

Learning How to Teach Computer Science – And Why I Teach the Way I Do

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Durham, NC USA

So Many People To Thank!

- My Husband and Family
- My mentors
- So many colleagues
 - AP CS, SIGCSE, ITiCSE Working Groups, Algorithm Visualization, JFLAP, Alice, CRA-WP, Rensselaer, Duke, ...
- So many students



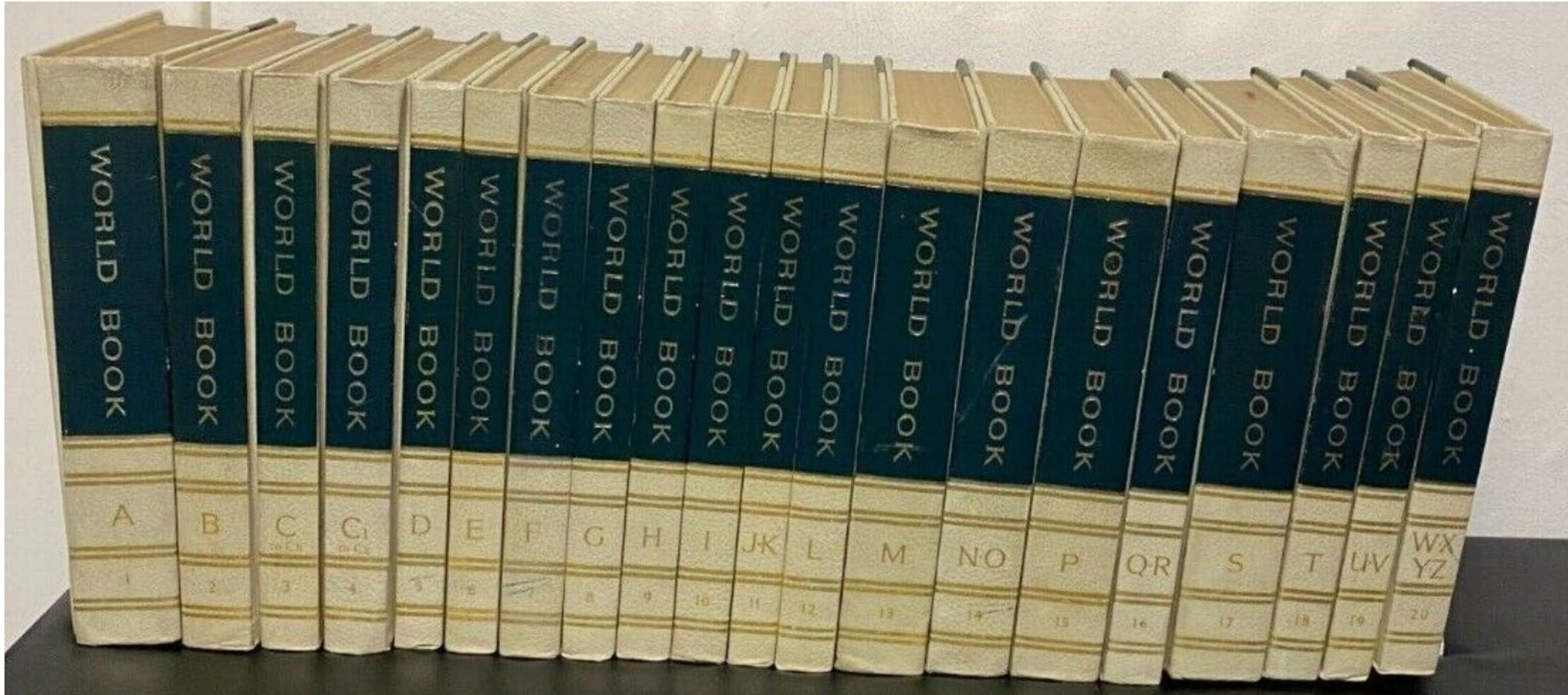
Thanks to Steve Wolfman and Gary Lewendoski for the SIGCSE 2010 scarf!

My Journey starts Way Back

- Very shy
- Me and my sisters
 - May 1970
- Solved a lot of puzzles
- Loved Math
- Interest in teaching



My World Wide Web



Computers?

- My Dad started ADP with Don Harley
- Large Disk drives and tape drives
- No computers in my H.S.



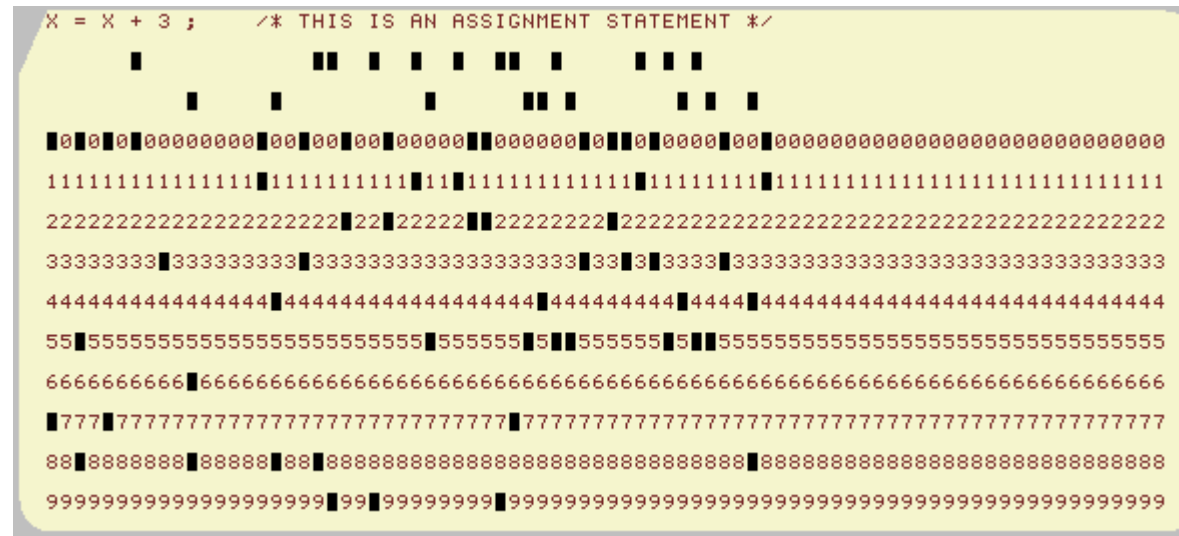
College – North Carolina State University



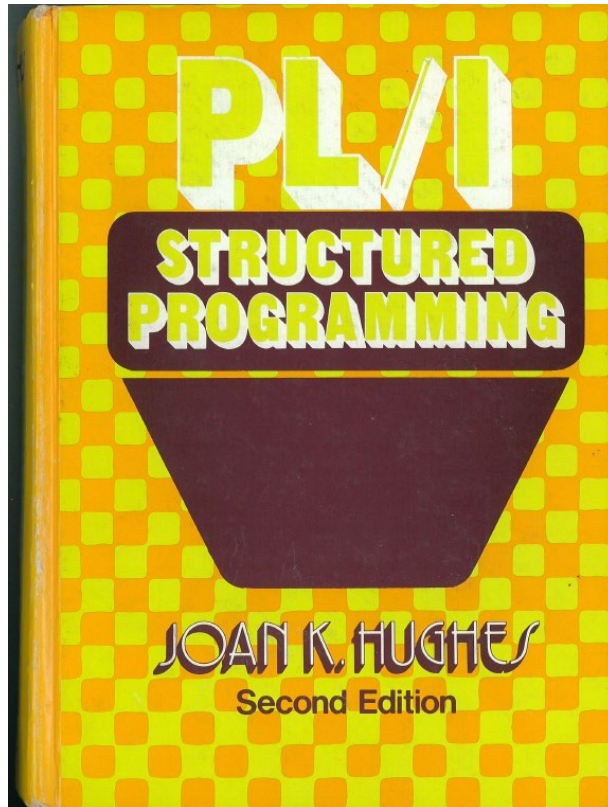
NC State

- Liked Math a lot
- Took programming course first semester
 - PL/1

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



PL/1 Structured Programming by Hughes



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PL/1 Program – Table for Powers of 2

766 PL/I Structured Programming

Positive Binary Values		Powers of 2	Absolute Values		Negative Binary Values	
Bit Positions 11 1111 1111 2222 2222 2233 0123 4567 8901 2345 6789 0123 4567 8901			Decimal Notation Base = 10	Hexadecimal Notation Base = 16	Bit Positions 11 1111 1111 2222 2222 2233 0123 4567 8901 2345 6789 0123 4567 8901	
0000 0000 0000 0000 0000 0000 0000 0000	0	0	0	No negative zero	1111 1111 1111 1111 1111 1111 1111 1111	
0000 0000 0000 0000 0000 0000 0000 0001	1	1	1	1111 1111 1111 1111 1111 1111 1111 1110		
0000 0000 0000 0000 0000 0000 0000 0010	2	2	2	1111 1111 1111 1111 1111 1111 1111 1100		
0000 0000 0000 0000 0000 0000 0000 0100	4	4	4	1111 1111 1111 1111 1111 1111 1111 1000		
0000 0000 0000 0000 0000 0000 0000 1000	8	8	8	1111 1111 1111 1111 1111 1111 1111 0000		
0000 0000 0000 0000 0000 0000 0001 0000	16	16	10	1111 1111 1111 1111 1111 1111 1111 0000		
0000 0000 0000 0000 0000 0000 0010 0000	32	32	20	1111 1111 1111 1111 1111 1111 1110 0000		
0000 0000 0000 0000 0000 0000 0100 0000	64	64	40	1111 1111 1111 1111 1111 1111 1100 0000		
0000 0000 0000 0000 0000 0000 1000 0000	128	128	80	1111 1111 1111 1111 1111 1111 1000 0000		
0000 0000 0000 0000 0000 0001 0000 0000	256	256	100	1111 1111 1111 1111 1111 1111 0000 0000		
0000 0000 0000 0000 0000 0010 0000 0000	512	512	200	1111 1111 1111 1111 1111 1110 0000 0000		
0000 0000 0000 0000 0000 0100 0000 0000	1,024	1,024	400	1111 1111 1111 1111 1111 1100 0000 0000		
0000 0000 0000 0000 0000 1000 0000 0000	2,048	2,048	800	1111 1111 1111 1111 1111 1000 0000 0000		
0000 0000 0000 0000 0001 0000 0000 0000	4,096	4,096	1,000	1111 1111 1111 1111 1111 0000 0000 0000		
0000 0000 0000 0000 0010 0000 0000 0000	8,192	8,192	2,000	1111 1111 1111 1111 1110 0000 0000 0000		
0000 0000 0000 0000 0100 0000 0000 0000	16,384	16,384	4,000	1111 1111 1111 1111 1100 0000 0000 0000		
0000 0000 0000 0000 1000 0000 0000 0000	32,768	32,768	8,000	1111 1111 1111 1111 1000 0000 0000 0000		
0000 0000 0000 0001 0000 0000 0000 0000	65,536	65,536	10,000	1111 1111 1111 1111 0000 0000 0000 0000		
0000 0000 0000 0010 0000 0000 0000 0000	131,072	131,072	20,000	1111 1111 1111 1110 0000 0000 0000 0000		
0000 0000 0000 0100 0000 0000 0000 0000	262,144	262,144	40,000	1111 1111 1111 1100 0000 0000 0000 0000		
0000 0000 0000 1000 0000 0000 0000 0000	524,288	524,288	80,000	1111 1111 1111 1000 0000 0000 0000 0000		
0000 0000 0001 0000 0000 0000 0000 0000	1,048,576	1,048,576	100,000	1111 1111 1111 0000 0000 0000 0000 0000		
0000 0000 0010 0000 0000 0000 0000 0000	2,097,152	2,097,152	200,000	1111 1111 1110 0000 0000 0000 0000 0000		
0000 0000 0100 0000 0000 0000 0000 0000	4,194,304	4,194,304	400,000	1111 1111 1100 0000 0000 0000 0000 0000		
0000 0000 1000 0000 0000 0000 0000 0000	8,388,608	8,388,608	800,000	1111 1111 1000 0000 0000 0000 0000 0000		
0000 0001 0000 0000 0000 0000 0000 0000	16,777,216	16,777,216	1,000,000	1111 1111 0000 0000 0000 0000 0000 0000		
0000 0010 0000 0000 0000 0000 0000 0000	33,554,432	33,554,432	2,000,000	1111 1110 0000 0000 0000 0000 0000 0000		
0000 0100 0000 0000 0000 0000 0000 0000	67,108,864	67,108,864	4,000,000	1111 1100 0000 0000 0000 0000 0000 0000		
0000 1000 0000 0000 0000 0000 0000 0000	134,217,728	134,217,728	8,000,000	1111 1000 0000 0000 0000 0000 0000 0000		
0001 0000 0000 0000 0000 0000 0000 0000	268,435,456	268,435,456	10,000,000	1111 0000 0000 0000 0000 0000 0000 0000		
0010 0000 0000 0000 0000 0000 0000 0000	536,870,912	536,870,912	20,000,000	1110 0000 0000 0000 0000 0000 0000 0000		
0100 0000 0000 0000 0000 0000 0000 0000	1,073,741,824	1,073,741,824	40,000,000	1100 0000 0000 0000 0000 0000 0000 0000		
0111 1111 1111 1111 1111 1111 1111 1111	2,147,483,647	7F,FFF,FFF	80,000,000	1000 0000 0000 0000 0000 0000 0000 0000		
No positive equivalent	2,147,483,648	80,000,000		1000 0000 0000 0000 0000 0000 0000 0000		

FIGURE D.4 Powers-of-two table.

Jobs at NCSU and where to go next?

- Systems Programmer – University Systems Control Center
 - Pull data off of Magnetic tapes
- Undergraduate Research Assistant
 - David McAllister, Numerical Analysis
- Double major in Computer Science and Math
 - Start of Senior year – Question led me to Math Advisor
 - Dana Latch
 - You are going to graduate school, aren't you?



David McAllister



Dana Latch

Applied to PhD programs and Industry

- Applied to PhD programs
- IBM
 - Got job offer and Accepted
- Still waiting from PhD programs



Issue with my GRE Score

- Quantitative – High score – 90%
- High GPA
- Verbal – low score - 28%
- Prof. Latch referred me to a Psychologist for evaluation
 - 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

Sent Letter to Graduate Schools

PURDUE
UNIVERSITY

Office of the
Vice President for Research and
Dean of the Graduate School

March 23, 1983

Dear Ms. Rodger:

I am pleased to offer you official admission to study toward the Doctor of Philosophy degree in the Department of Computer Sciences for the 1983 fall session at the West Lafayette campus. Your admission is conditional upon the following:

1. Demonstration of proficiency in English composition during your first term. This may be accomplished in the Office of Writing Review, Heavilon Hall.
2. Satisfactory completion of your undergraduate degree and submission of your undergraduate final transcript during your first term.

Demonstrate
proficiency in
English
Composition

What about that IBM job?

- Turned down the job to go to graduate school
- They offered me a summer job!

English Proficiency Done!

**PURDUE
UNIVERSITY** OFFICE OF WRITING REVIEW

September 20, 1983

Dear Ms. Rodger,

Demonstrated
proficiency in
English
Composition!

It is a pleasure to inform you that you have cleared the English requirement for graduate students and that the Graduate School has been so notified. Since neither this office nor the Graduate School normally notifies your major professor, you may want to show him this note. Then, we suggest that you keep it as official evidence that you have met the requirement. If you would like to come by the office and look over the corrections on your paper, we will be glad to show it to you.



Graduate School at Purdue

- Teaching Assistant for intro programming in Fortran
 - Taught several Discussion sections
 - Punch cards
- First Semester deciding research area
 - Numerical Analysis
 - Algorithms
- TA for several other courses
- Liked teaching and helping students!



Greg
Frederickson



Finished PhD at Purdue

- PhD Purdue University 1989
 - Computational Geometry
 - Parallel Scheduling Algorithms
- Job Search
 - Two-body problem

Assistant Professor Rensselaer Polytechnic Institute



- 1989-1994
- Continued research in algorithms
- First two women faculty in dept – me and Ellen Walker
- Really like teaching and helping students



Ellen Walker

Career Change from a Lunch at a SIGCSE TS

- Presented paper at SIGCSE 1994 in March in Phoenix, Arizona
- Heard about new position at Duke University
- I was listening, but had low self-esteem
- One month later
 - Got two NSF grants – Education, and Broadening Participation
- Sunday, Emailed Alan Biermann to inquire about position



Rocky Ross



Alan Biermann

Career Change from a Lunch at a SIGCSE TS

- Alan Biermann's response:

"We are having 3 candidates interview next week and may put out an offer."

"It is probably too late to apply now unless our search is unsuccessful in which case a second round could take place."

- I emailed him back and said I would apply
 - I mention I just got 2 NSF grants!
- He emails back:

"Congratulations on your grants success. Yes, you should send in your application. (But do not put a huge effort into it unless you find out we have reopened the search.)"

- On Monday, I FEDEX'd my paper application!



Alan Biermann

Career Change from a Lunch at a SIGCSE TS

- Tuesday: I get a call from Owen Astrachan
 - They need my reference letters today and want me to come interview this week.

- Wednesday: an email from Owen

"I'd like to extend an invitation to come to Duke", "If you could arrange to come by tomorrow evening (Thurs)"

- I email him on Thursday:

"I picked up my tickets this morning. So you can find me, I'll be wearing white jeans and white sneakers. I have long brown hair and wear glasses."

- He emails back:

"I got your abstract and your self-description. I'm kind of skinny, wear glasses and will be looking like I'm looking for someone."



Owen Astrachan

Thank you for reference letters!



Mukkai
Krishnamoorthy



Erich Kaltofen

Bob McLaughlin

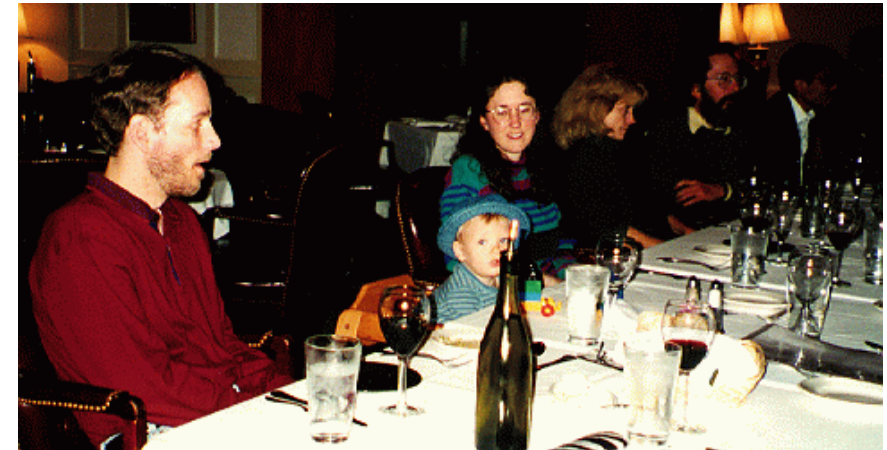
Assistant Professor of the Practice Duke University

- Since 1994
- Assistant -> Associate -> Professor of the Practice
- Been involved with SIGCSE in many ways and lots of communities through SIGCSE interactions
- Here are some of the communities I have been involved with



Community: AP Computer Science

- Test Development Committee 1995-2001
- CS A Exam and CS B Exam
 - Pascal 1984-1998
 - C++ 1999-2003
 - Java 2004 – present
- Lots of panels at SIGCSE on changing AP CS



Community on Algorithm Visualization

- 1992 – Computers in Science Education and Training Workshop, Nova Scotia, met John Stasko
- SIGCSE conferences met many people
- My Workshop on Interactive and Visual Tools 1996
 - Gave talks – Stasko, Poplawski, Ericson, Guzdial, ...
- AlgoViz – Cliff Shaffer and others
- Many ITiCSE Working Groups on Algorithm Visualization – Tom Naps and others
- Online textbooks – OpenDSA, Runestone Academy



John Stasko



Cliff Shaffer

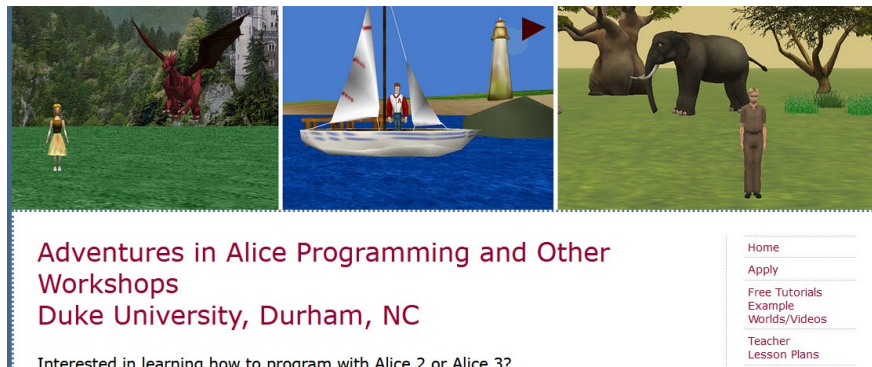


Tom Naps



Community - CS into K-12 with Alice

- Met Wanda Dann and Steve Cooper at SIGCSE 02
- Integrating Alice into CS 0
- Workshop 2005 at Duke
- First Alice Symposium at Duke – College and HS
- Adventures in Alice Programming!
- Many years with K-12!



What about My Disability?

- Diagnosed as heading to Graduate School
- Never got any accommodations in Graduate School
- Never got any accommodations as a Professor
- It has been hard!
- Takes me longer to do things
 - Writing
 - Organizing thoughts
- Been easier to talk about with
 - BPC activities, Access Computing, NCWIT, CRA-WP



Another Psych Evaluation

- November 2021
 - "scores revealed a large and unusual discrepancy between verbal reasoning and nonverbal reasoning, indicating an underlying verbal-based learning disability"
 - "very mild/high functioning end of the autism spectrum"
 - Camouflaging behaviors – masking or strategies to hide autistic characteristics

I'm autistic

- Nice to have a name to my difficulties

How do I Compensate?

- I start things really early or else!
- I write down notes everywhere!
- In meetings I write down and organize my thoughts before speaking
- I have a sticky note on my laptop for lecture
- I say tongue-twisters for articulation

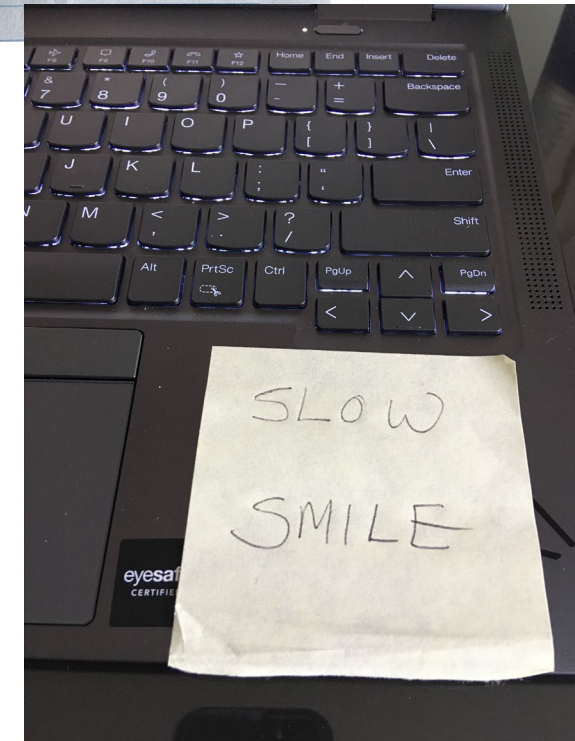
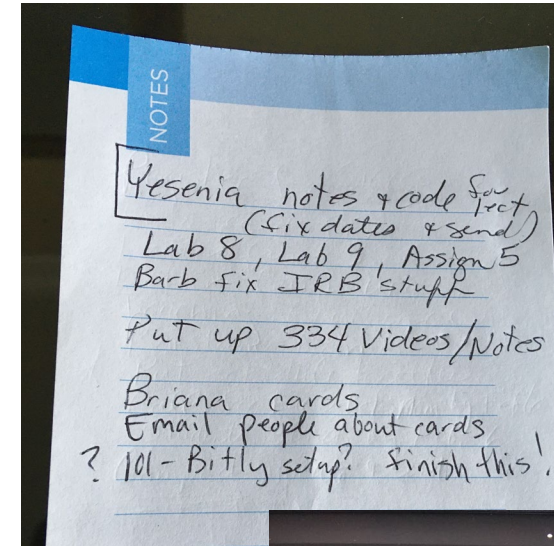
2. Betty Botter bought some butter

But she said the butter's bitter

If I put it in my batter, it will make my batter bitter

But a bit of better butter will make my batter better


So 'twas better Betty Botter bought a bit of better butter



That is my Journey, now on to Teaching

Learning How To Teach Computer Science

- Amazing that getting a PhD means you can now teach!
 - Little Training -> Being a Teaching Assistant
- First semester at Rensselaer – Challenge – Prior Dept Decision:
 - Combine CS1/CS2 with Foundations of Computing (automata, grammar)
 - Give challenge to new women faculty! Ellen Walker and me
- How did we survive:
 - Energetic
 - Loved both subjects
 - Stay one step ahead of students!



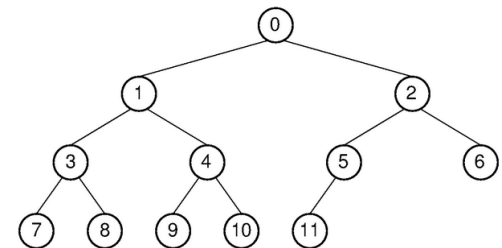
Don't do this to your
new faculty!

Advice from many years on Learning to Teach

- 7 tips
- By the way – I'm still learning!

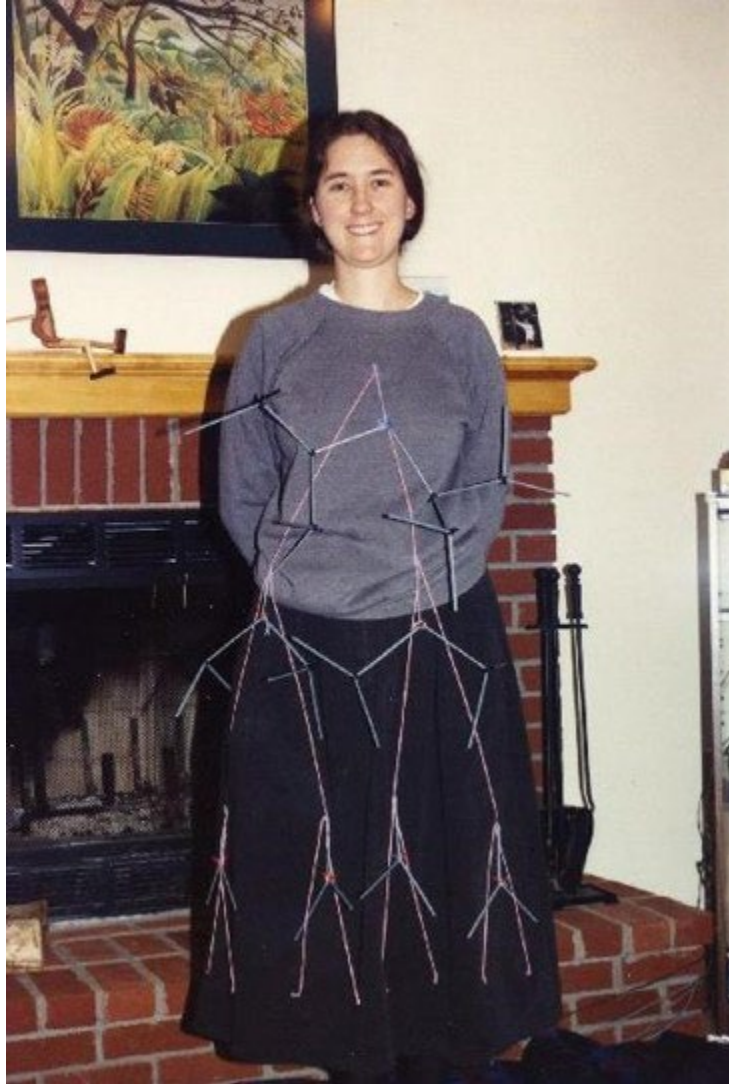
1) Borrow

- Borrow lecture notes and slowly make them your own
- Borrow assignments and slowly make them your own
- Borrow Ideas
- You are at a great place to borrow ideas – SIGCSE TS
 - "Making Lemonade: Exploring the bright side of large lecture courses", Wolfman, SIGCSE 02
 - Make a binary tree with your class to find the depth of the tree
 - Nifty Assignments
 - Very cool assignments since 1999
 - Boggle, Book Recommendations



2) Make concepts visual

What data structure is this?

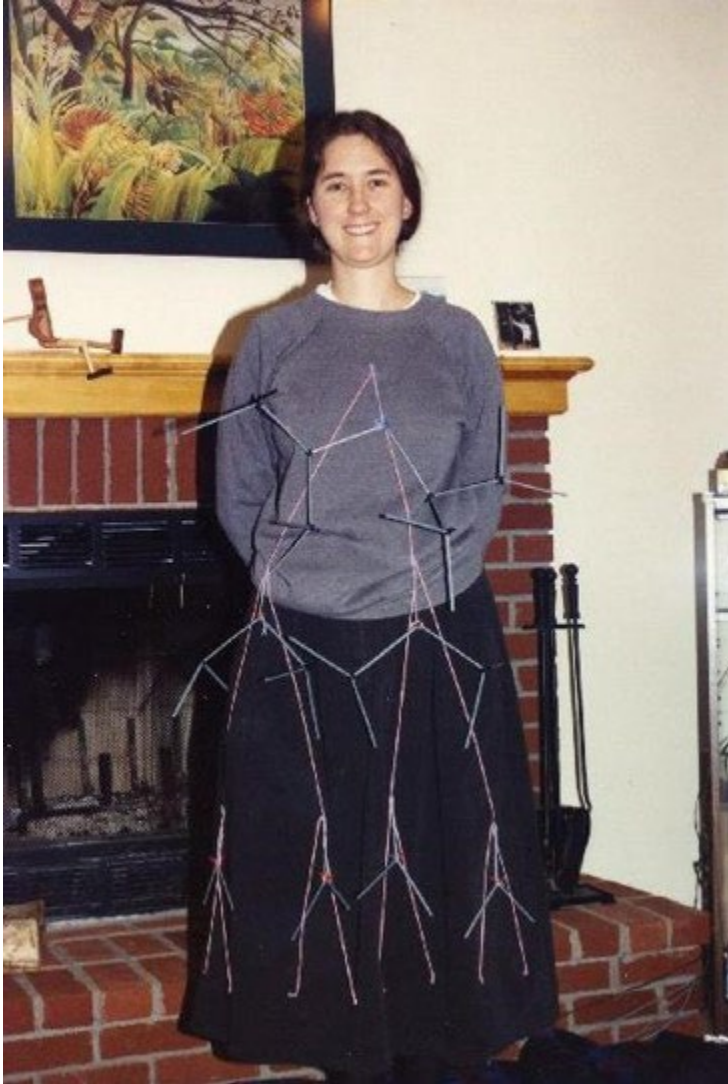


March 17, 2023

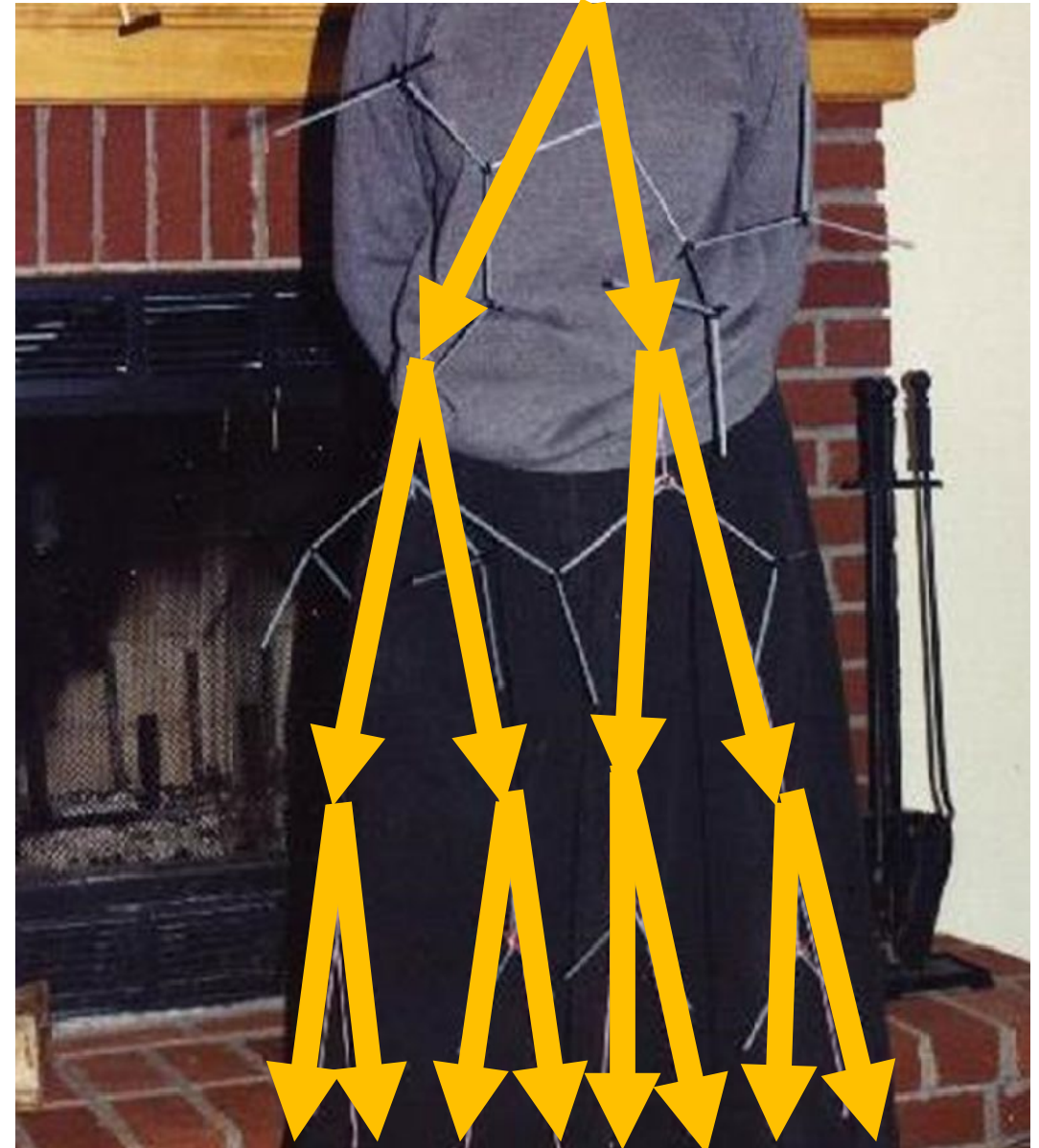


SIGCSE 2023

What data structure is this?

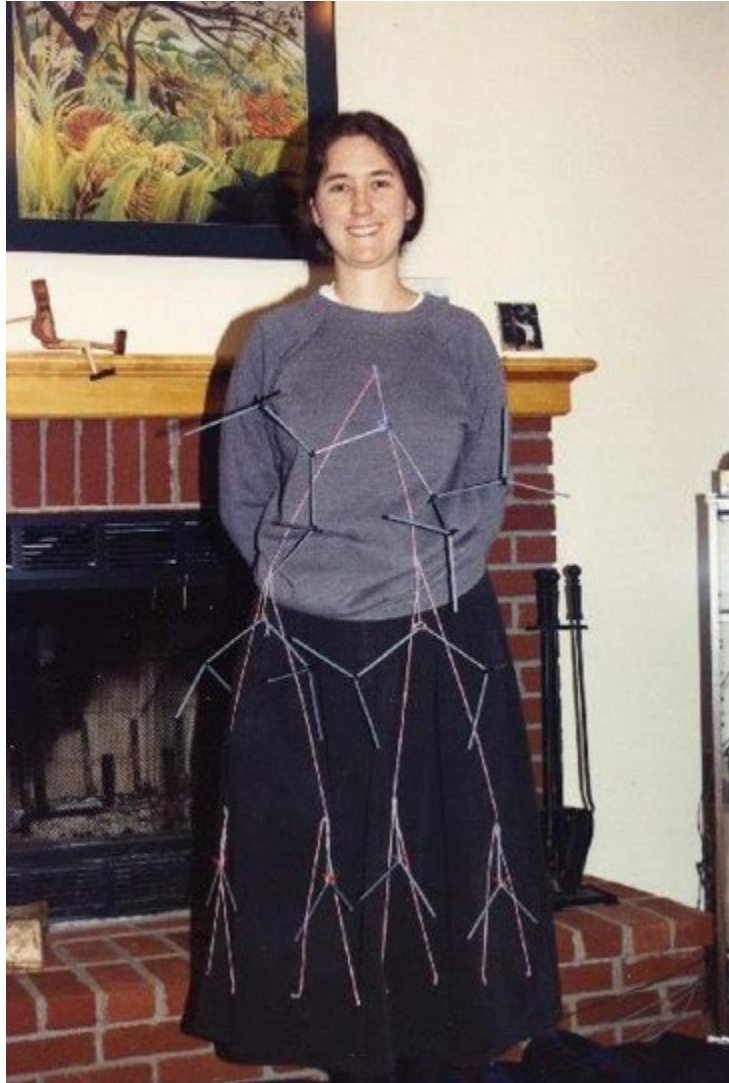


March 17, 2023



SIGCSE 2023

What data structure is this?

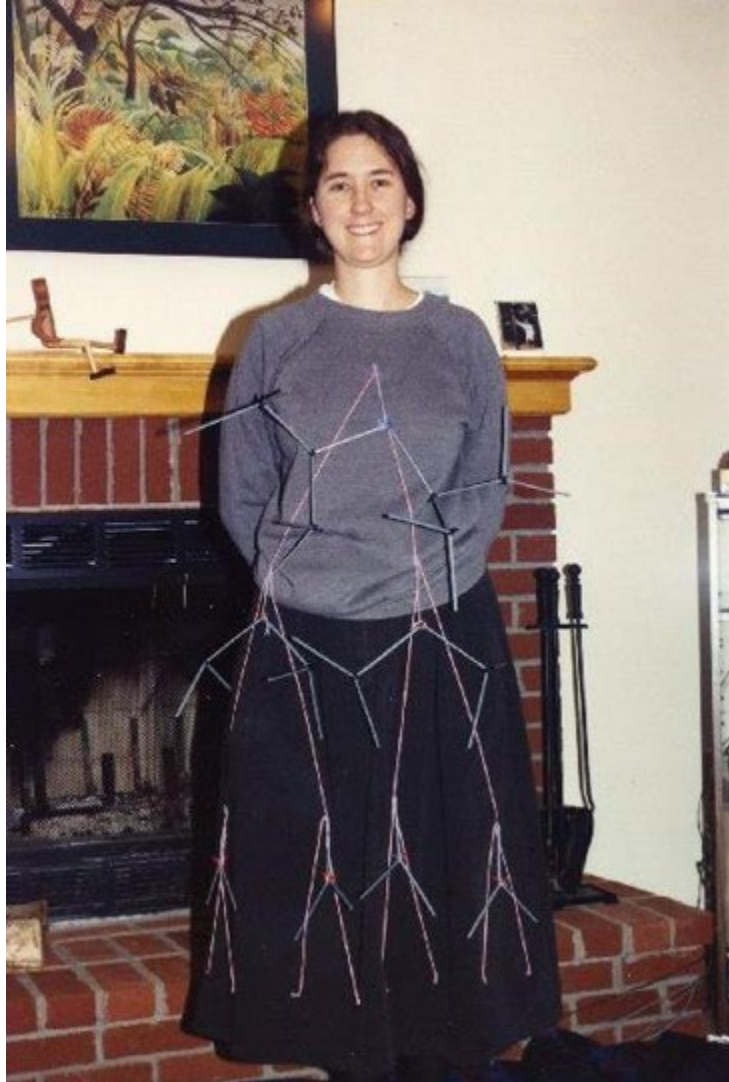


March 17, 2023



SIGCSE 2023

What data structure is this?



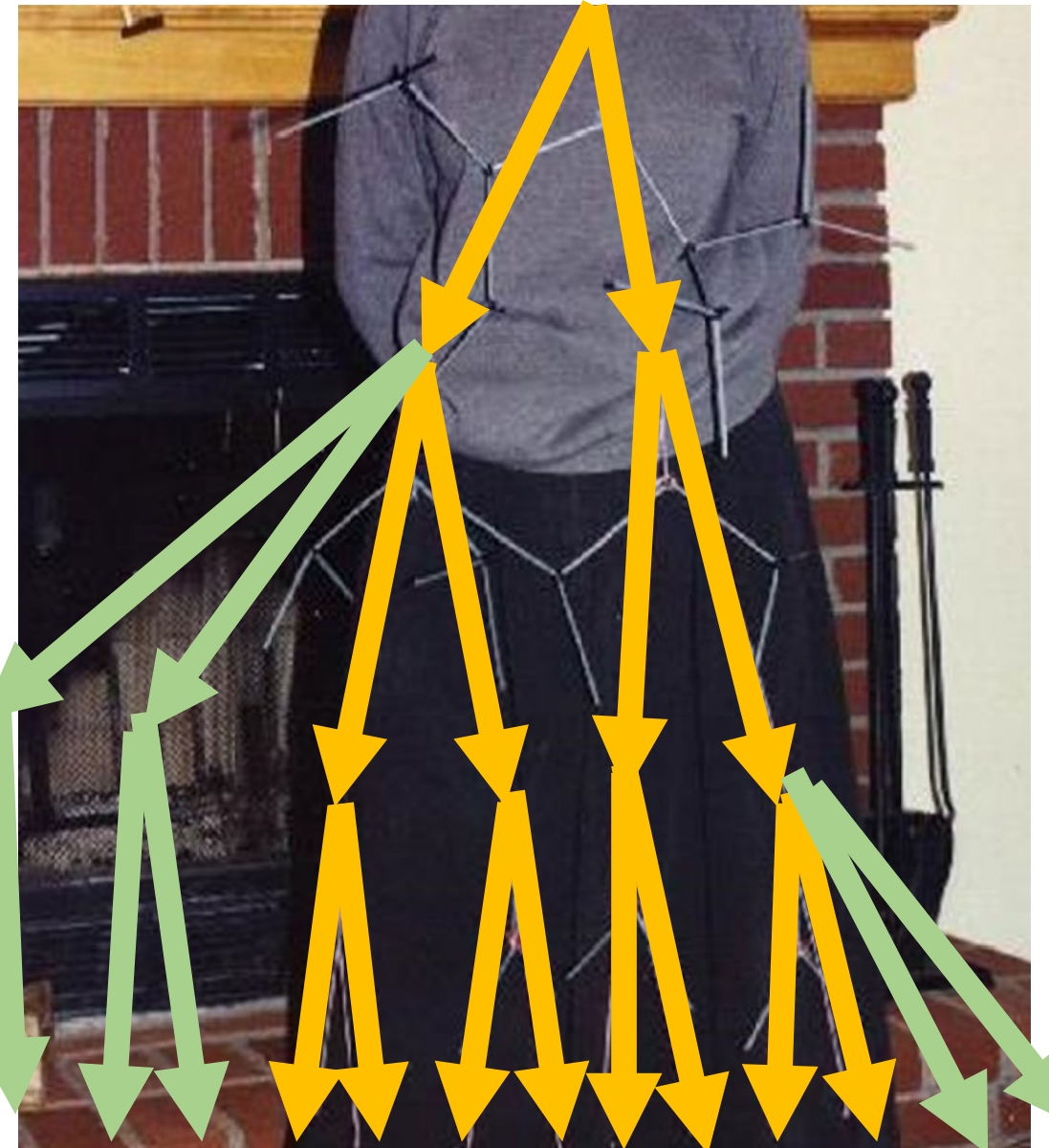
March 17, 2023

Attached to
each node,
green
subtree of
the same size
made with
molecule kit

Only two
shown

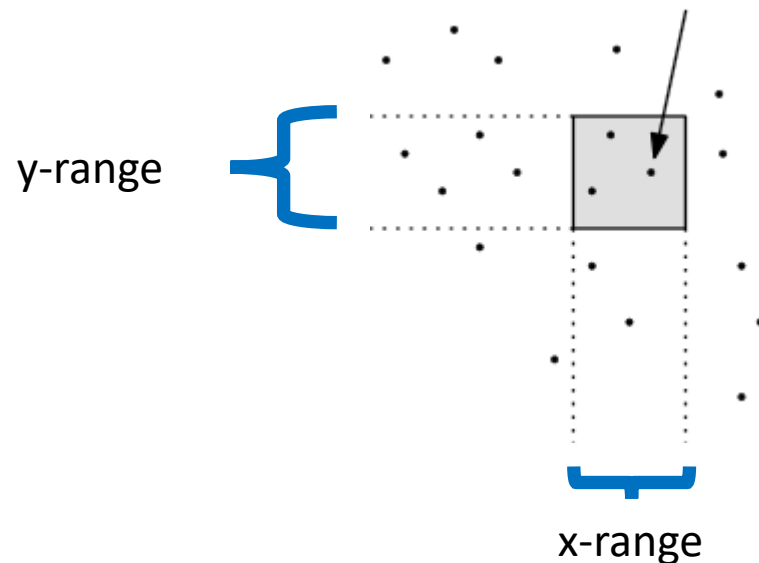
What is it?

SIGCSE 2023

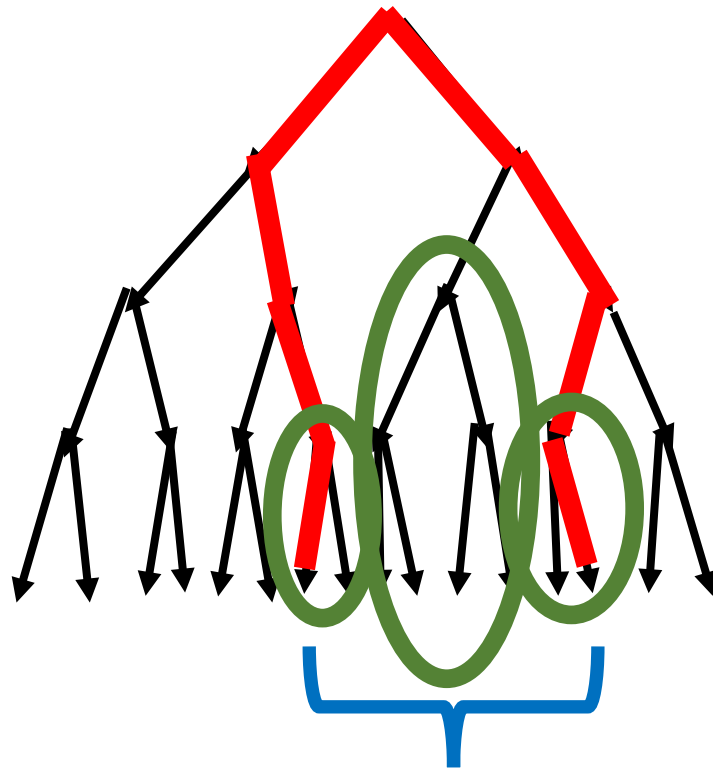


2-D range tree

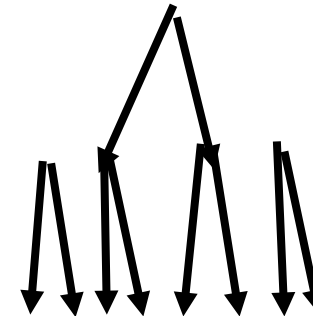
- Here is the problem
- Points in the x-y plane
- Search in for those points in a square



Main tree by x-values, subtree by y-values



In the x-range



Each subtree organized by y-value

Search each subtree by y-value

Did you follow that?

- Engagement Taxonomy
- "Exploring the role of Visualization and Engagement in Computer Science Education", ITiCSE 2002 Working Group, Naps et al.
- Six levels of engagement with visualization technology
 - No viewing ← lowest level
 - Viewing
 - Responding
 - Changing
 - Constructing
 - Presenting

3) Make Lecture Interactive – Don't give answers Names, Types, and Values

- Relate to a file. Consider: `cats.jpg`
- What is its name?
- What is its type?
- What is its value?

Names, Types, and Values

- Relate to a file. Consider: `cats.jpg`
- What is its name?
 - `cats.jpg`
- What is its type?
 - `.jpg` (type of image file)
- What is its value?
 - Content of the file, picture of cats?



Compare input from all

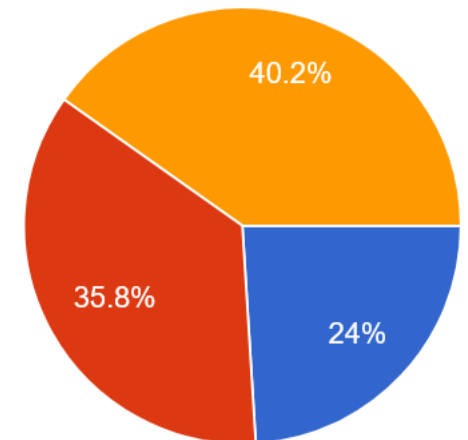
- Use forms (google forms) or clickers

Do the variable names of the argument and parameter need to match (as in the names are exactly the same)?

- ☐ Yes, if they don't match it's an error
- ☐ No, they do not need to match as long as they are related in some way
- ☐ No, they never need to match

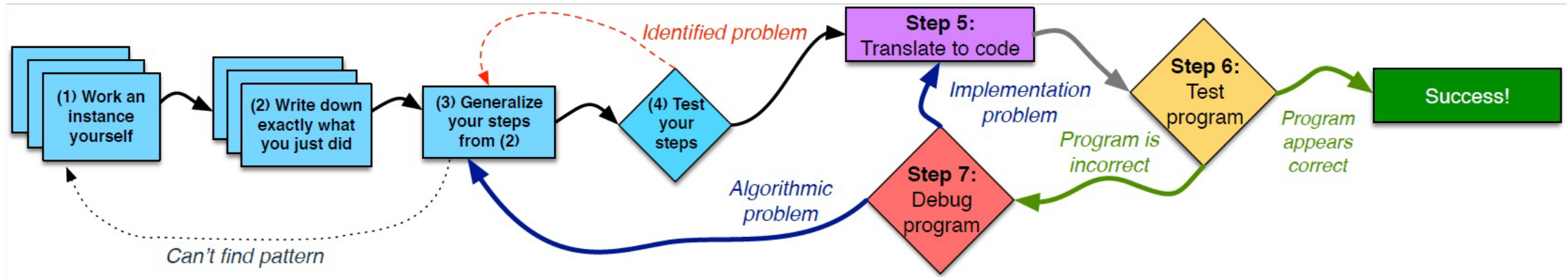
204 responses

- Yes, if they don't match it's an error
- No, they do not need to match as long as they are related in some way
- No, they never need to match



Use interactive techniques

- In CS1 we teach 7 steps: from problem to running code



- Will students use this?
- Not unless they see you using it!
- We use it in lecture a lot to solve problems

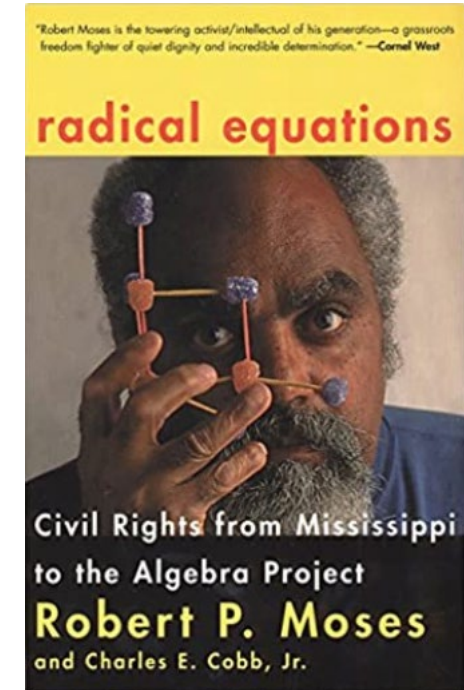
*"Translation from problem to code in 7 steps",
CompEd 19, Hilton, Lipp, and Rodger, 2019.*

From a CS 1 student:

"I just want to tell you that I tried the seven step method, and **I worked on all of my code** for one or two hours **before I even looked at the computer**. AND IT WORKED! I got all my code right on the first try! For the first time ever, I don't have to go to the help lab ..."

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

Constance Bland

- Mississippi Valley State University, Professor, Chair, Vice president of Academic Affairs
- In 1999, the only Black woman to get a PhD in CS.
- Bob Moses wrote that she says: "I wasn't committed...I liked the idea of math based on a student's experience...", "... it really began to sink in just how valuable this project was or could be"
- She was a co-PI (Mississippi site) on my NSF Alice grant to teach middle school teachers programming!



4) Use Visual and Interactive Tools in Teaching

- Many Tools for learning programming:



- KEY: You must use the tools while teaching!
- Students need to see you make mistakes!

Python Tutor – My Favorite tool for Visualizing data concepts in CS 1

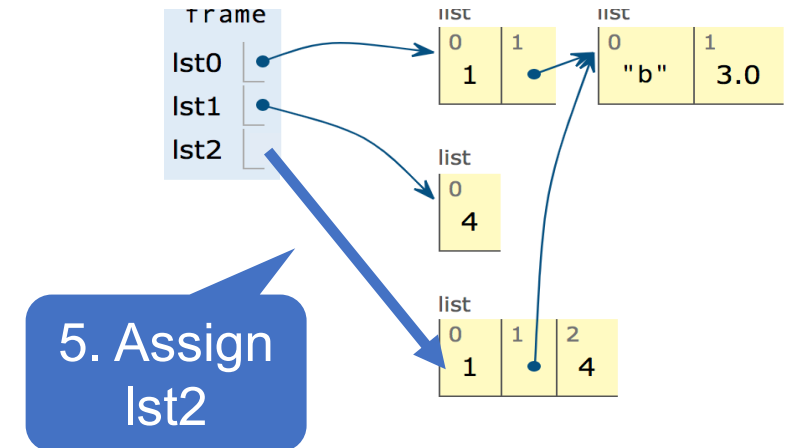
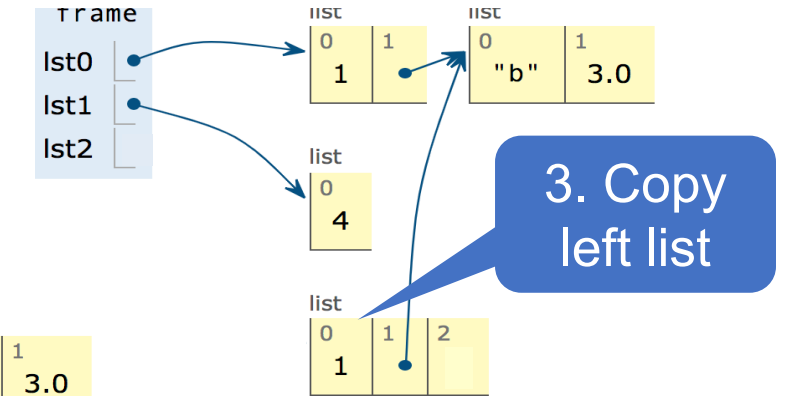
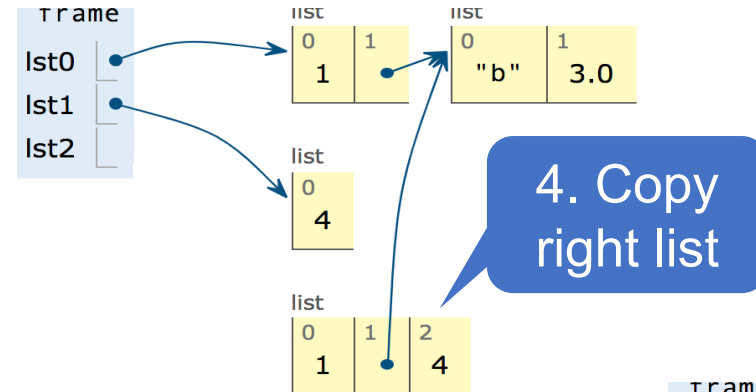
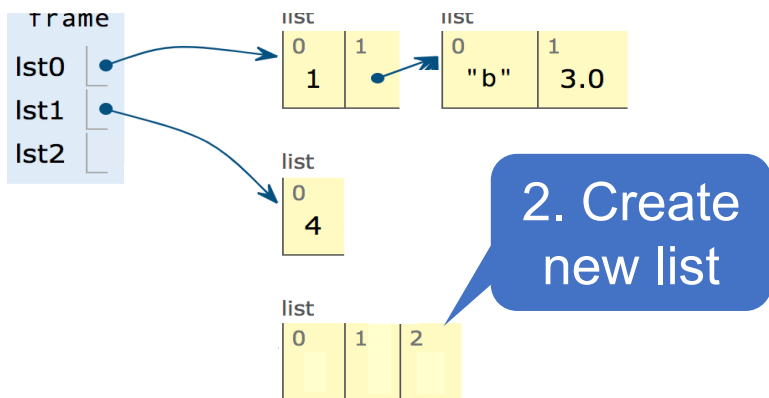
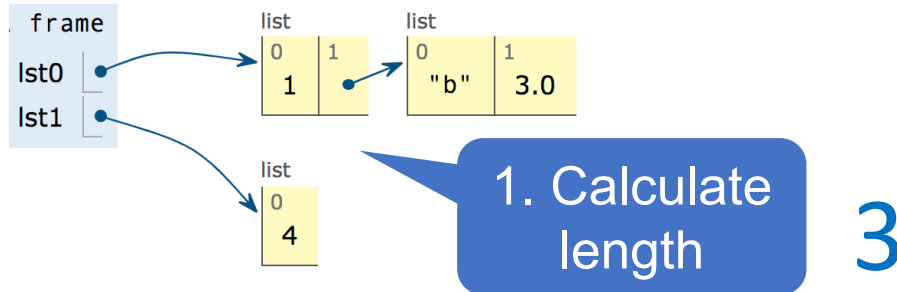
- Example: Concatenation of two Python lists
- Two ways to demo
 1. Step through example using Python Tutor
 2. Copy screen shots onto a slide
- Pause to ask questions
- This example I borrowed from Kristin Stephens-Martinez!

Concatenation of two lists, 5 steps:

Length, create, copy, copy, assign

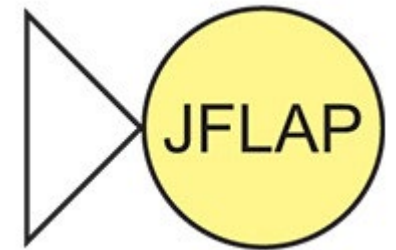
- How is the inner list copied?

```
1 lst0 = [1, ['b', 3.0]]
2 lst1 = [4]
3 lst2 = lst0 + lst1
```



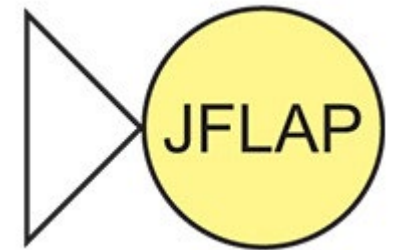
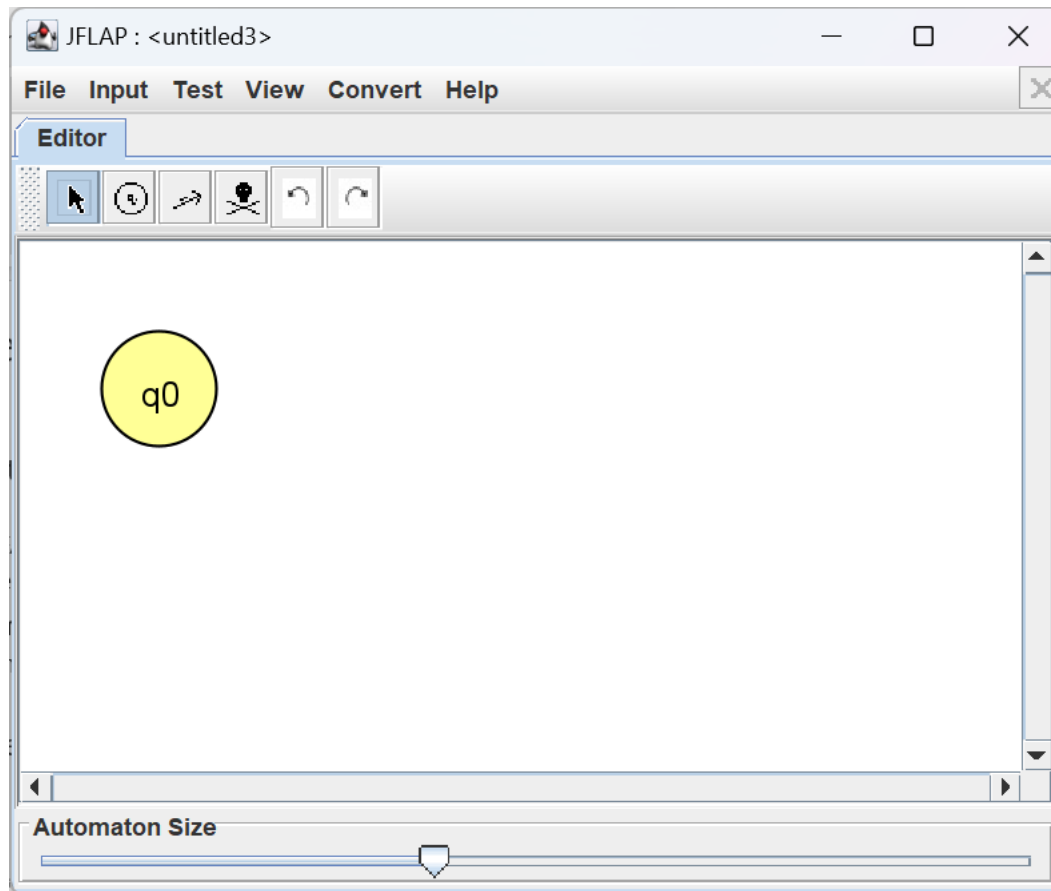
Example: use JFLAP in teaching Automata

- Use JFLAP during lecture to step through an example
 - Building a Finite State Machine and tracing through it



During lecture, step through an example

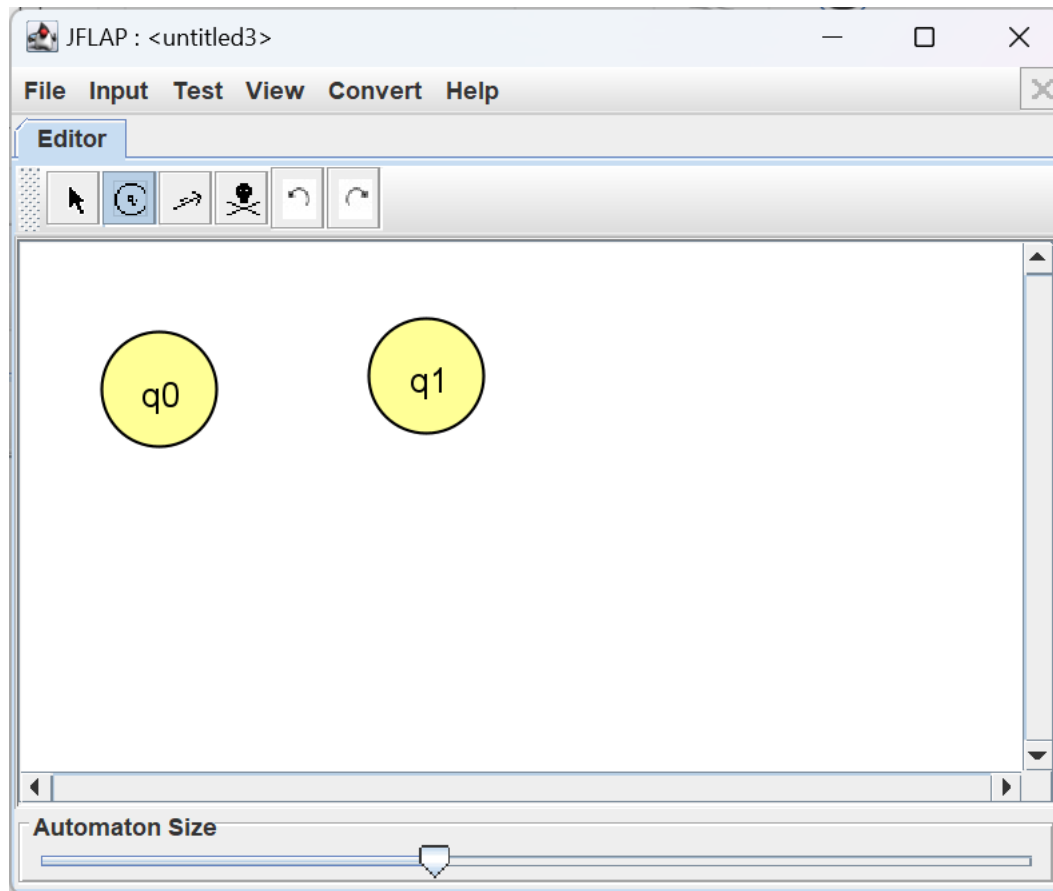
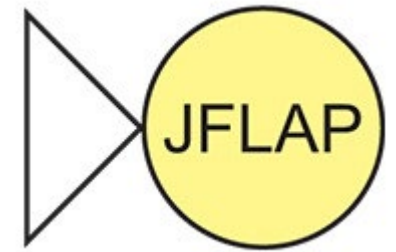
- Building a Finite State Machine



Students tell me
what to do

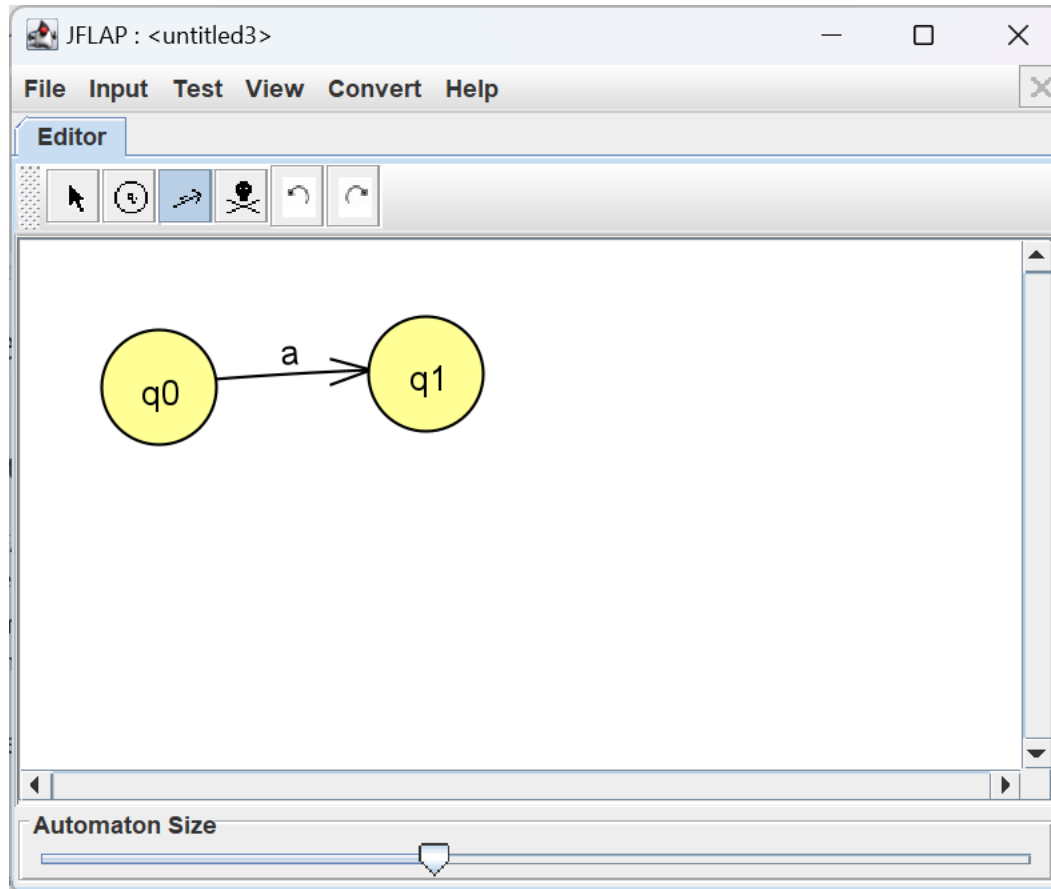
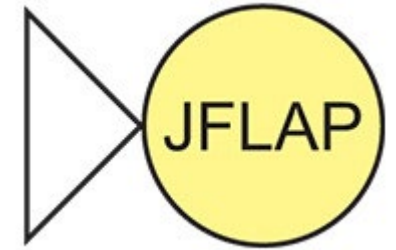
During lecture, step through an example

- Building a Finite State Machine



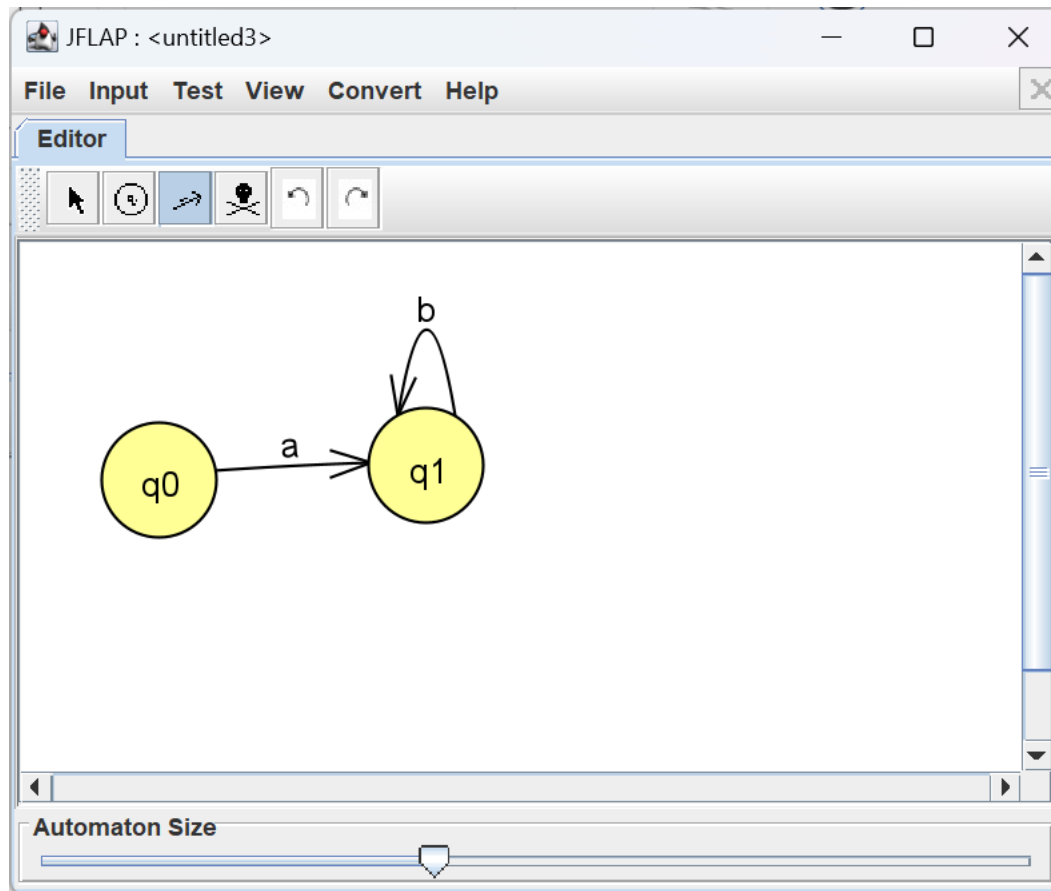
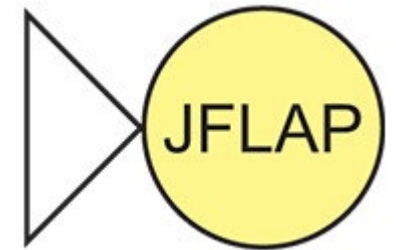
During lecture, step through an example

- Building a Finite State Machine



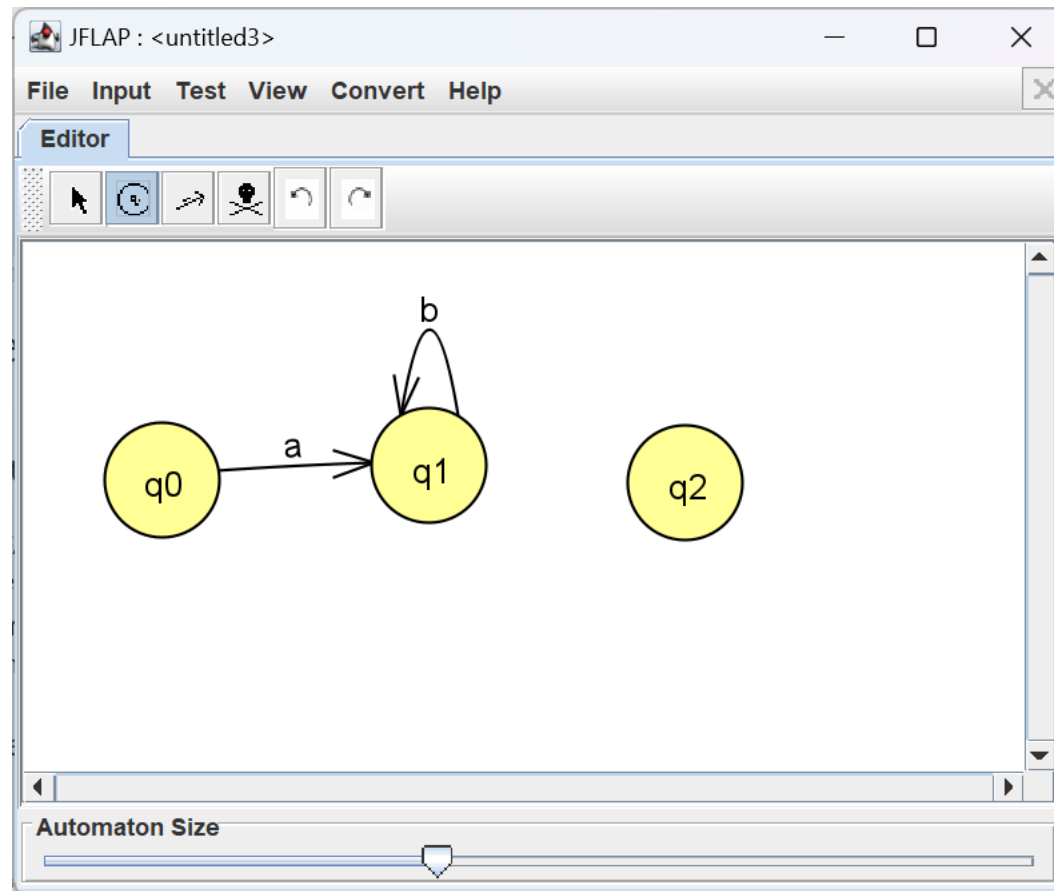
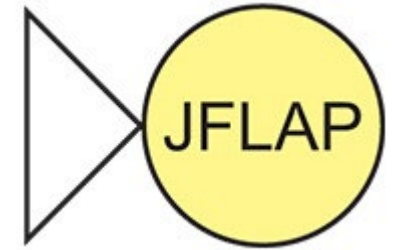
During lecture, step through an example

- Building a Finite State Machine



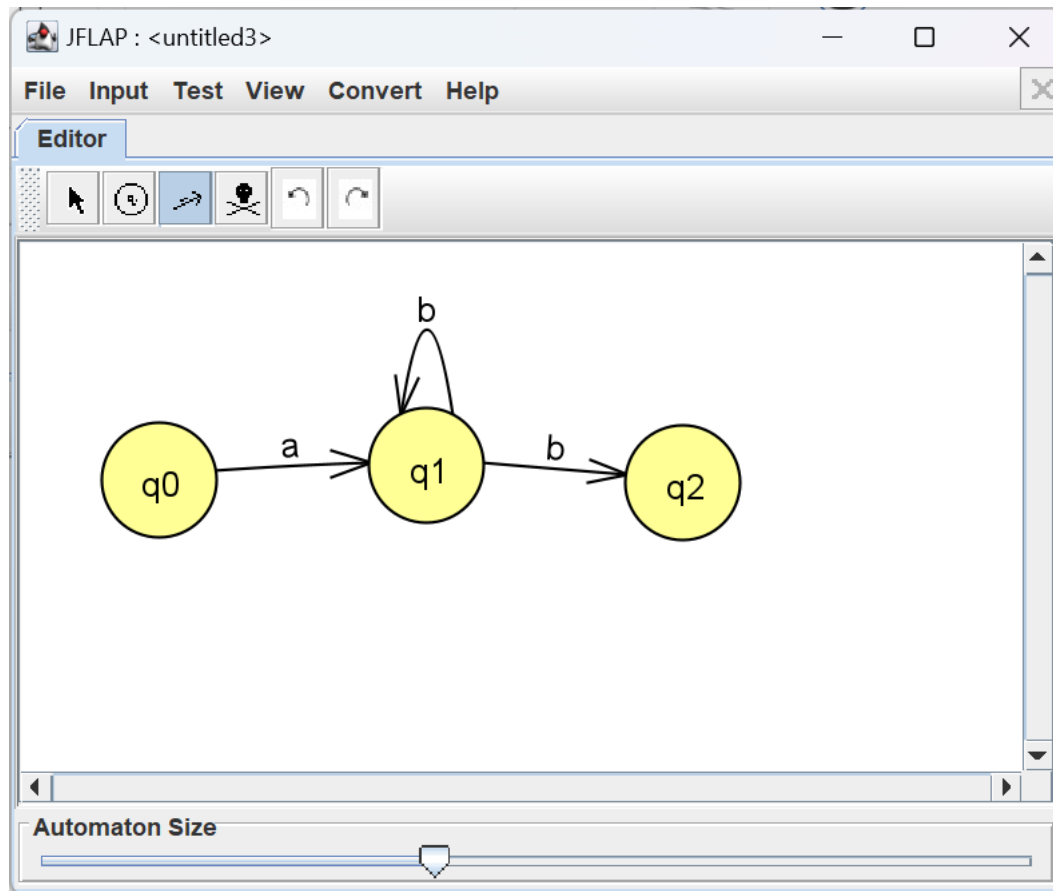
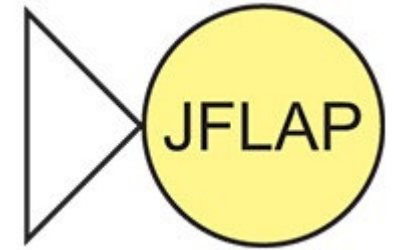
During lecture, step through an example

- Building a Finite State Machine



During lecture, step through an example

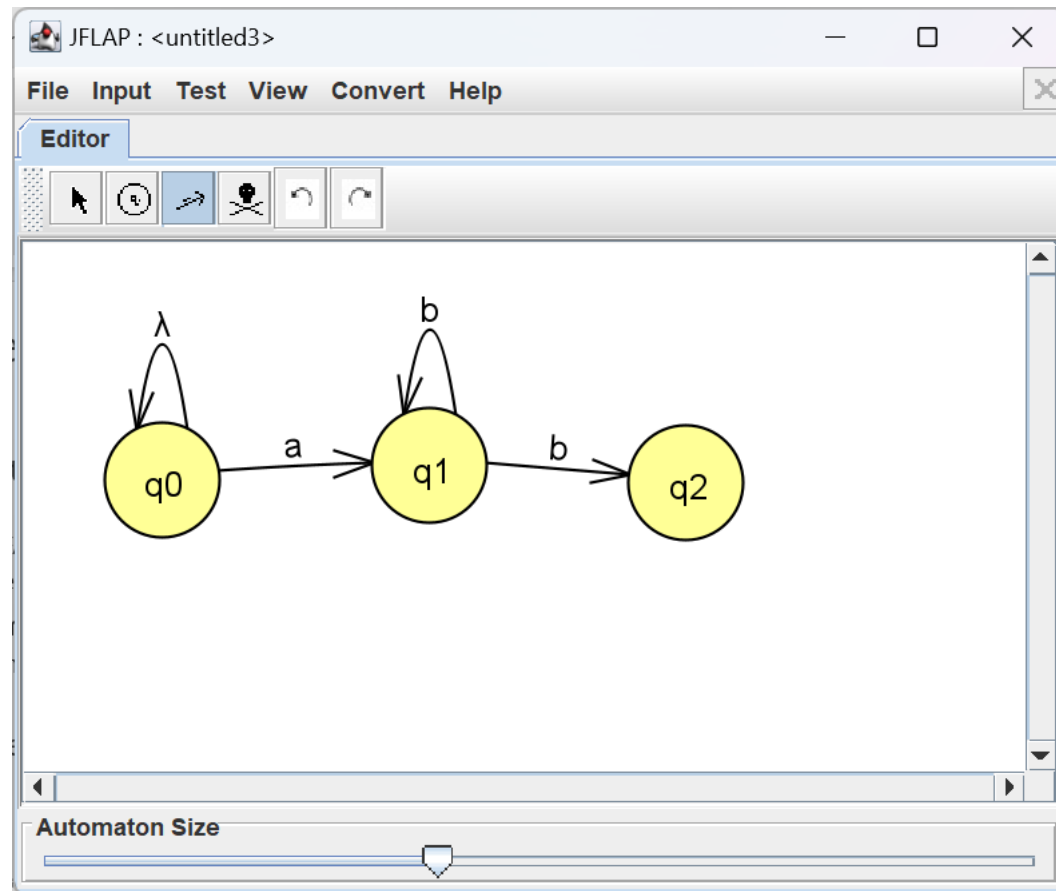
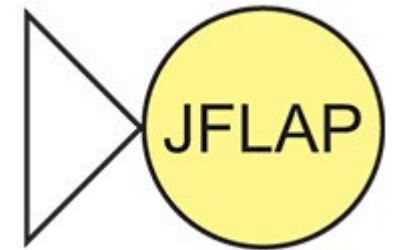
- Building a Finite State Machine



During lecture, step through an example

- Building a Finite State Machine

-

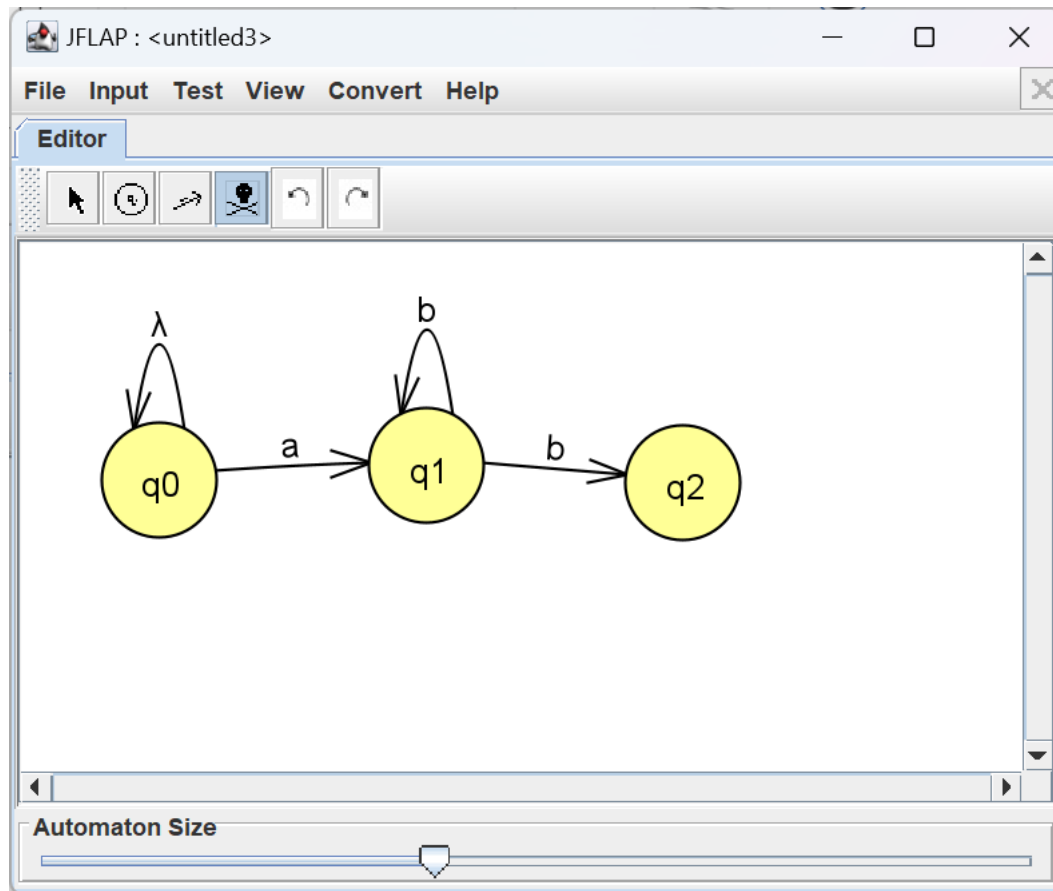
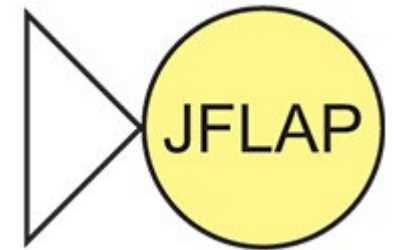


Oops!

During lecture, step through an example

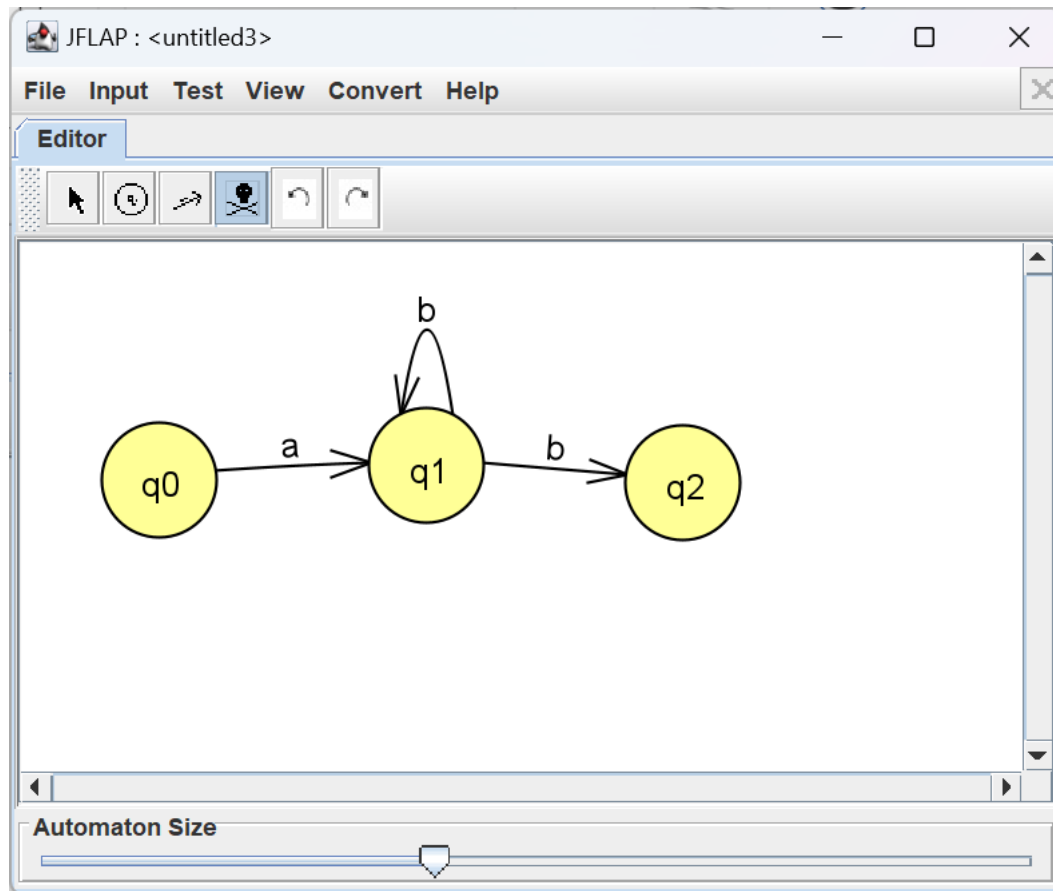
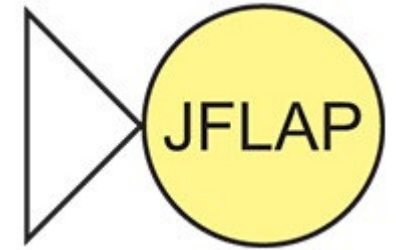
- Building a Finite State Machine

-



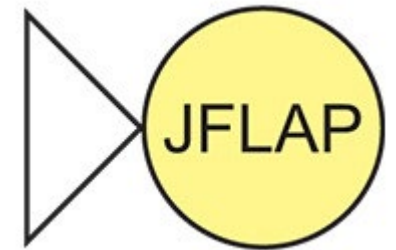
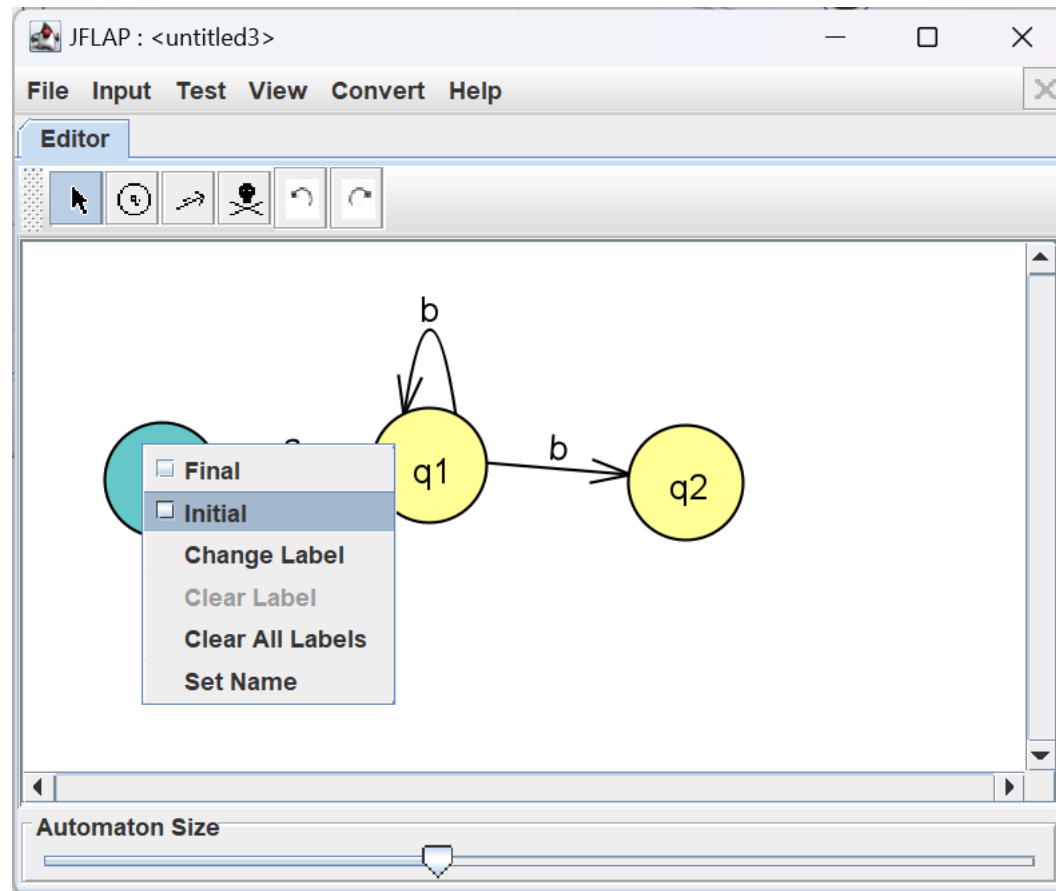
During lecture, step through an example

- Building a Finite State Machine



During lecture, step through an example

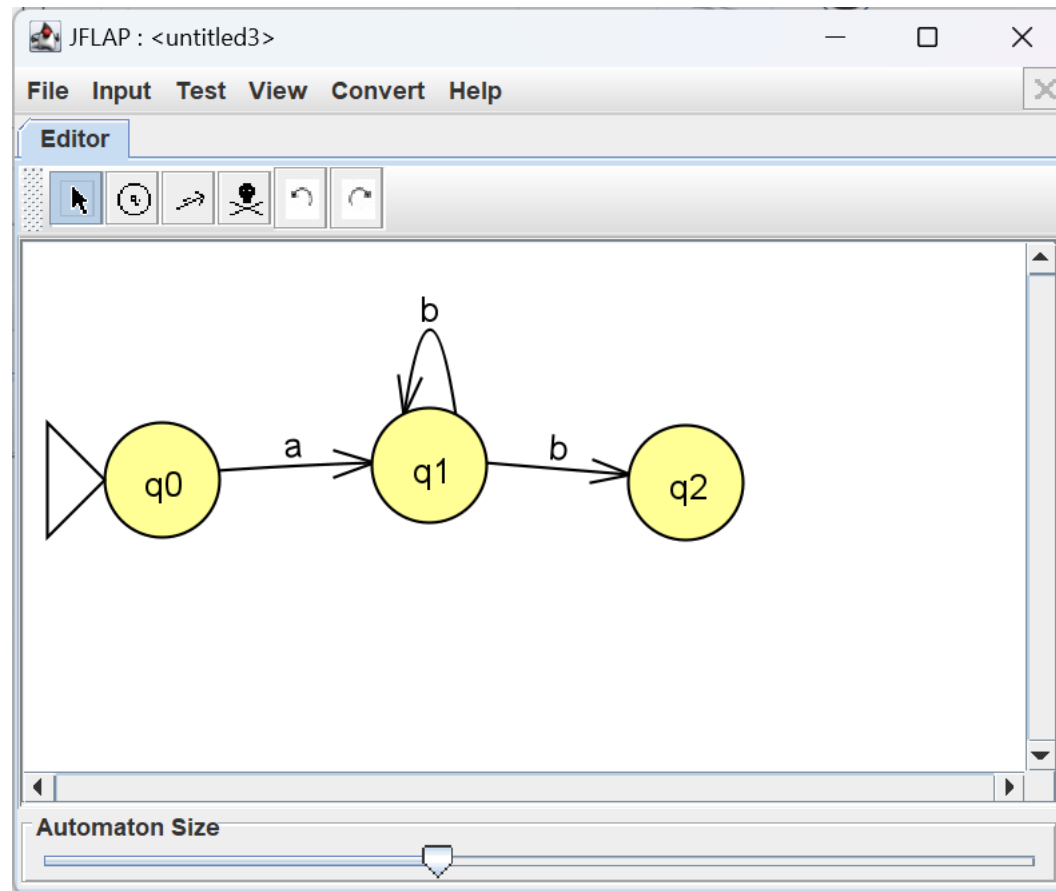
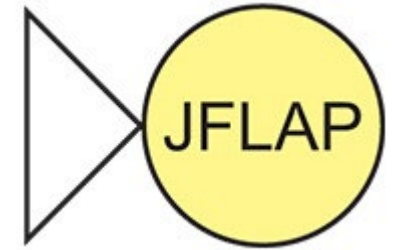
- Building a Finite State Machine



Some things
may not be
obvious

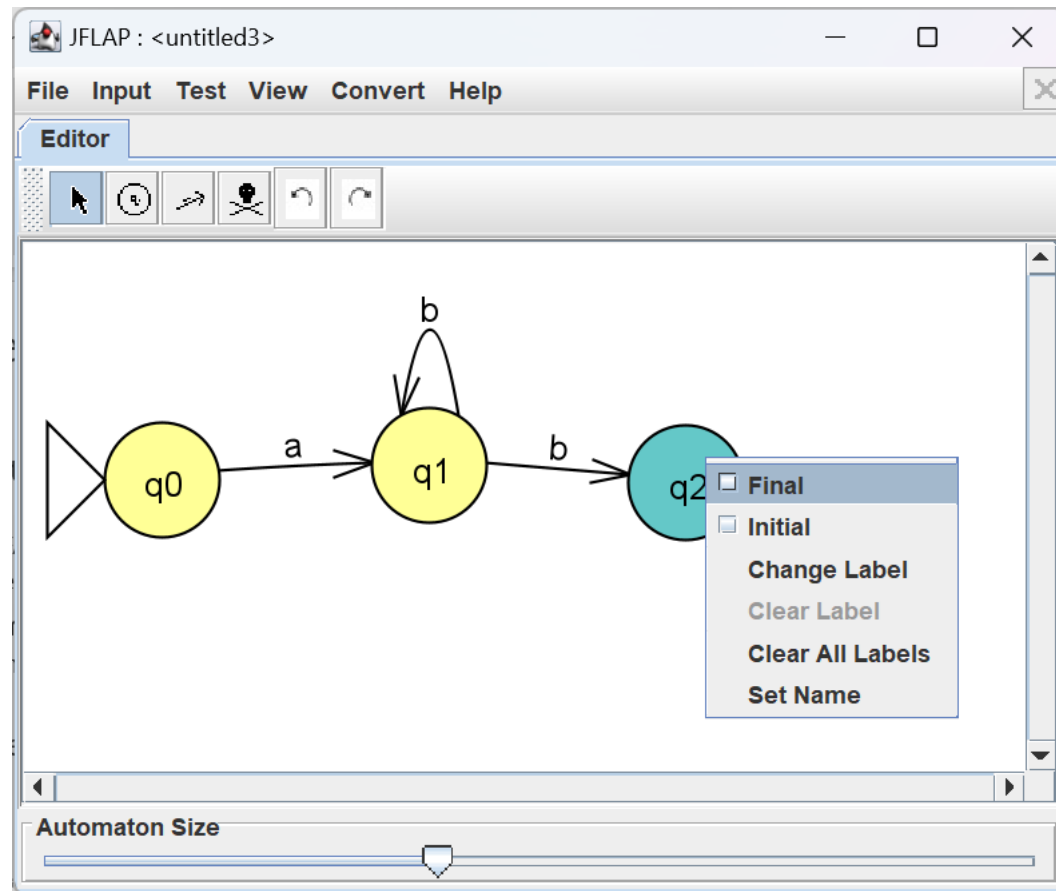
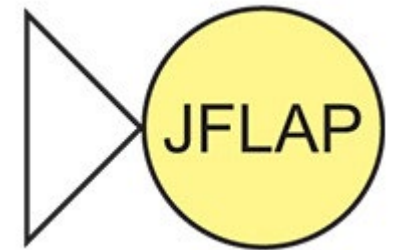
During lecture, step through an example

- Building a Finite State Machine



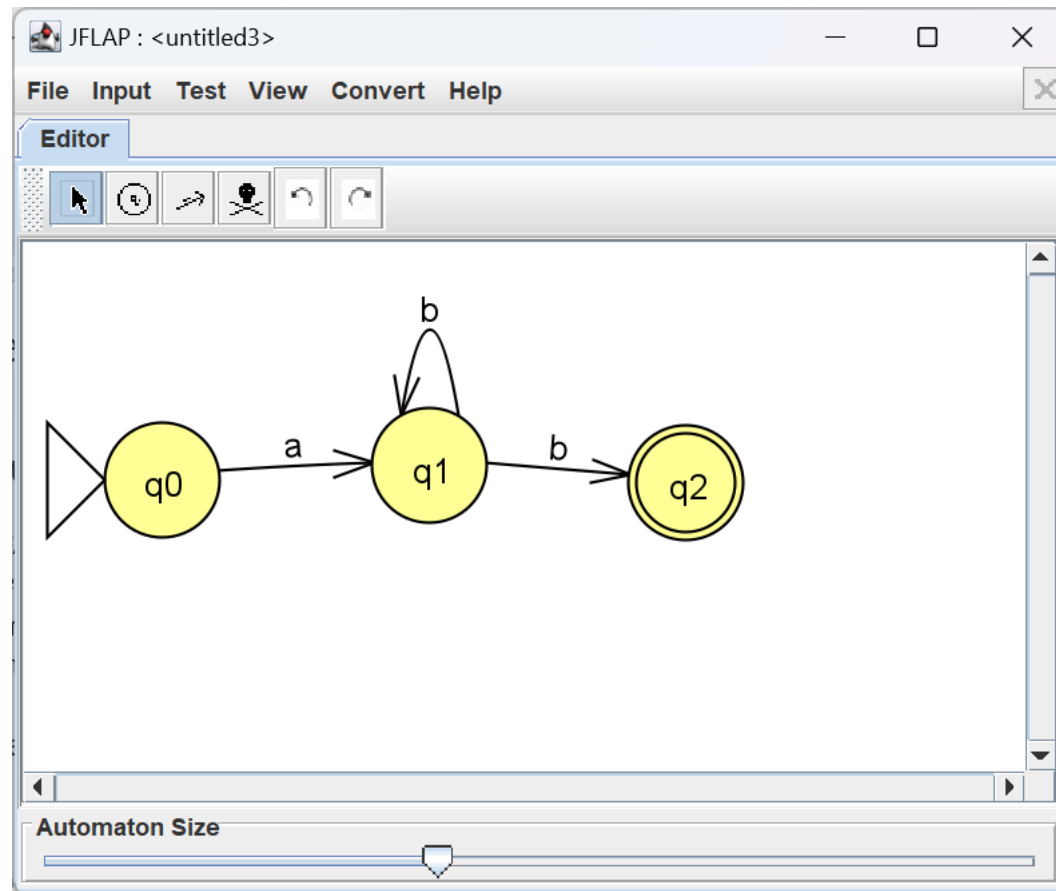
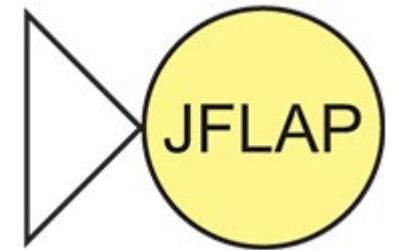
During lecture, step through an example

- Building a Finite State Machine



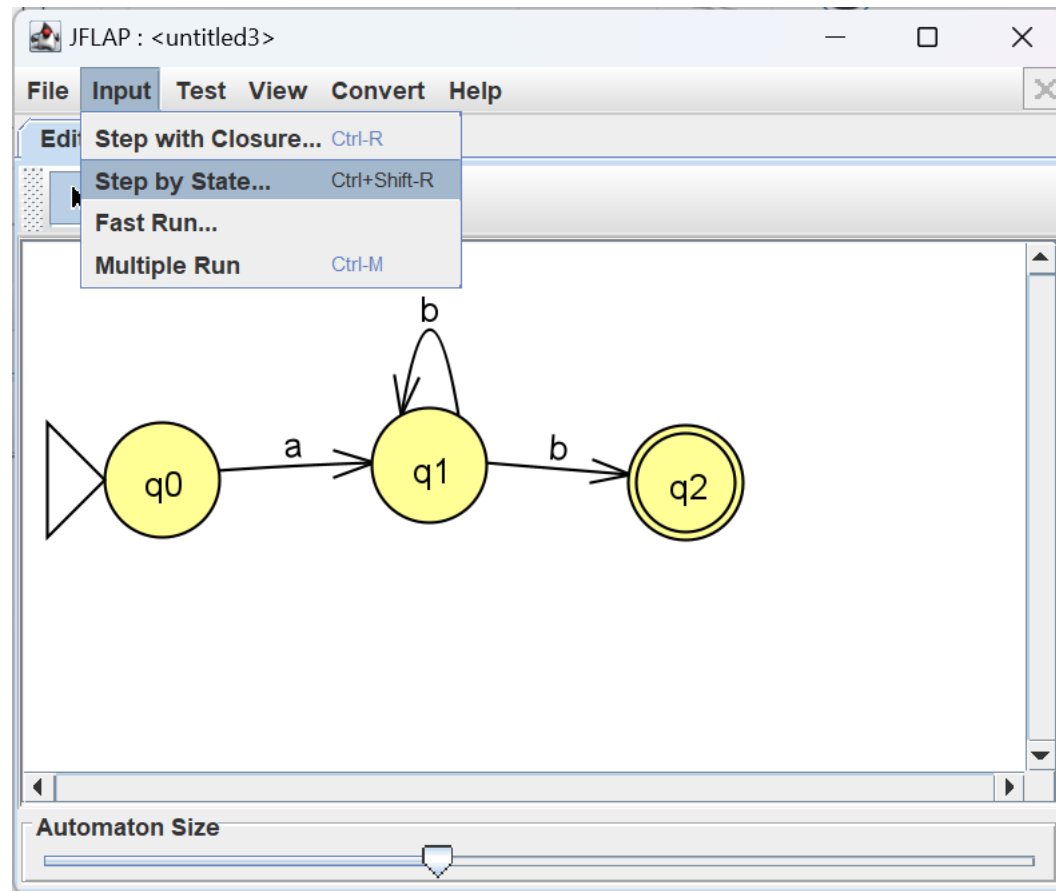
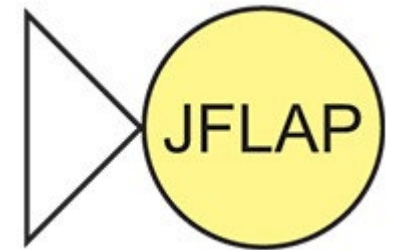
During lecture, step through an example

- Building a Finite State Machine



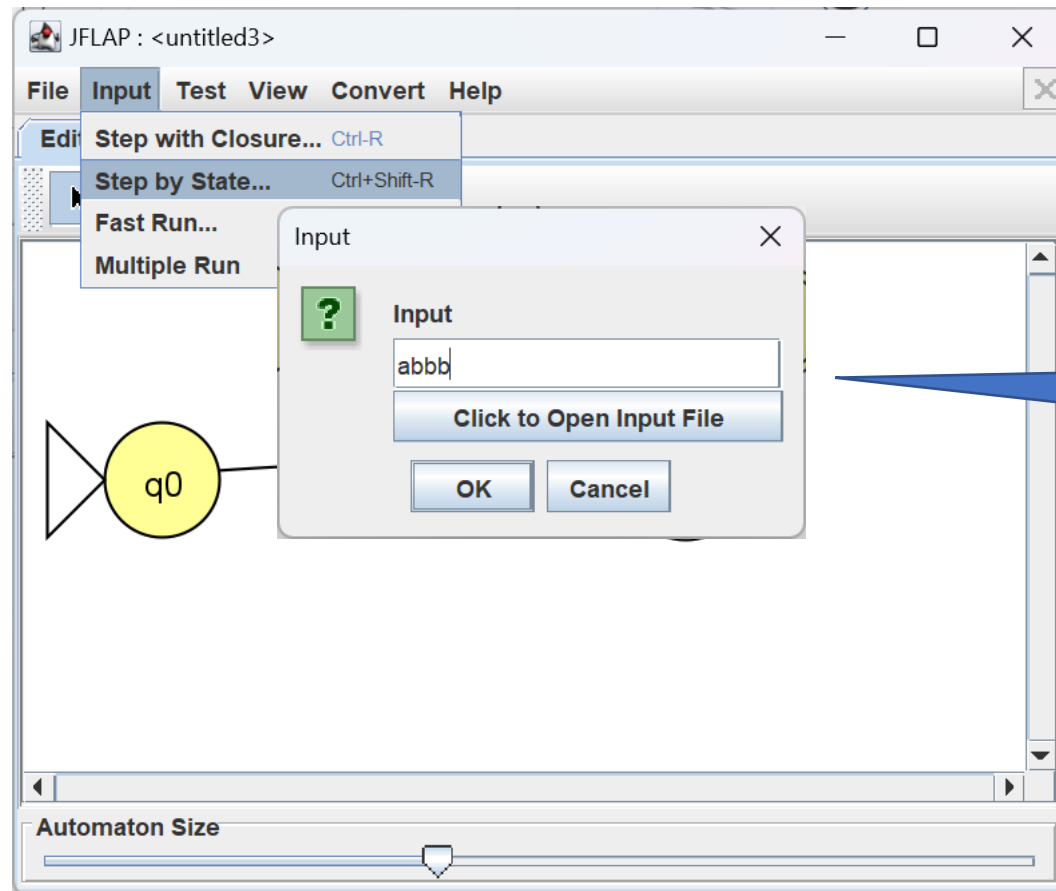
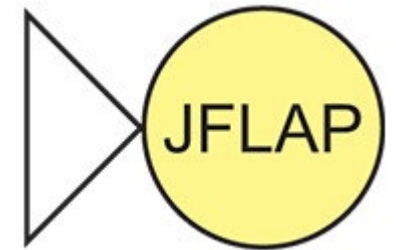
During lecture, step through an example

- Trace an input string



During lecture, step through an example

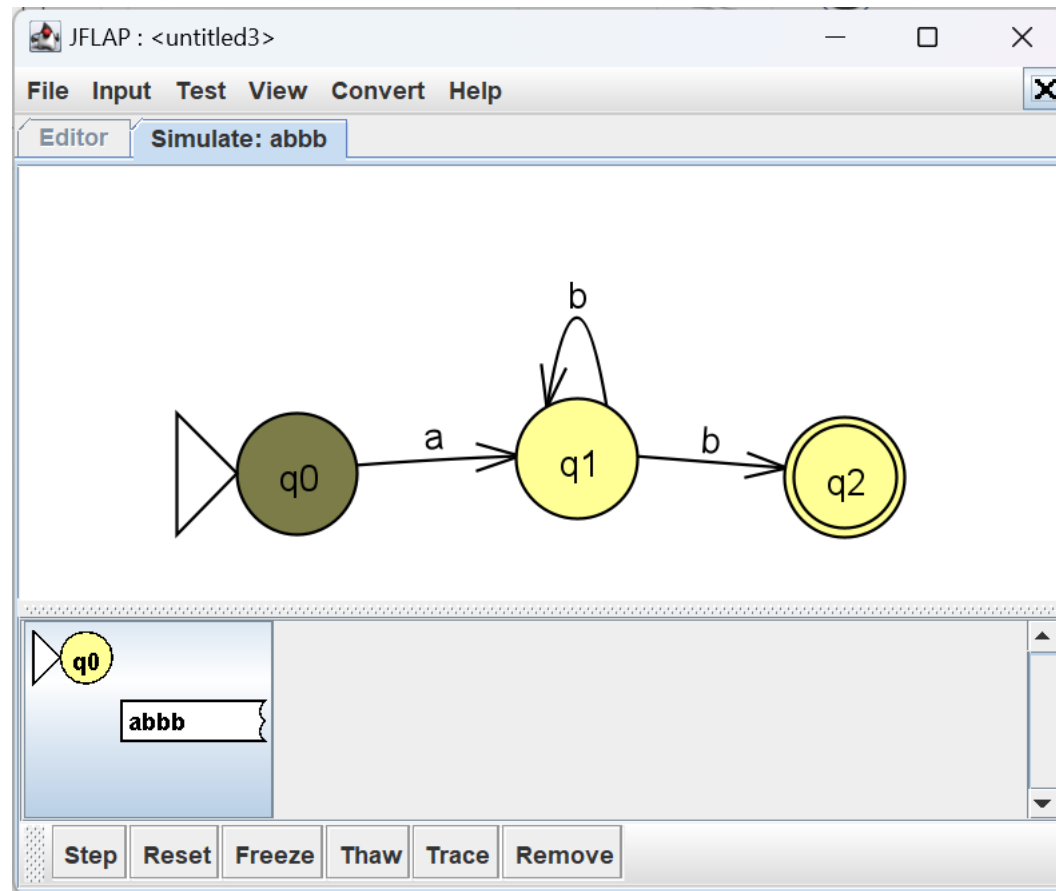
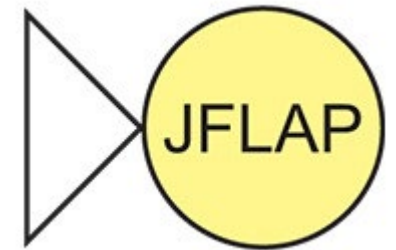
- Trace an input string



A student can
pick the input
string

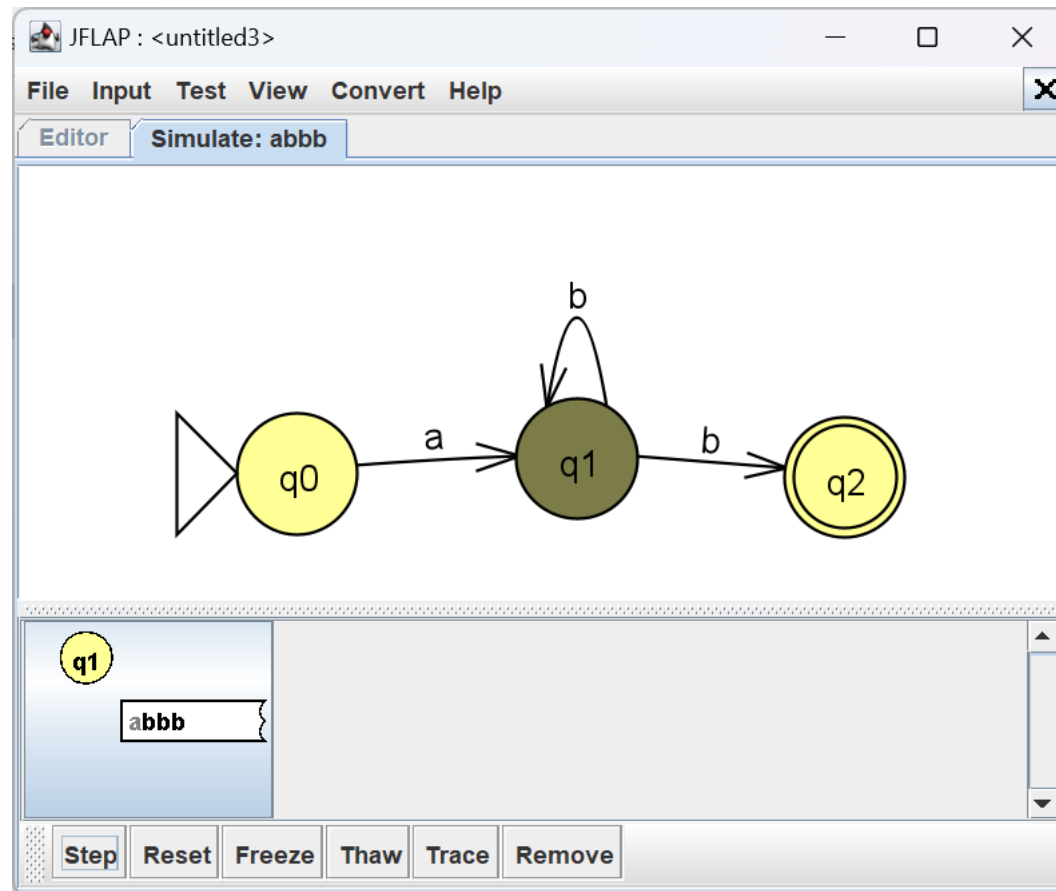
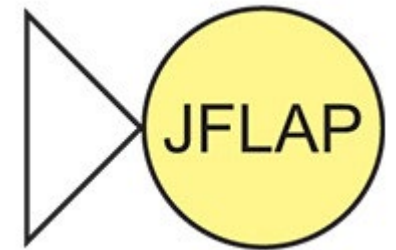
During lecture, step through an example

- Trace an input string



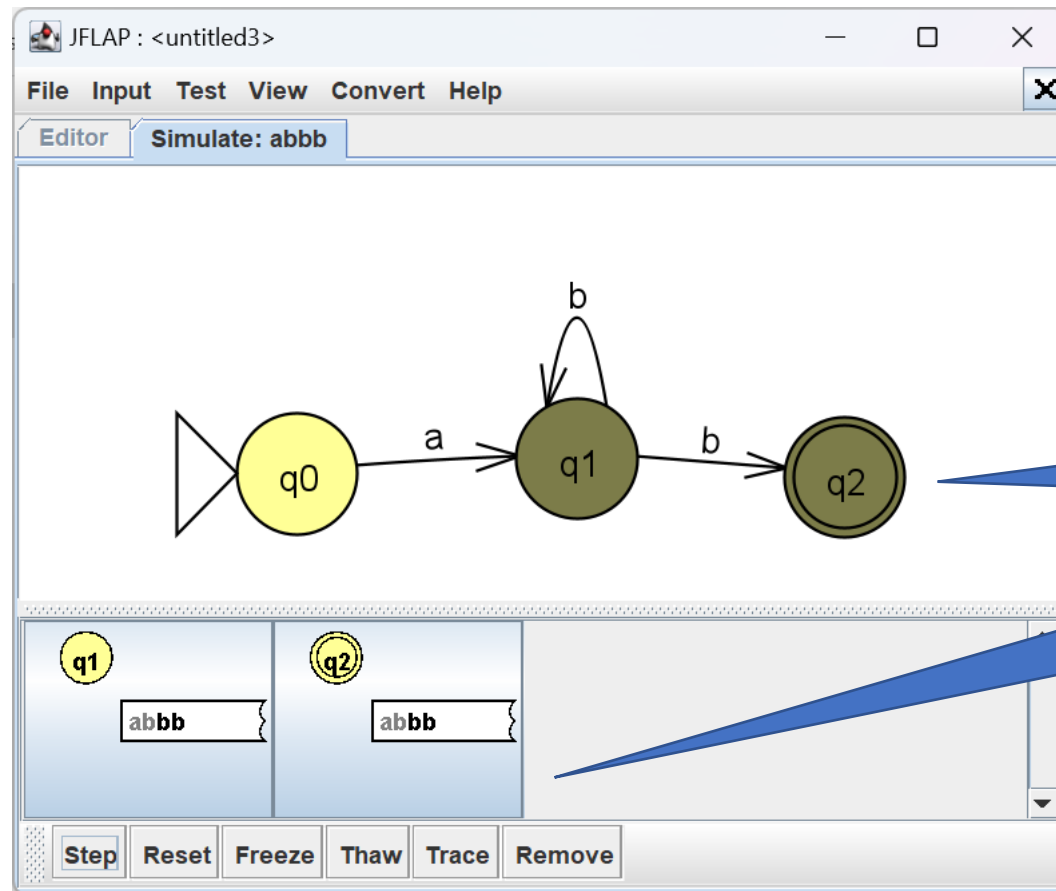
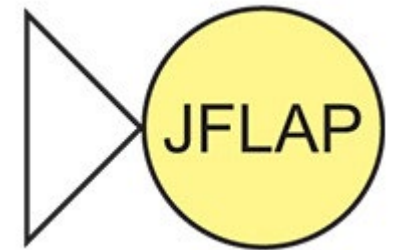
During lecture, step through an example

- Trace an input string



During lecture, step through an example

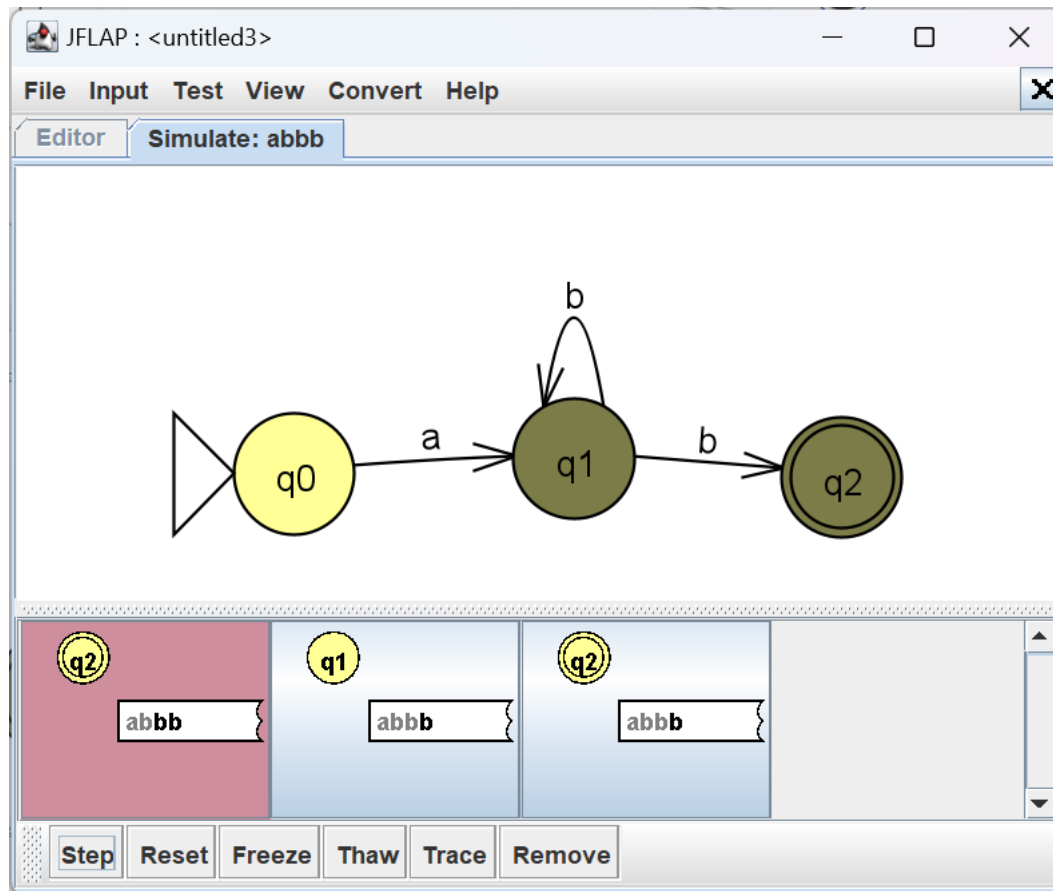
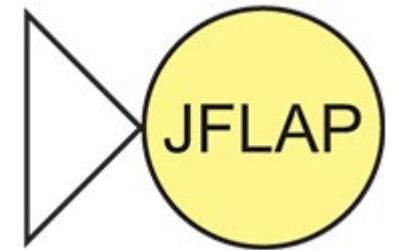
- Trace an input string



Notice it is
Nondeterministic!

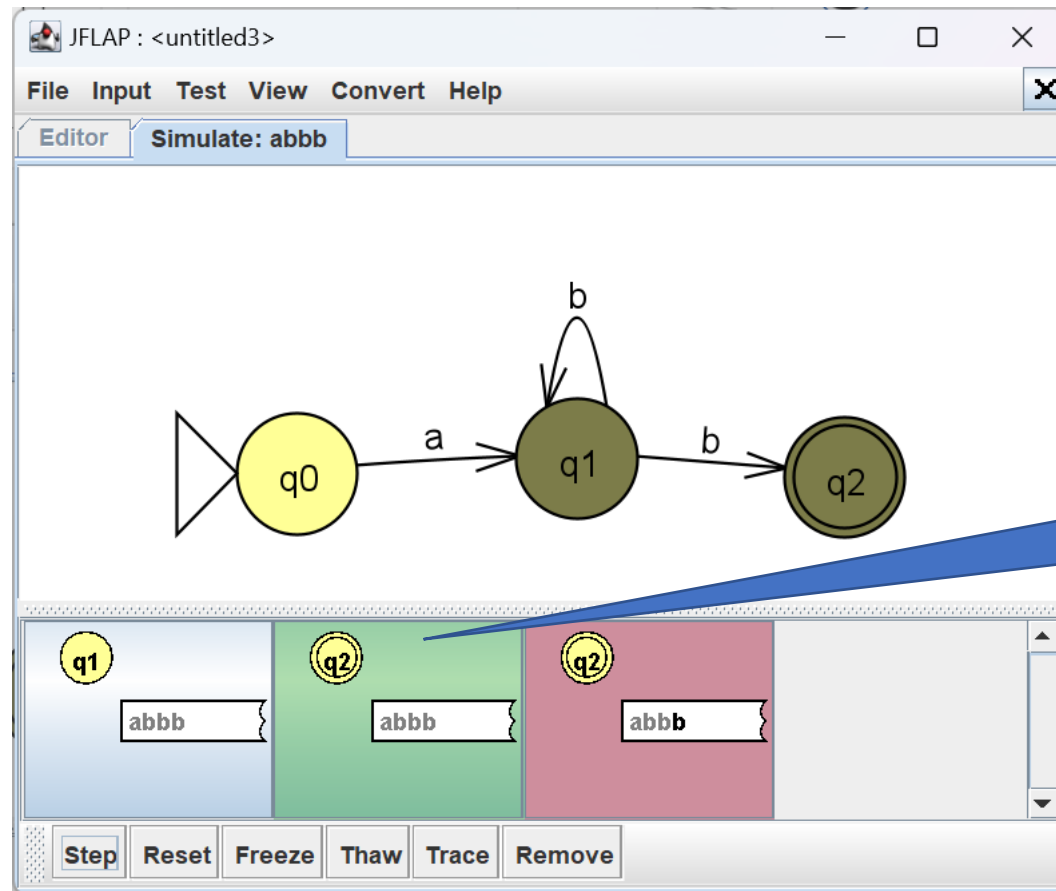
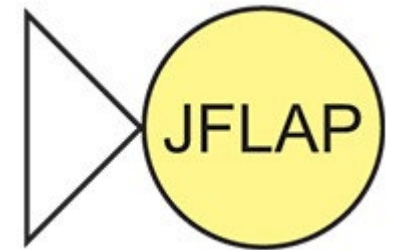
During lecture, step through an example

- Trace an input string



During lecture, step through an example

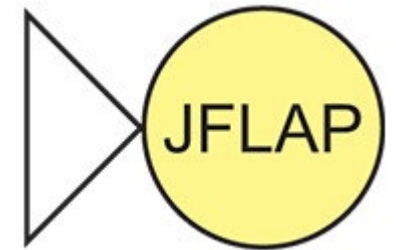
- Trace an input string
-



String
accepted!

Other ways I use JFLAP in teaching

- Step through a proof or example
 - Converting an NFA to DFA
 - Show parsing some strings can take a long time!
 - Pause and ask what will happen next!
- Use JFLAP for homework problems
 - Check your answer on a conversion
 - Build an NPDA for a particular language
 - Compare parsing methods
- Students use for studying for an exam



Trying to solve impossible problems

- Build an NPDA or write a CFG for $L = \{ww \mid w \in \Sigma^*\}$, $\Sigma = \{a, b\}$
 - In class exercise
 - IMPOSSIBLE, NPDA has one stack, This language is NOT context-free
- Asked ChatGPT to solve this problem

RO

Can you write a CFG for the language ww where w is a string of a's and b's



Yes, I can write a CFG for the language ww where w is a string of a's and b's.
Here's one possible grammar:

$S \rightarrow aSa \mid bSb \mid \epsilon$

WRONG!

Use ChatGPT in class to solve problems

$$L = \{ww \mid w \in \Sigma^*\}, \Sigma = \{a, b\}$$

RO

But abbabb should be in this language, and your grammar does not generate that string.



You are correct, my apologies for the oversight in my previous answer. The grammar I provided generates strings of the form ww , but not strings of the form $abbabb$. Here's an updated grammar that generates both:

$$S \rightarrow aSbA \mid bSaA \mid \epsilon$$

$$A \rightarrow aAbA \mid bAbA \mid \epsilon$$

WRONG!

This grammar has two non-terminals, S and A . The start symbol S generates

Use ChatGPT in class to solve problems

$$L = \{ww \mid w \in \Sigma^*\}, \Sigma = \{a, b\}$$

RO

But this grammar generates the string aabbab which is not in the language L



Use ChatGPT in class to solve problems

$$L = \{ww \mid w \in \Sigma^*\}, \Sigma = \{a, b\}$$

RO

But this grammar generates the string aabbab which is not in the language L



You're right, I apologize for the mistake. Here's an updated CFG that should generate only strings of the form ww:

$$S \rightarrow aSb \mid bSa \mid \epsilon$$

WRONG
This is the first wrong grammar again!!

Use ChatGPT in class to solve problems

$$L = \{ww \mid w \in \Sigma^*\}, \Sigma = \{a, b\}$$

Using these productions, we can derive the string abbabb as follows:

$S \rightarrow bSa \rightarrow baba$

But it doesn't derive the string???

But we cannot derive the string aabbab using this CFG.

I hope this updated answer is helpful.

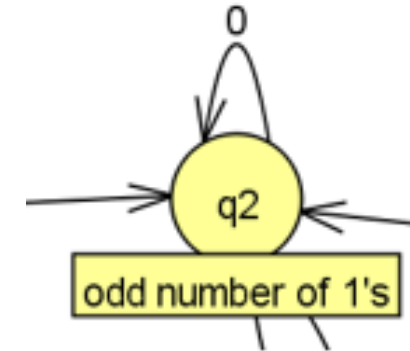
Totally busted!

If you can't find a tool, build one

- A few tips from experience with JFLAP

What can make the tool more useable?

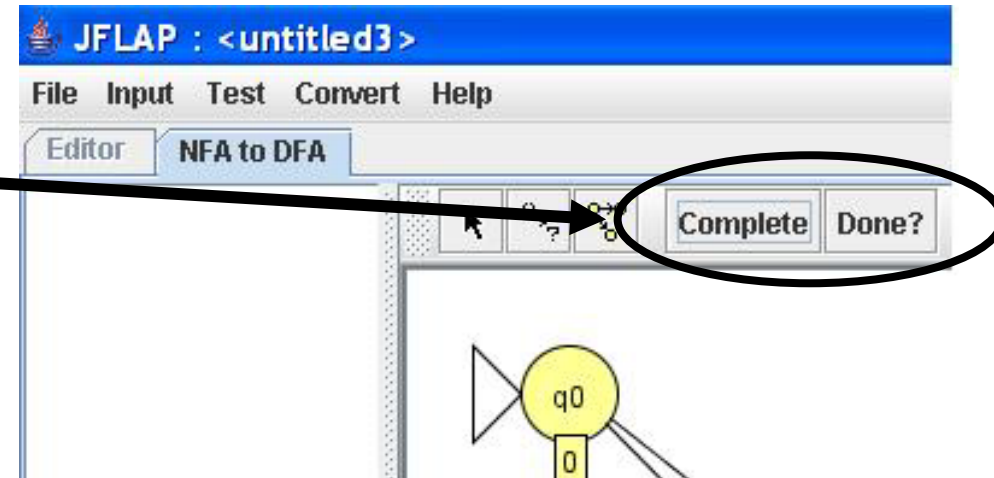
- Annotations on states
- Multiple run window
 - Develop test data
 - Easier for grading
- General definitions
 - FA – recognize one or more symbols
 - NPDA – pop or push 0 or more symbols
- Batch processing



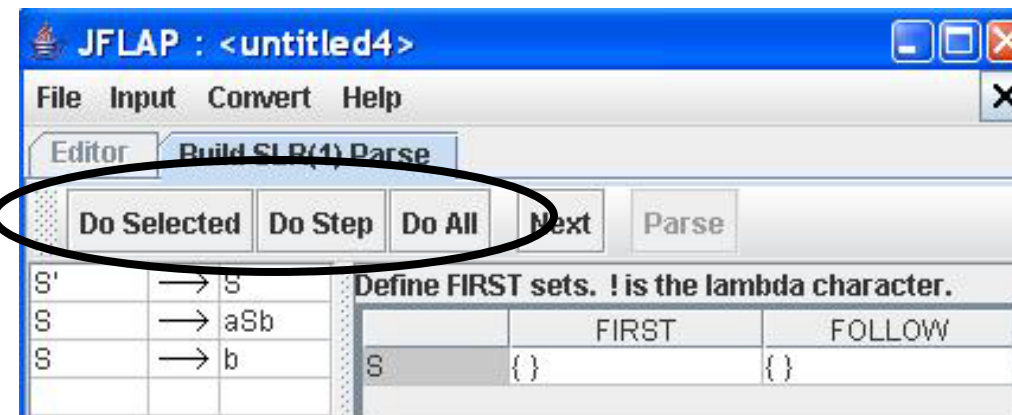
Multiple Run	
Input	Result
a	Accept
aa	Accept
aab	Accept
aabb	Accept
	Reject
acb	Reject
abcb	Accept
abbcc	Accept
abcab	Reject
bc	Reject

In following an algorithm, allow user to proceed on if they got it

- Complete the rest for them



- Complete parts for them

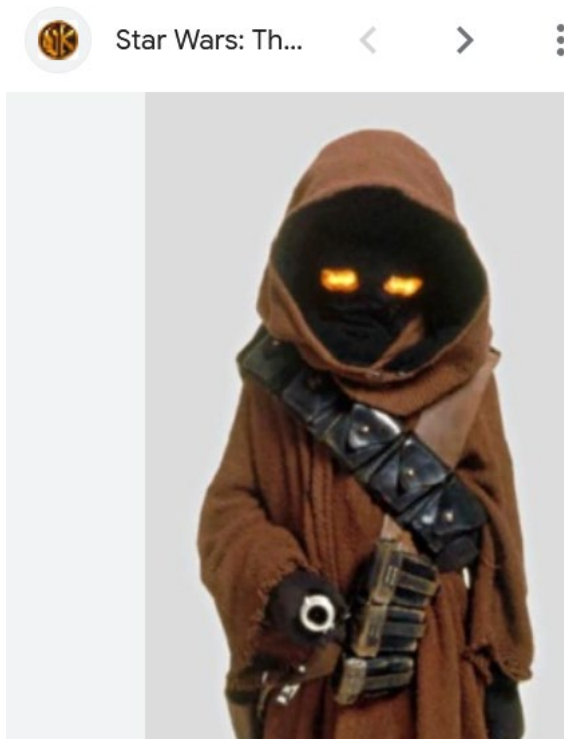


Add Pause/Checkpoint questions

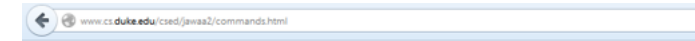
- Allow for pause to think about what comes next
- Undo/go back
- Pop up a quiz question to see if the user understands what he/she just did

Naming your software tool

- What is a good name?
- One tool Jawa



Jawa - Star Wars: The Old Re...



Rectangle

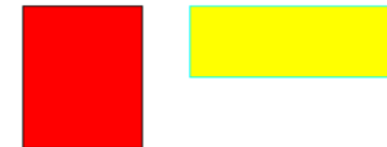
Parameters:

name	a name uniquely identifying this rectangle
x	x-coordinate
y	y-coordinate
width	width of the rectangle
height	height of the rectangle
color	color of the rectangle outline
bkgrd	color of the rectangle's background

Example:

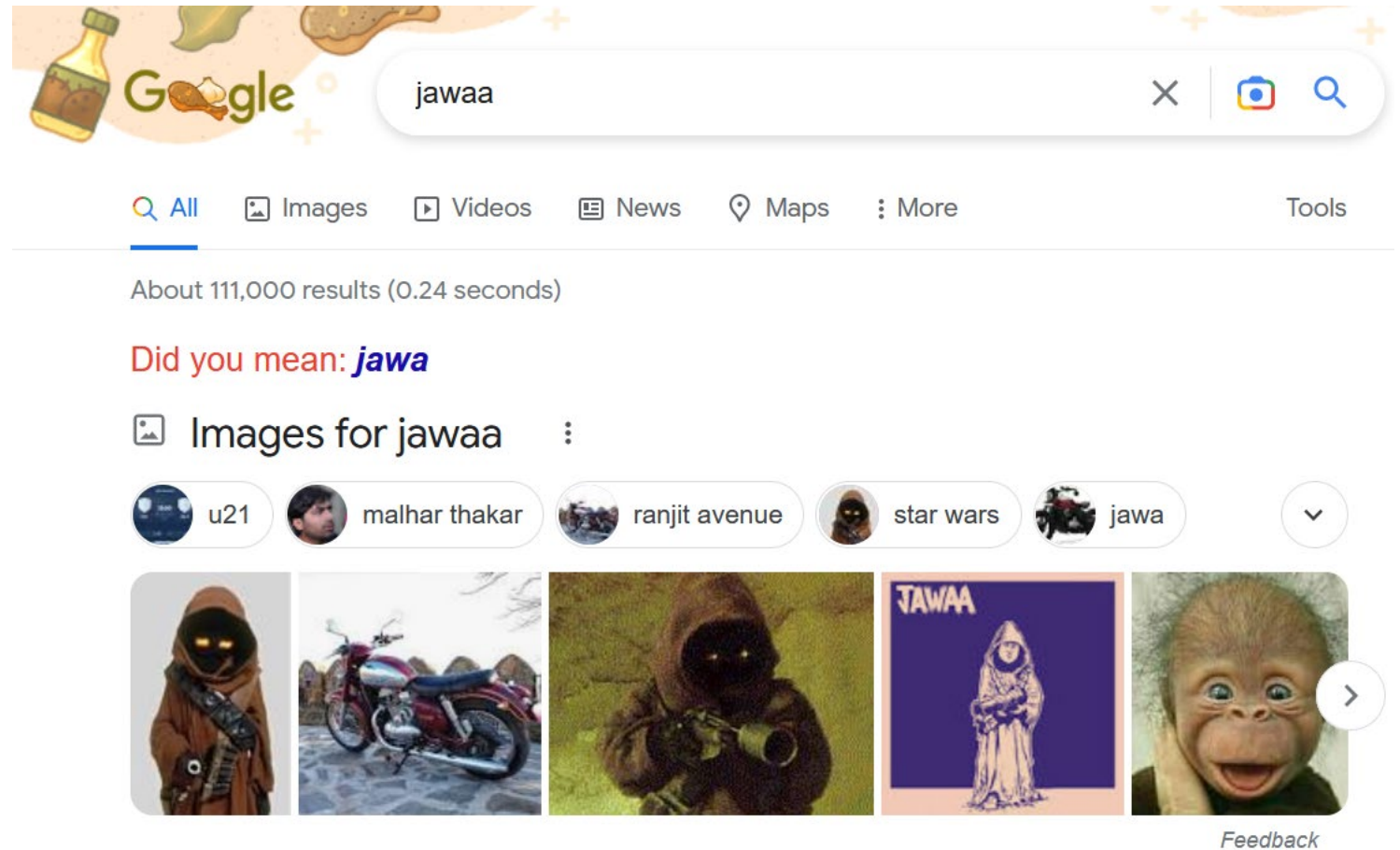
```
rectangle r1 10 20 100 120 black red
rectangle r2 150 20 180 60 cyan yellow
```

The first example will create a rectangle with its upper left corner at (10,20) and its width will be 100 and its height will be 120. The rectangle will be red with a black outline, as shown in the figure below on the left. The second example will create a rectangle with its upper corner at (150,20) and its width will be 30 and its height will be 60. The rectangle will be yellow with a cyan outline. This is shown in the figure below on the right.



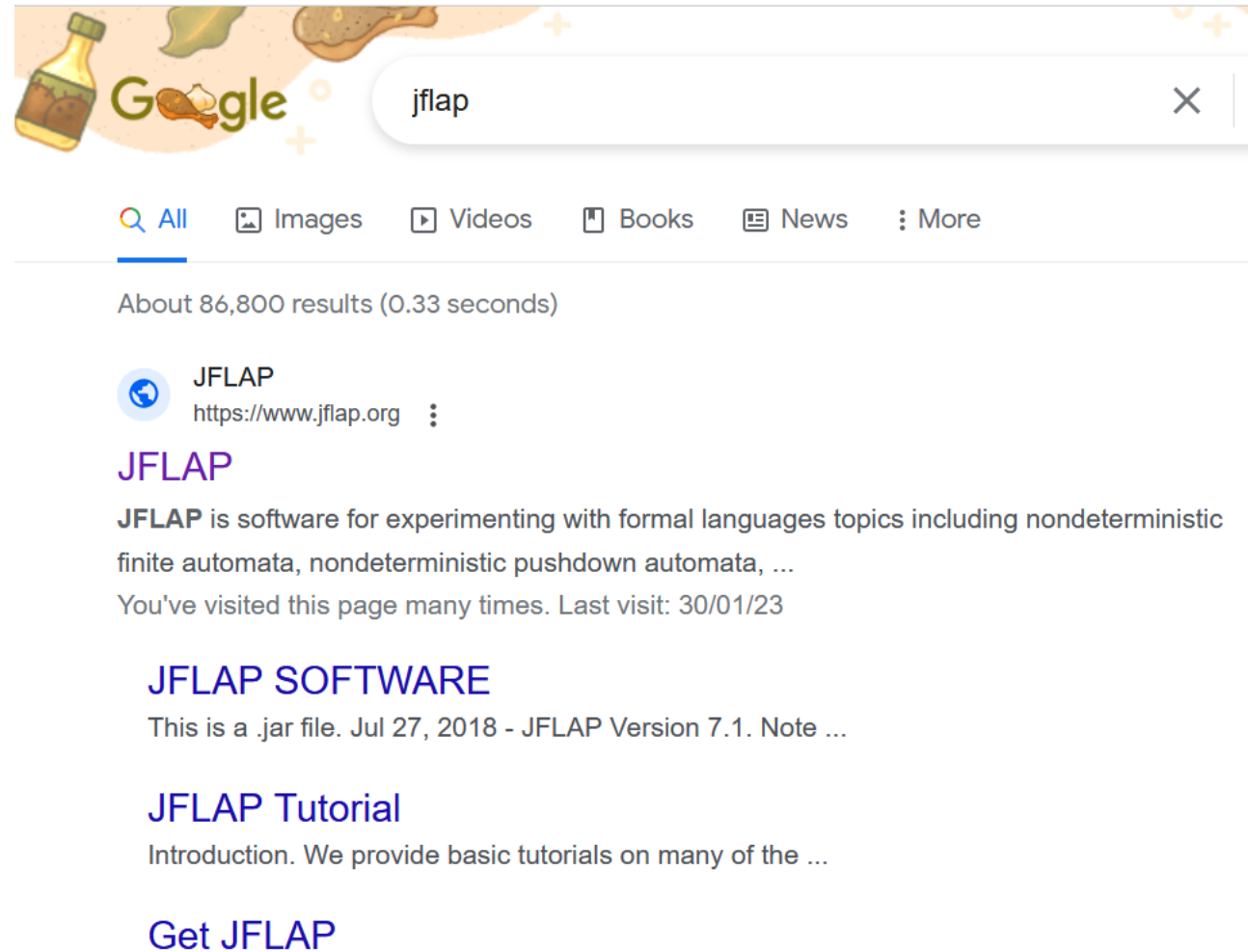
Naming your software tool

- What is a good name?
- One tool Jawa
- Search
 - Mostly star wars!



Naming your software tool

- What is a good name?
- JFLAP originally named FLAP
 - Formal Languages and Automata Package
- Java came along...
 - JFLAP



Naming your software tool

- What is a good name?
- FLAP
 - Formal Languages and Automata Package
- Java came along...
 - JFLAP

Google search results for "jflap".

YouTube
https://www.youtube.com › watch
JFLAP 01 Starting up and first DFA - YouTube
jflap 01 creating a dfa 2018 08 04 17 47 43.
YouTube · RowanRobots · Aug 4, 2018
14:51
9 key moments in this video

unist.hr
https://mapmf.pmfst.unist.hr › JFLAPupute PDF
JFLAP USER MANUAL AND EXERCISES
Written by student Tobias Fransson as a Manual for **JFLAP** simulator use in the course: Formal Languages, Automata and Theory of Computation (FABER). Content.
44 pages

Rose-Hulman
https://www.rose-hulman.edu › class › csse › resources
JFLAP Installation Instructions - Rose-Hulman
JFLAP is a tool developed by Susan Rodger and others, for the visualization of the machines and languages studied in a typical Theory of Computation course.

5) Use Applications to show WHY!

- CS 1 - Build a recommender system to recommend books, movies and restaurants
 - Dictionaries, parallel lists, etc.

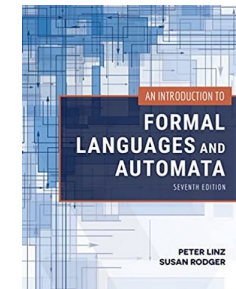
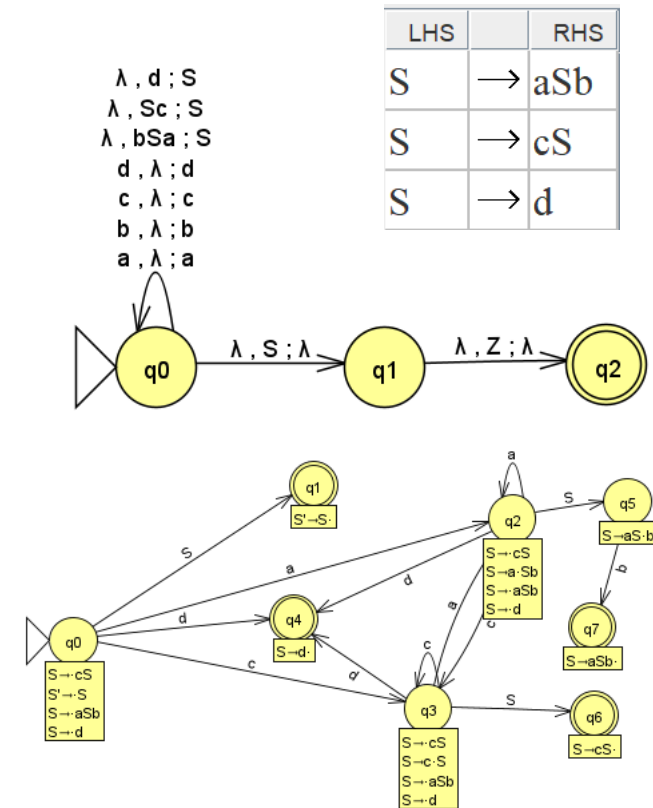


Use Applications to show WHY!

- Automata Theory and Formal Languages
 - Why are we learning this?
- Relate it to what they know
 - They have all had errors when compiling their program
 - **ERROR ON LINE 63**

Use Applications to show WHY!

- Write an interpreter for a small language
 - Write a CFG to define the programming language
 - LR Parsing – NPDA that models the LR parsing process
 - Build an LR Parse Table – build a DFA with states that have meaning about what is on the stack so far
- Spent summer 2021 (pandemic) writing 3 chapters on parsing to add applications section to Formal Languages and Automata Textbook



6) Make it Hands on and Fun!

- Explore different Sorting algorithms
- Sort with cards!



Make it Hands on and Fun!

- Explore different Sorting algorithms
- Sort with cards!
- Use Big Cards!
 - Height: 14.5 inches = 36.3 cm



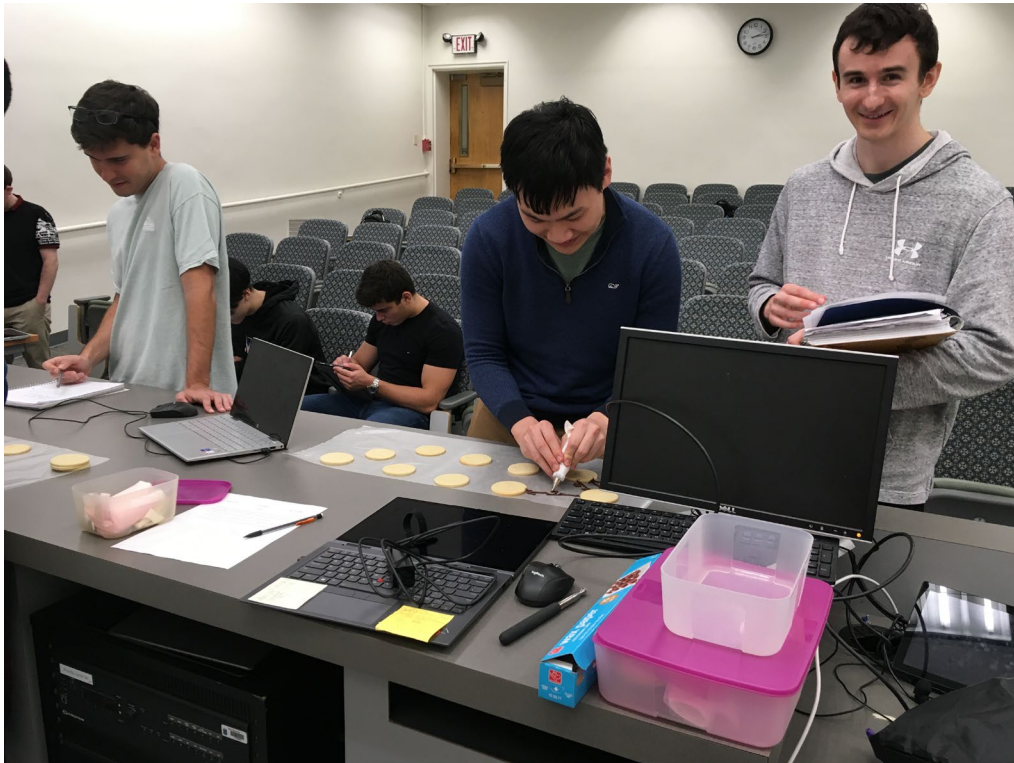
Make it Hands on and Fun!

- Explore different Sorting algorithms
- Sort with cards!
- Use Big Cards!
 - Height: 14.5 inches = 36.3 cm
- Sort with cookies!



Make it Hands on and Fun!

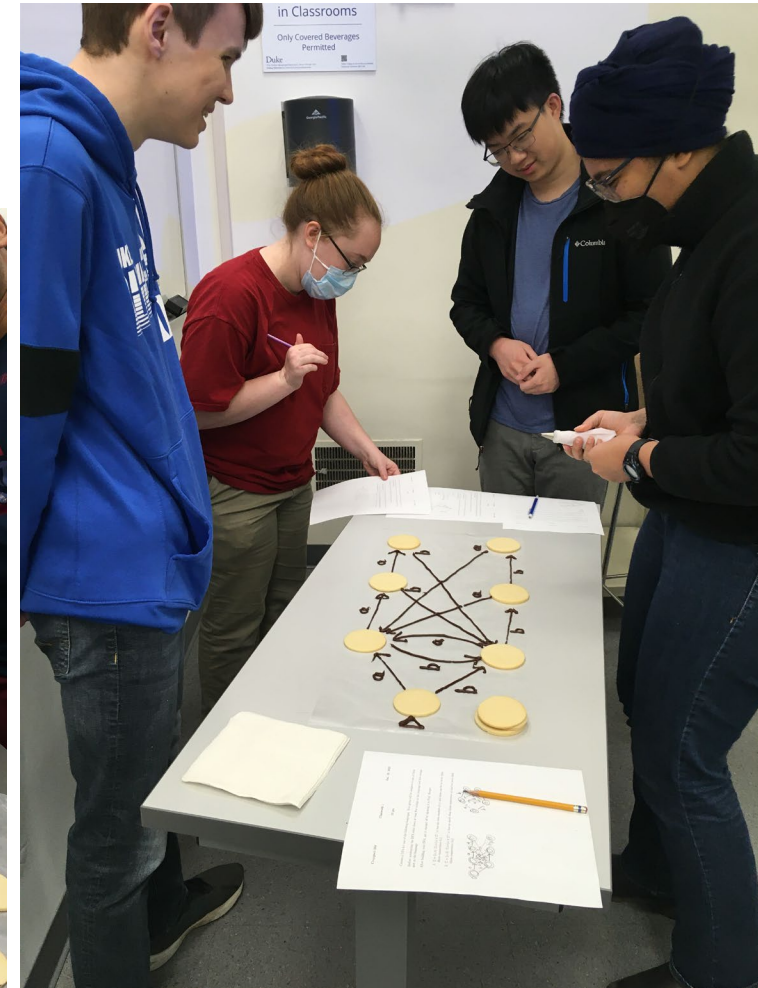
- Students build DFA with cookies and icing



March 17, 2023



SIGCSE 2023



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Or just Surprise them with a treat!

- Fall 2022 CompSci 101 Python Cookies



March 17, 2023



SIGCSE 2023



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April 2020 – Make your own cookies!

<https://bit.ly/makeJavaCookies>

MAKING JAVA COOKIES

by
Susan Rodger



March 17, 2023

SIGCSE 2023

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7) Make change happen!

- Change your lecture
 - Borrow ideas from others!
- Change lives
 - Mentor students, junior faculty, staff
 - Mentor anyone you can!
- Attend a Mentoring workshop
 - Or encourage others to
- Change the culture in Computing

CRA Leadership Academy for Faculty



Early & Mid-Career Mentoring Workshop

2023 GRAD COHORT



Nicki Washington Shani Daily



Cultural Competence in Computing (3C) Fellows

Questions?



Python Logo cookies



Alice
cookies

