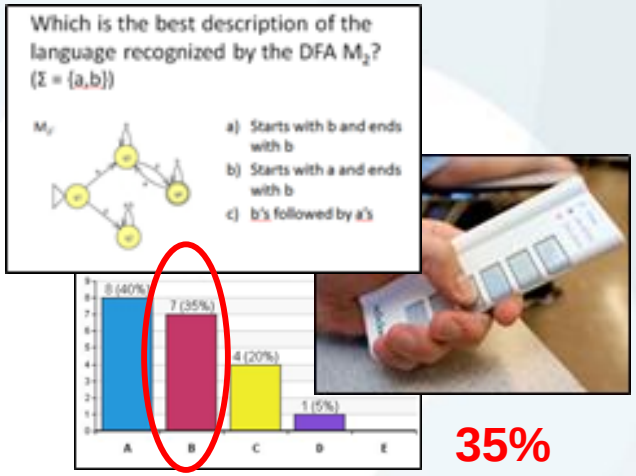

35% correct

80% correct

PeerInstruction4CS.org

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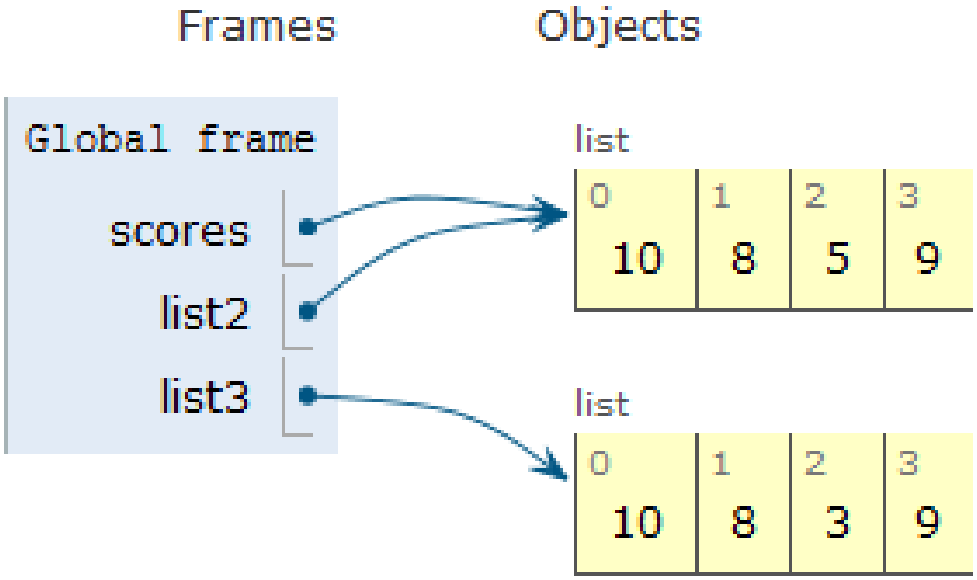
Using Animations/Software Tools and Props in Class

Use Engaging and Visual Tools Example: Python Tutor www.pythontutor.com

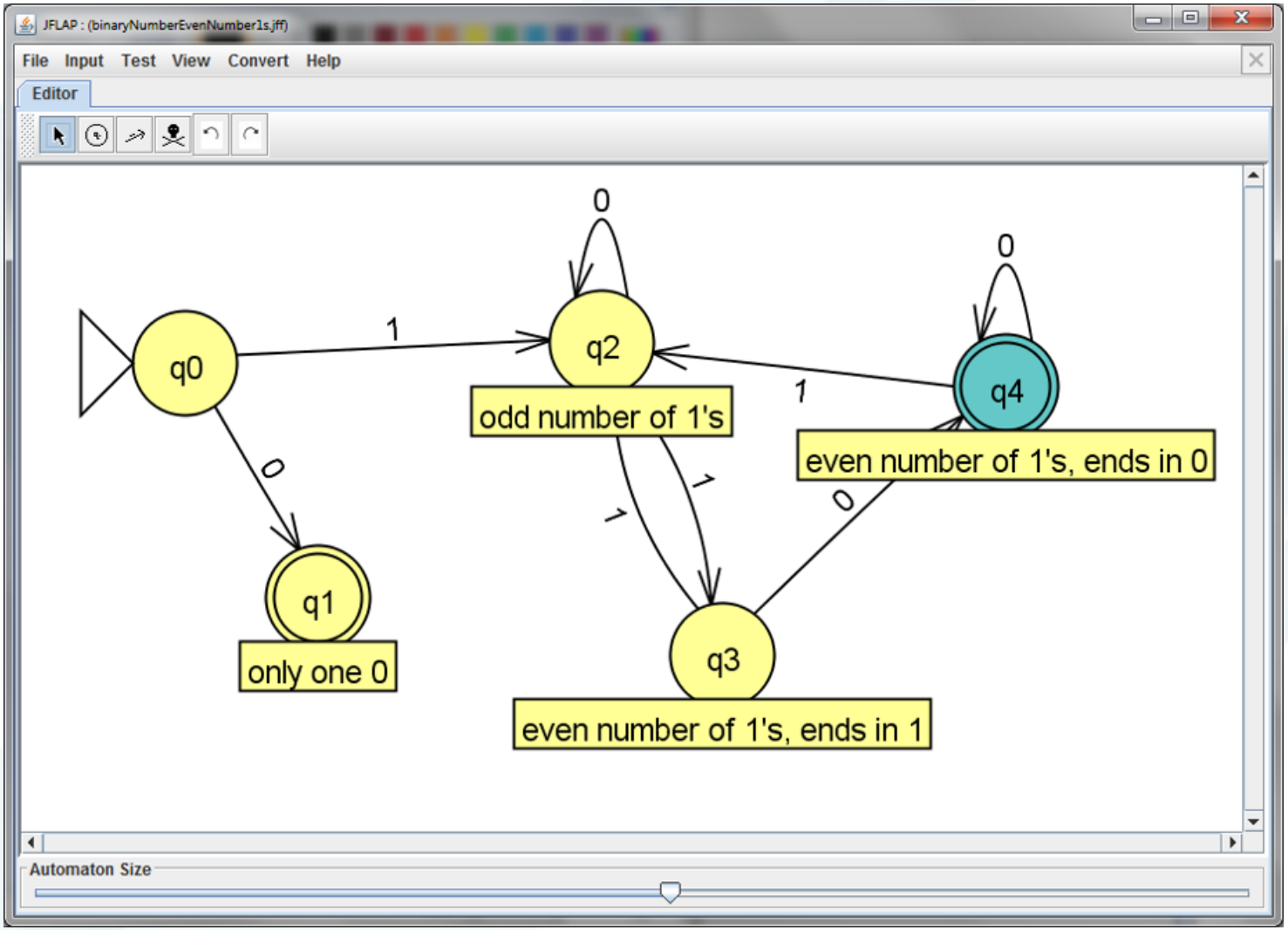
```
1  scores = [10, 8, 3, 9]
2  list2 = scores
3  list3 = scores[:]
4  scores[2]=5
```



Active Learning

- CS Unplugged – csunplugged.org

Teaching Automata with JFLAP



Passing Parameters in Class

Pass by reference – throw frisbee

Pass by value – throw copy of frisbee

Pass by const reference – throw "protected" frisbee

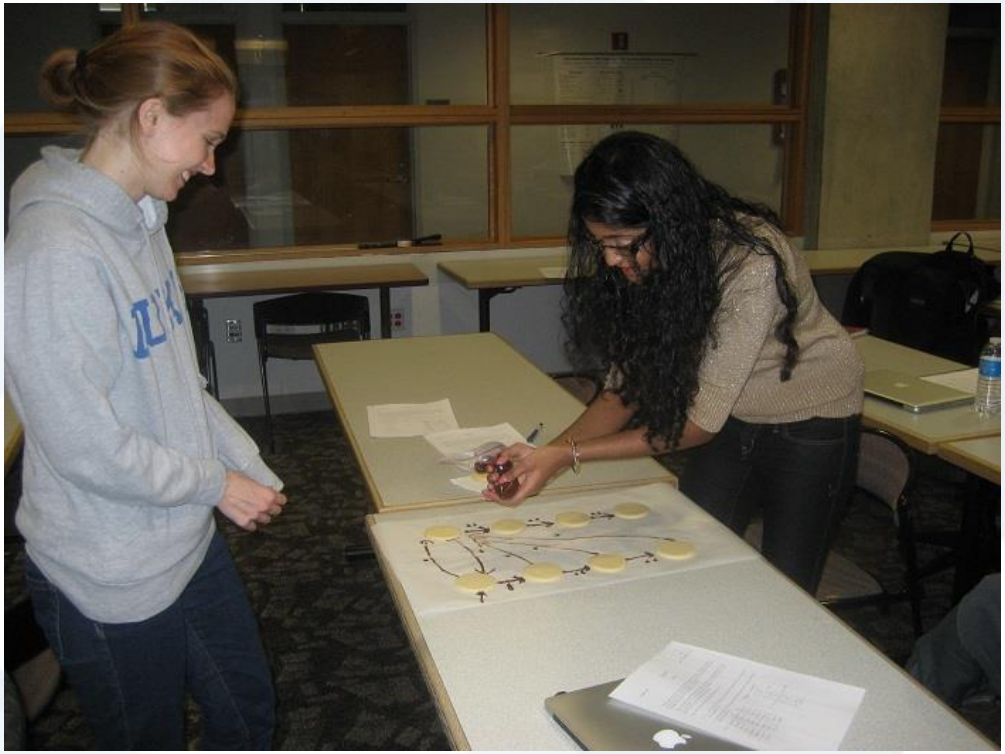
Ways to use playing cards: www.cs.duke.edu/csed/wikipedia

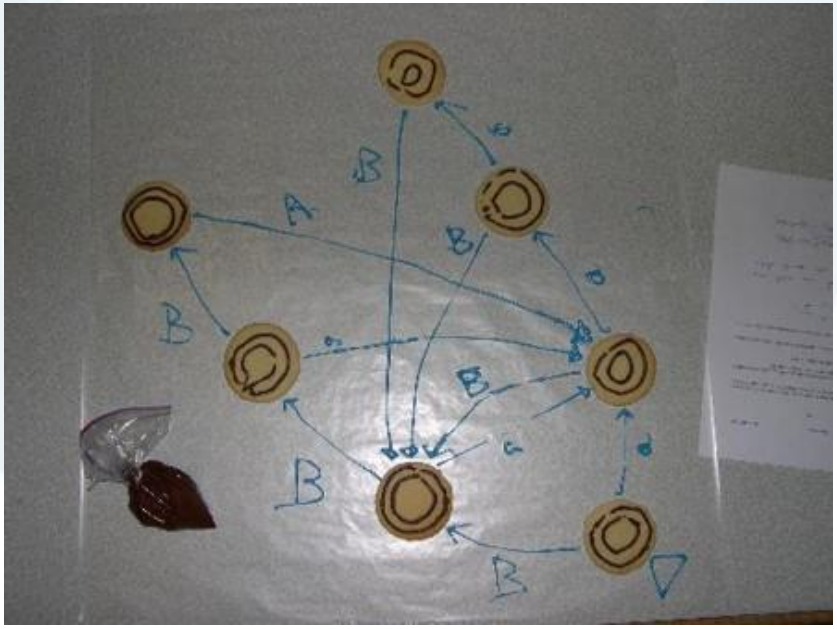
Insertion Sort

Card Class – shuffling, dealing hands

Poker hands – Full house, Flush, etc.

Edible Computer Science





Commit to Try Something New

Share ideas at your table

Enter something you want to try:

http://bit.ly/2fMFnpi

We will email you a reminder next week (and only one reminder).

Slides available: bit.ly/cra-teaching-2018

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How to Survive Large Courses

- Cut back on Email
- Use Bulletin Board – like Piazza
  - Students can post anonymously
  - Lots of people can be answer questions
  - You can endorse answers
- Manage with google forms
  - Form if you are sick and need extension
  - Form if you get test accommodations
  - Form to sign up for alternate exam time
  - Form to request a regrade
- Automate Grading of Assignments

Duke: large = 300-350

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Teaching Assistants Undergraduate/Graduate

- Mandatory training session
  - Behavior - Don’t date your students
  - How to help someone
  - What not to do
- Link to Duke site
  www.cs.duke.edu/courses/spring15/compsci101/training/
- Meet weekly with them
  - Make them do X before they help students with X

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Assessing Course/Teaching

- Course Evaluation – end of semester
  - These matter to your Dept/University
  - What do the majority say, ignore outliers
- Get feedback earlier – do your own
  - Have anonymous form for feedback and encourage
- Get Someone to sit in and provide feedback
- Determine what you need to improve on

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Improving Teaching

- Is there a teaching and learning center?
- Video tape yourself and watch it
- Class boring? Voice monotone?
  - Practice tongue-twisters
  - Take theatre or public speaking course
  - Toastmasters
- Talk too fast? Note to remind to slow down
- Don’t move? Start moving around
  - Get a wireless/laser presenter

Improving Teaching
Attend SIGCSE

- Conference focuses on CS Education
  - Papers, Panels, Workshops, Bofs
  - Attend every year, always get new ideas to try in your courses
  - Friendliest and Cheapest Conference
  - CRA-W Mentoring Workshop at SIGCSE 2017
- If you can’t attend, check out SIGCSE papers in ACM Digital Library

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THANKS

Please rate and review the session in the GHC 18 mobile app

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