Effective Teaching and Class Management

CRA-W Workshop

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Valerie Barr in One Slide

acm's women in computing

acm-w

Intro #1: The Technical Me

- MHC BA in Applied Math '77, NYU MS in CS '79, Rutgers PhD '96
- Hofstra University, 1995 - 2004
- Union College, 2004 - now
- Research: CS Education, software testing, interdisciplinary applications

Intro #2: Non-Technical Me

- Partnered (not married)
- One daughter, 23, but nest no longer empty
- Chair of ACM-W (okay, that's tech)
- Other fun: it's all about the bike

Two Perspectives

Some differences because we represent

- Small school, small(er) classes
- Large school, large(r) classes

And a whole bunch of overlap about pedagogy and practices, maybe with some tweaks.

Small College experience

+ High touch, lots of student contact

- Lots of grading, more courses to prepare

Example:

- Susan -- 35 TAs at once
- Me – I rarely teach a class larger than 35

Welcome to your new department

1. Start out with courses that are in your comfort zone.
2. Find out where your courses "fit"
3. Check out the facilities (physical, electronic)
4. Make sure you can get everything working
5. Look at course management system from student perspective – often!
6. Technology use in class?

Technology use in class

Computers:

- Benefit – students try stuff out in real time
- Negative – that smiling face, impact on neighbors

Phone:

- Benefit – there are none
- Negative – inattention, lack of learning

Technology use in class

Computers:
- Benefit – students try stuff out in real time
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Phone:
- Benefit – there are none
- Negative – inattention, lack of learning

What to do:
- About computers
- About phones

This will not work in large classes!!!!

So now you've been teaching for a while

- Don't change everything all at once

- Observe others (not just in CS)

- Organize your course materials
    - Be able to reuse but also easily modify from term to term
    - Don't ever assume you'll never teach a course again
    - Do assume that someone will ask you for your materials

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

Evaluations – Be proactive

- The evaluations were meh

- But there are explanations

- Options you have....
    - Meet with your chair
    - Write a letter for your file

This may be a small school thing.

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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

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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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Susan Rodger in One Slide

Intro #1: The Technical Me…

NCSU BS Math & CS '83 -> Purdue PhD, '89 (algorithms, data structures)

Rensselaer 89-94 – Assist Prof

Duke '94-now - Professor of the Practice (assist, assoc, full)

Research: Visualization, algorithm animation, CS education

Intro #2: Non-Technical Me

- Married

- Kids: Two teenage boys
  - Always trying to keep up with them

- 3 cats, over 200 fish

- Other fun: swimming, running, write Wikipedia pages, baking

What is Professor "of the Practice"?

Position exists in many departments at Duke
> About 20% of Arts and Sciences Faculty

PhD preferred, or appropriate professional experience

Non-tenure track, permanent position, promotable

Renewable contracts (4 – 8 yrs)

Focus on "education in the discipline"

Focus on undergraduates

Main tasks
> Teaching (2 courses per semester)
> Research (related to education) – grants/publish in CSED
> Service, advising

Planning - Syllabus

- Book, papers, online materials
- Outline of topics and assigned readings
- Homework/assignments
- How many tests? Final exam?
- Grade based on?
- Course policies - explicit
  - collaboration? On which assignments?
  - Who can they get help from? Internet? People outside the course?
  - Check assignments with Moss

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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

    (check accommodation guidelines)

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

```
1 def square(x):
2     runningtotal = 0
3     for counter in range(x):
4         runningtotal = runningtotal + x
5
6     return runningtotal
7
8 toSquare = 10
9 squareResult = square(toSquare)
10 print("The result of", toSquare, "squared is", squareResult)
11
```

ActiveCode: 1 (sq_accum1)

Electronic Textbooks (ebooks) engage students

OpenDSA (Shaffer, Virgina Tech)
    Algorithm animations built in

runestoneinteractive.org (Brad Miller,
    Several books (Python)
        • Python - try and run code built in
        • Quizzes

Zyante.com – interactive textbooks

Track student progress

Requirements and design strategies for open source interactive computer science eBooks
    ITiCSE 2013 Working Group (Korhonen, Naps, et al)

Preparation for first day and first day…

What type of lecture?

What type of room?

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Here is a slide for the first day…

Classroom rule:

NO SITTING IN THE LAST FOUR ROWS!

Come forward

Yes YOU who is sitting in the last four rows.

Large school, room, classes only!

Ways to Select students to answer questions

Problem – same students always eager

How do you get other students to participate?

- Randomly call on them or pass a talking stick
- Keep track of who has spoken already
- Work in groups – call on group
- Assigned groups – call on group numbers

Lecture Format

Traditional way of teaching

Professor Lectures

Students hear only 13%

Most of what they here is:

BLAH BLAH BLAH BLAH BLAH

Interactive or "Flipped" Lecture

Students must prepare (read, video)
Lecture/Introduce for 5-15 minutes
Students solve a problem
    Solve problem from scratch (longer)
    Find what is wrong with a "solution" (shorter)
Discuss solution
    Ask how many did X? (gets students involved)
    Go over your solution (intentionally make mistakes)
    Go over student attempt/solution
    Student present solution (longer)
REPEAT

Small school -> this is studio style teaching with integrated lecture and hands-on

Pair Programming

Students work on problem with one computer in pairs

"Driver" and "navigator"

Alternative

Everyone has their own laptop

But work in pairs

Groups/Pairs

Assigned

(and changed often)

```
CompSci 4 Section 1
Pairs as of October 22, 2009

    Front of room

         G1 G2   G3 G4
  G5  G6   G7    G8    G9
 G10 G11 G12 G13 G14 G15
 G16 G17 G18 G19 G20
 G21 G22 G23 G24 G25

Group 1
```
     Student1 name student1email
     Student2 name student2email
```
Group 2
```
     Student3 name student3email
     Student4 name student4email
```
Group 3
```

Interactive Lecture Notes and Handouts

Create two versions of lecture notes
- Slides with missing parts
- Release complete slides later

Does Your School have special rooms to teach in?
Example: Special Layout with Computers

20 computers, 40 students

Extra desks for group work

Advantage: see what students are doing
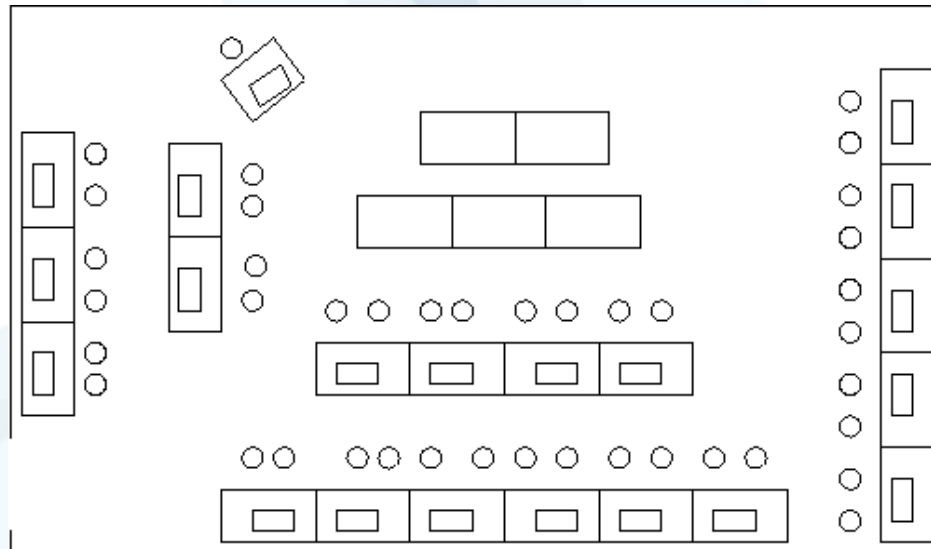
Does Your School have special rooms to teach in?
Example: Studio-style room

24 computers, 24 students

During lecture, no computers in the way

During hands-on, easy to see them work, help them
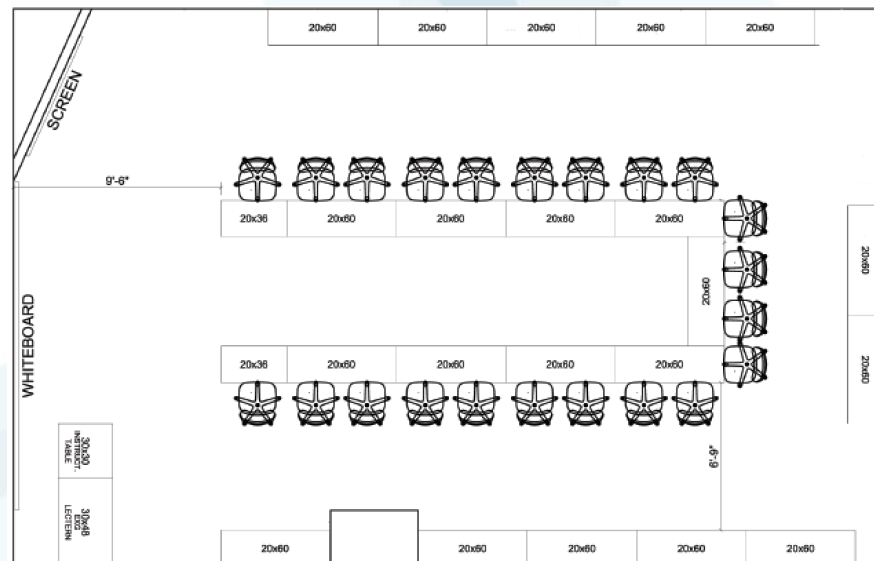
Teaching Assistants Undergraduate/Graduate

- 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

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; Union: large = 40-50

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Instant Feedback in Lecture

Clickers

Google forms

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Google Forms

Mystery While

* Required

NETID of person 1 *

Example: abc123

NETID of person 2

Example: abc123

NETID of person 3

Example: abc123

NETID of person 4

Example: abc123

Names of people filling out form *

(first and last name for each person, separate each name by a comman)

Google Forms (Multiple choice)

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

○ "Go"

○ "Go3"

○ "Go*3"

○ "GoGoGo"

○ None

○ Nothing is printed

(180 responses)

92.2%

● "Go"
● "Go3"
● "Go*3"
● "GoGoGo"
● None
● Nothing is printed
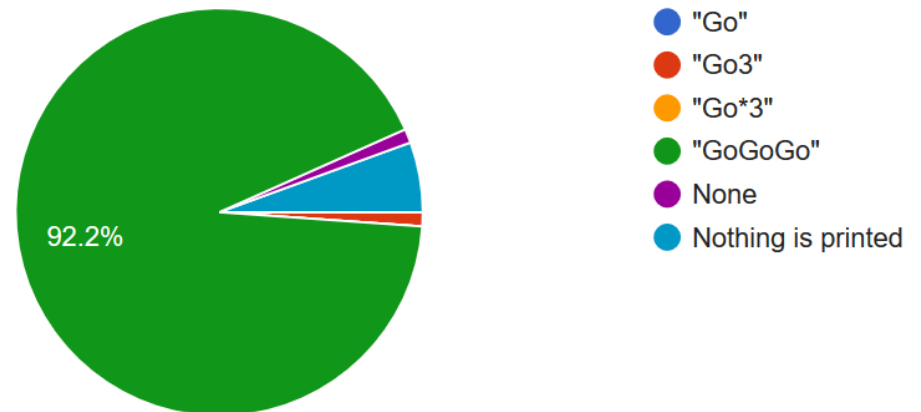
Google Forms (Multiple Choice 2)

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

○ "Go"

○ "Go5"

○ "GoGoGoGoGo"
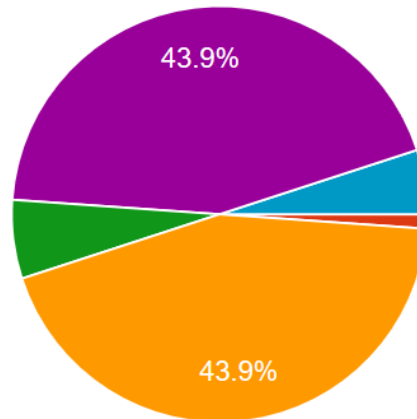
○ None

○ "GoGoGoGoGo" and N

○ Nothing is printed

(180 responses)

- 🔵 "Go"
- 🔴 "Go5"
- 🟠 "GoGoGoGoGo"
- 🟢 None
- 🟣 "GoGoGoGoGo" and None
- 🔵 Nothing is printed

43.9%

43.9%
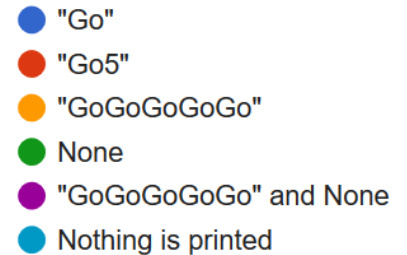
Google Forms (Free form)

What does Mystery2 do (in words)?*

What does Mystery3 do?*
(in words)

Google Forms (responses)

H	I	J	K	
What does Mystery3 do?				
It counts every character in a word except for lowercase "e"s				
It counts the number of characters in the word that aren't lowercase e's.				
It is counting the number of characters in the word that are not e's				
Count the number of characters that are not 'e' in the word				
Mystery 3 returns a given a given word without the lowercase e's.				
Counts the lower case es in the word.				
It returns the number of characters in a word that are not e.				
Counts all of the letters in word that aren't 'e'				
Counts the number of characters that are not e in the word.				
Counts all the characters that aren't e				
counts how many letters there are that are not "e"				
Mystery 3 counts the characters in a string that are not 'e', then returns the total count.				

Setting up Google Forms

Make it easy for students to get form

bitly

Paste a long URL here to shorten...

CUSTOM BITLINK

Current: http://bit.ly/1CWexRo

Customize your Bitlink! Extend your brand,
build trust, and drive engagement.

bit.ly ▾   /   101S15-0205-01

Cancel   **SAVE**

Engaging students in a group activities/large course

Acting out stories, games

- *Everything I needed to know about teaching*… - Pollard, Duvall (SIGCSE 2007)

Acting out algorithms with the whole class

- Make a binary tree with the whole class
- Calculate the height of the tree
- *Making Lemonade … large lecture classes* – Wolfman (SIGCSE 2002)

Acting out algorithms with a subset of students

- Sorting algorithms – selection sort, insertionsort, etc
- CS Unplugged activities

Large Courses - UTAs

- Had 35 UTAs for CS 1!
- Get Head UTAs
  - One to run the lab training
  - One to organizing evening consulting hours
- Have separate Piazza site for Profs/TA/UTAs
- Fill out time card AND google form to account for what hours spent on
- Costly!

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Online Teaching

- MOOC or Regular Course/Other Sites
- Videos – you make or work with professionals, short or full course length
- Prepare material way in advance
- May have to prepare many additional materials
  - Quizzes may randomly select questions

Using Animations/Software Tools in Class

Algorithm Animation Software/ Aps/Videos

AlgoViz.org – collection of algorithm visualizations

Samba, Jsamba - Stasko (Georgia Tech)

AnimalScript – Roessling (Darmstadt Univ of Tech, SIGCSE 2001)

JHAVE – Naps (U. Wisc. Oshkosh, SIGCSE 2000)

TRAKLA2 – Software Visualization Group – TKK Finland

JAWAA – Rodger et al (Duke, SIGCSE 2003)

Lots of animations and systems on the web!

Lots of videos of algorithm animations on the web!

Example – Arrays
Shuffle, then Selection Sort

Use of Algorithm Animation in CS 1/2

Instructor

Make/Use animations for lecture

Stop/Pause – ask what will happen next

must be interactive

Student

Create animations

Replay animations from lecture with same or new inputs
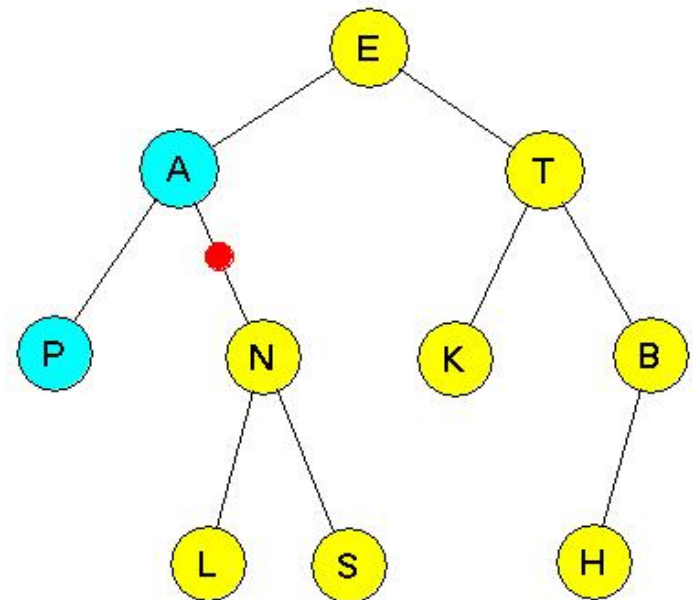
Use engaging and visual tools
Example: Python Tutor
www.pythontutor.com

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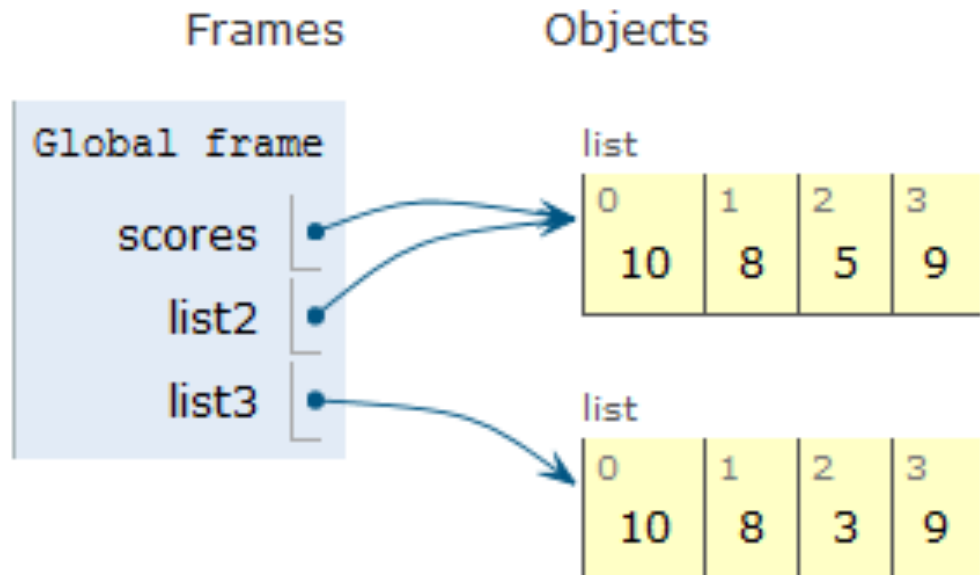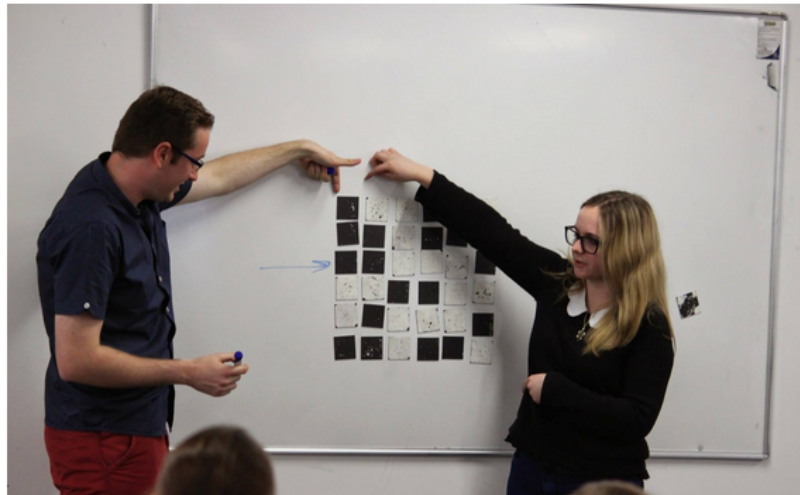
Active Learning

- CS Unplugged – csunplugged.org

Teaching with Props

Interaction in Class – Props
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

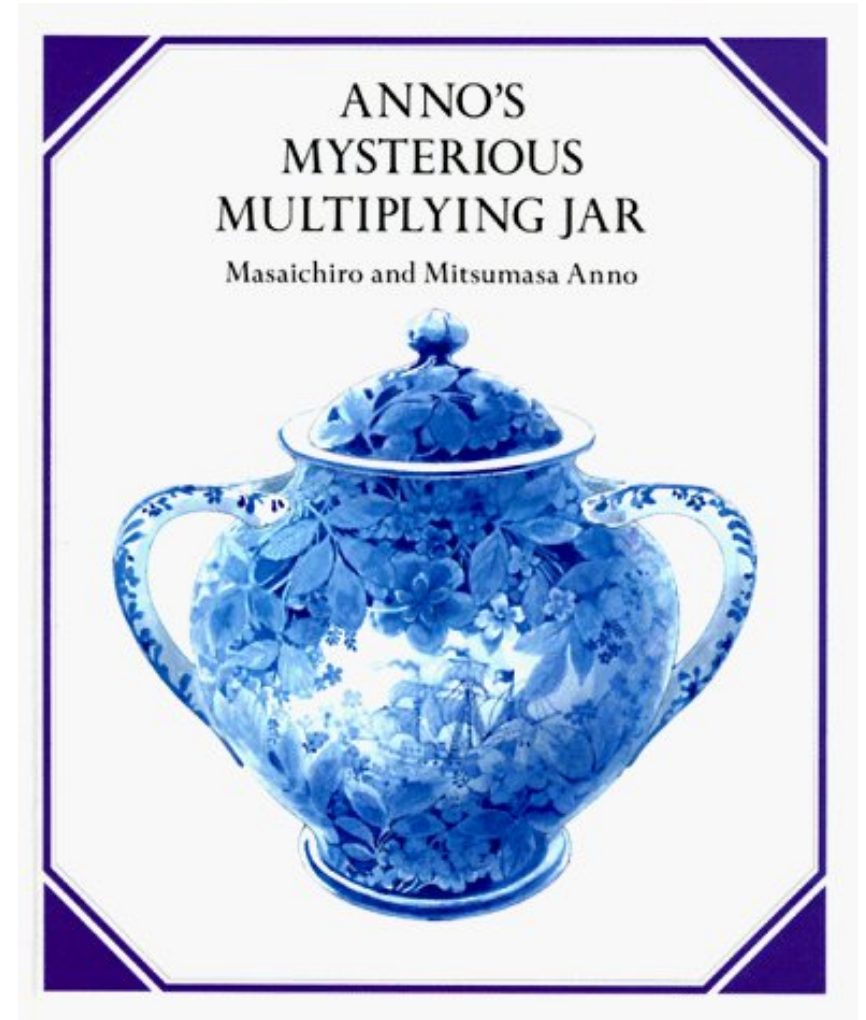Insertion Sort

Card Class – shuffling, dealing hands

Poker hands – Full house, Flush, etc.

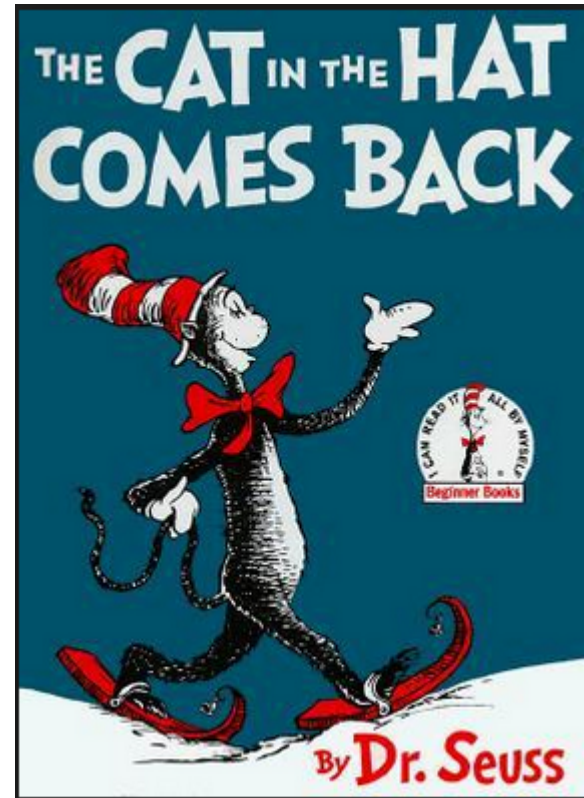# Example of Computer Science concept

Children's book

Also a story
about factorial
and recursion

Example of Computer Science concept

Children's book

Also a story
about recursion

Edible CS

- Make treats for students

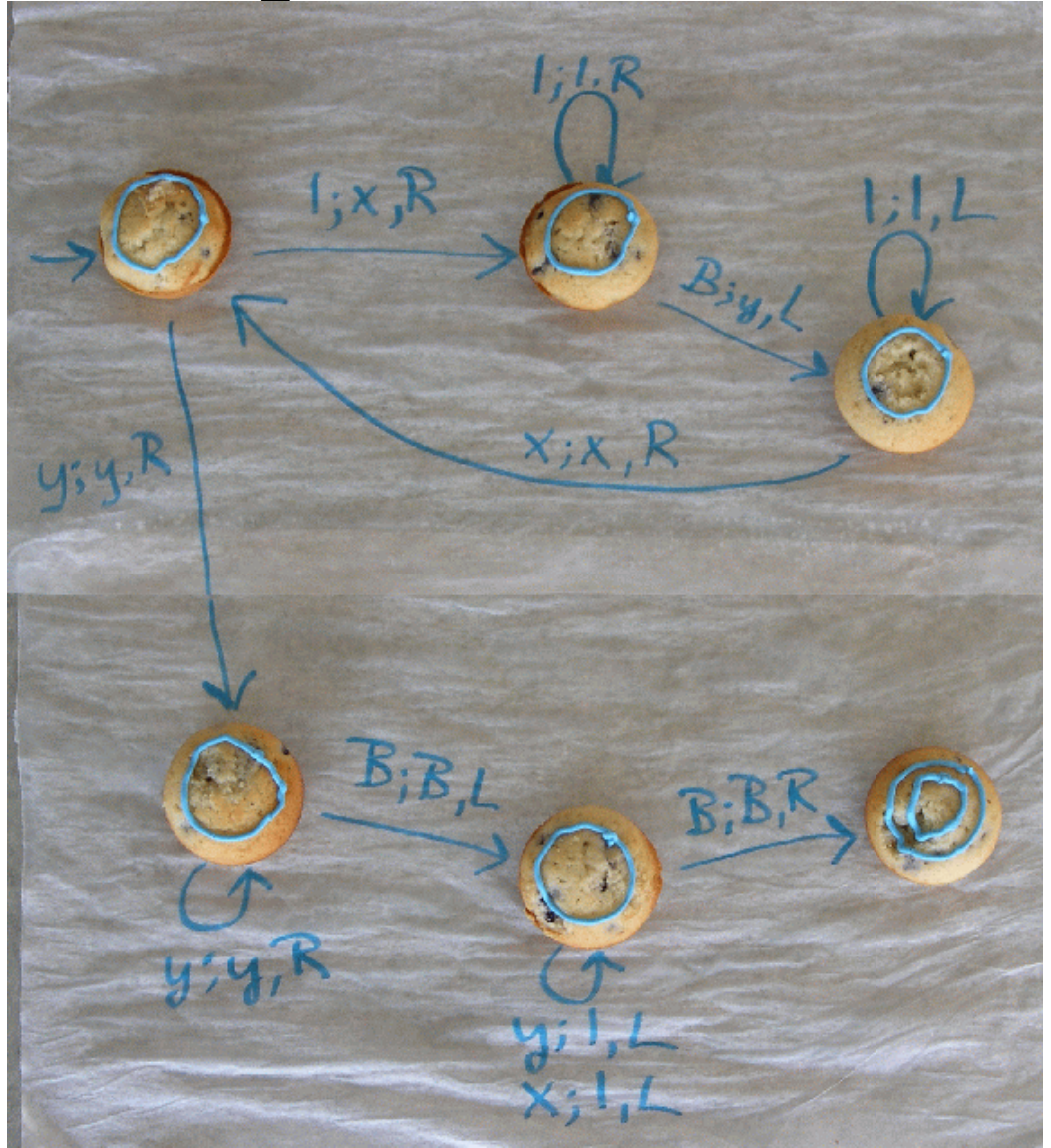- Use food to solve a problem

- Then eat the treats!

CS 1
Sorting
Cookies

Automata Theory
Interaction in Class – Props
Edible Turing Machine

TM for f(x)=2x
where x is unary

TM is not correct,
can you fix it?
Then eat it!

States are
blueberry
muffins

What should you do next?

Complete the GHC survey
Apply and Share your new knowledge
Follow up with someone you met here
Visit CRA-Women web site and Sign-Up
for CRA-Women Updates
Participate in CRA-W via Facebook,
Twitter (@CRAWomen), or Linked In

www.cra-w.org

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