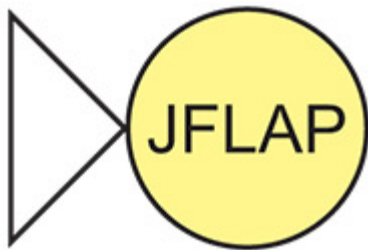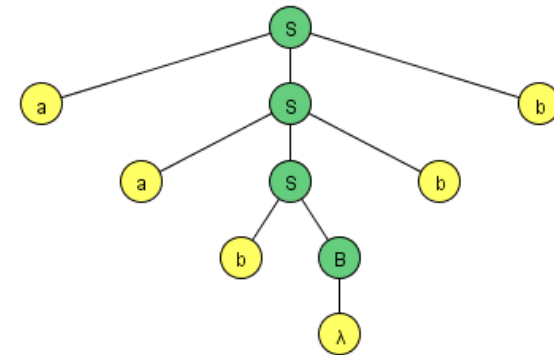# Changes to JFLAP to Increase Its Use in Courses

Susan H. Rodger
Duke University
rodger@cs.duke.edu

ITiCSE 2011
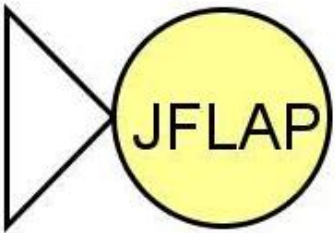Darmstadt, Germany
June 29, 2011

# Co-Authors

Henry Qin

Jonathan Su

Overview of JFLAP

- **J**ava **F**ormal **L**anguages and **A**utomata **P**ackage
- Instructional tool to learn concepts of Formal Languages and Automata Theory
- Topics:
  - Regular Languages
  - Context-Free Languages
  - Recursively Enumerable Languages
  - Lsystems
- With JFLAP your creations come to life!

JFLAP – Regular Languages

- Create
  - DFA and NFA
  - Moore and Mealy
  - regular grammar
  - regular expression
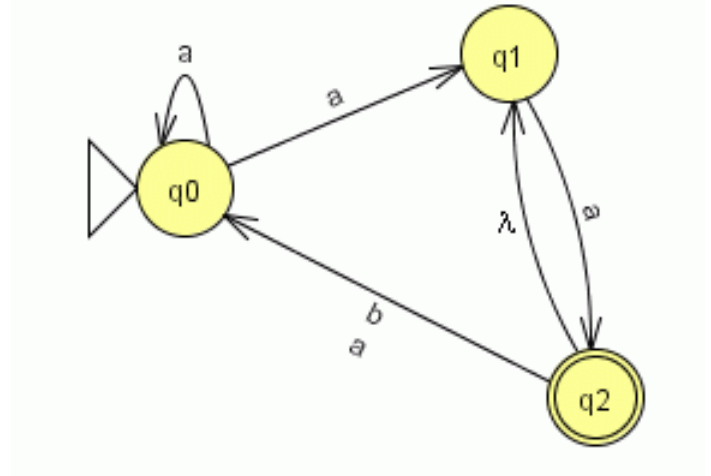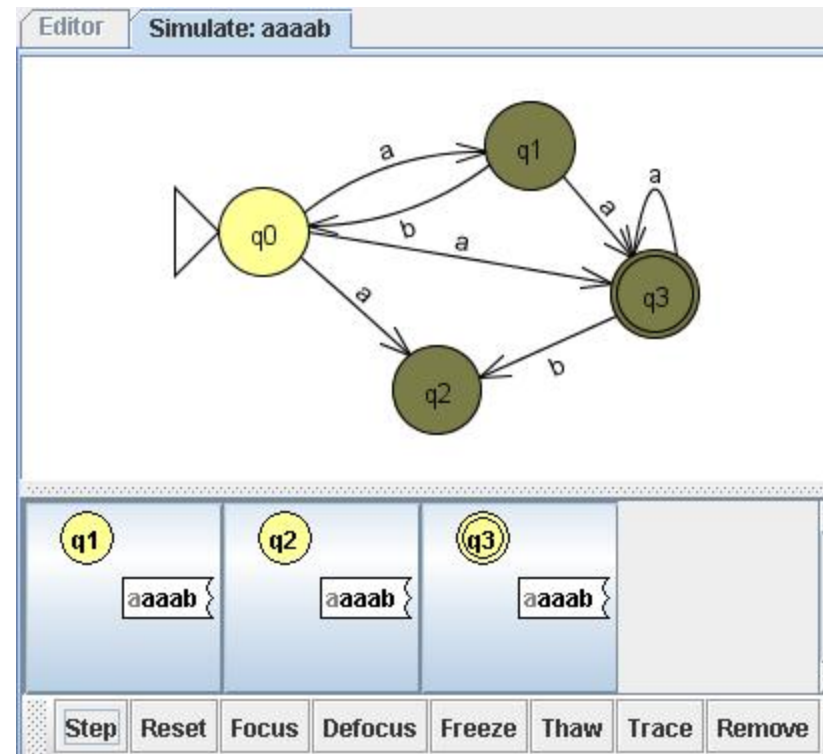
- Conversions
  - NFA to DFA to minimal DFA
  - NFA ←→ regular expression
  - NFA ←→ regular grammar
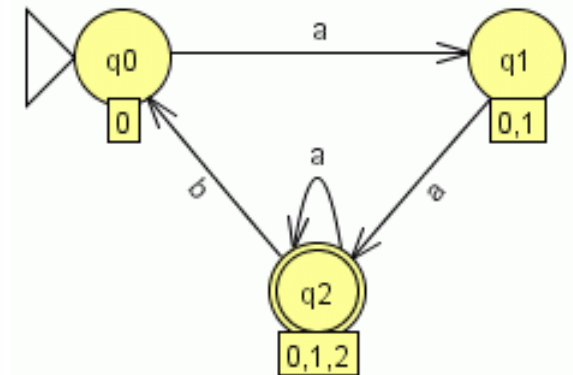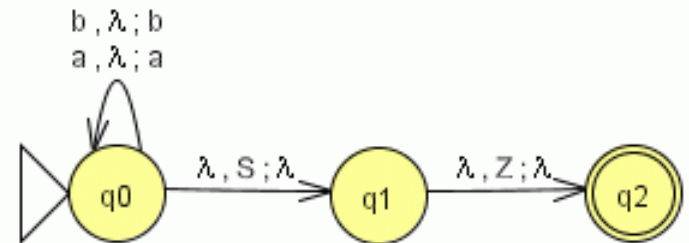
JFLAP – Regular languages (more)

- Simulate DFA and NFA
  - Step with Closure or Step by State
  - Fast Run
  - Multiple Run
- Combine two DFA
- Compare Equivalence
- Brute Force Parser
- Pumping Lemma
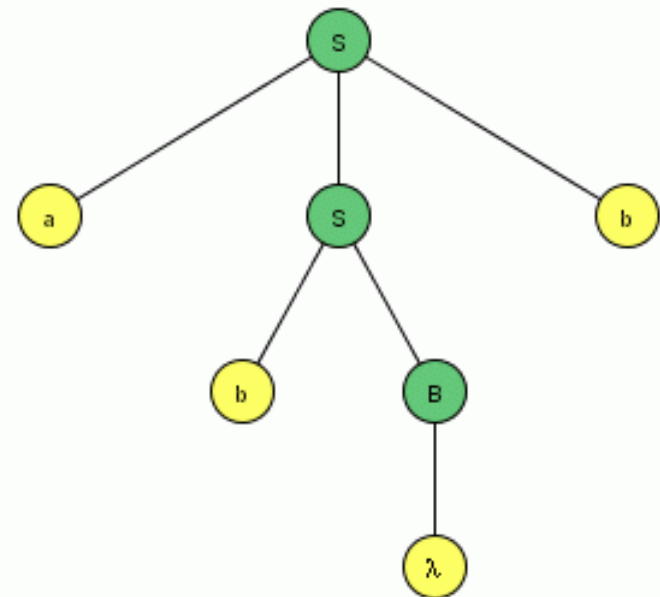
JFLAP – Context-free Languages

- Create
  - Nondeterministic PDA
  - Context-free grammar
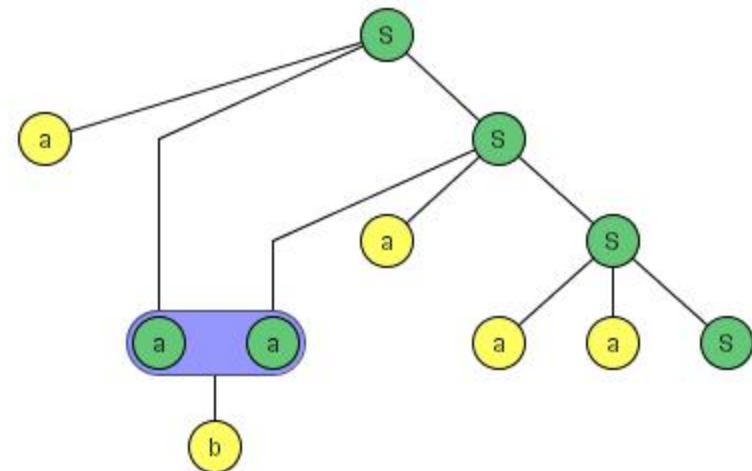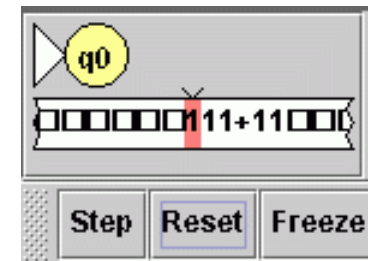 - Pumping Lemma

- Transform
  - PDA $\rightarrow$ CFG
  - CFG $\rightarrow$ PDA (LL & SLR parser)
  - CFG $\rightarrow$ CNF
  - CFG $\rightarrow$ Parse table (LL and SLR)
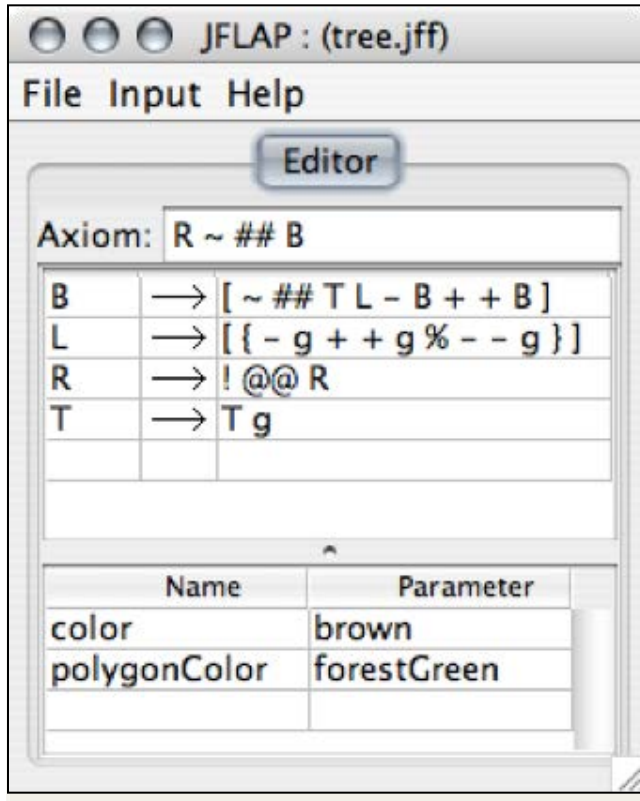 - CFG $\rightarrow$ Brute Force Parser

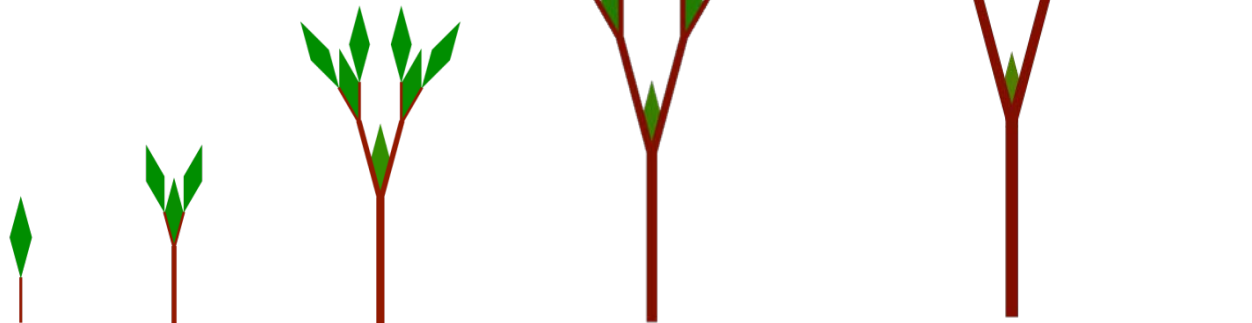# JFLAP – Recursively Enumerable Languages

- Create
  - Turing Machine (1-Tape)
  - Turing Machine (multi-tape)
  - Building Blocks
  - Unrestricted grammar

- Parsing
  - Unrestricted grammar with brute force parser
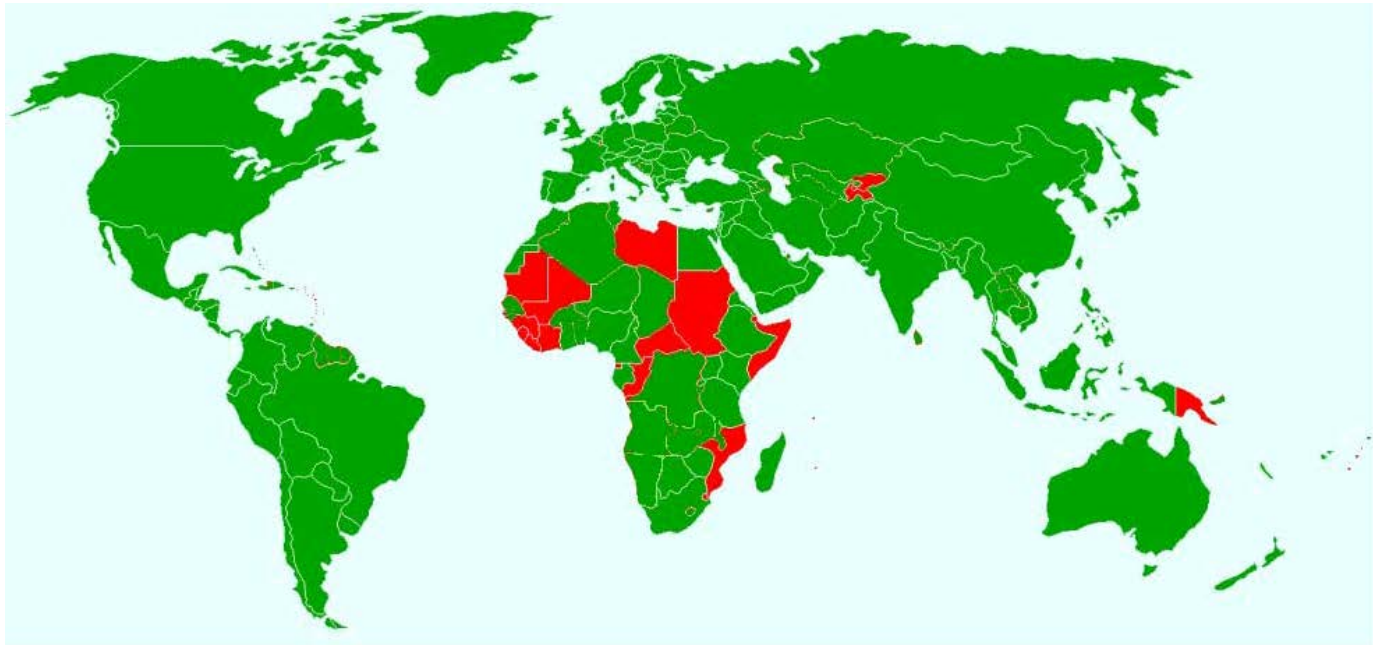
JFLAP - L-Systems

- This L-System renders as a tree that grows larger with each successive derivation step.
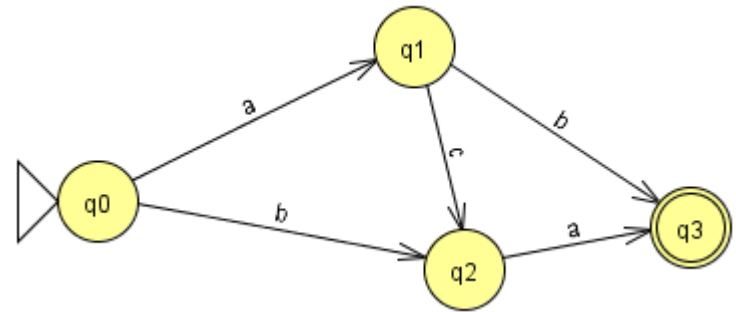
JFLAP's Use Around the World

- JFLAP web page has over 300,000 hits since 1996
- Google Search
  - JFLAP appears on over 9830 web pages
  - Note: search only public web pages
- JFLAP been downloaded in over 160 countries
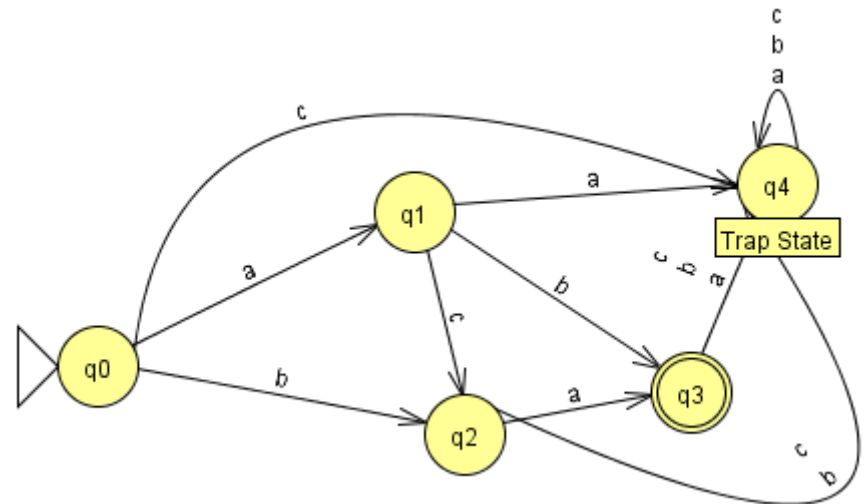
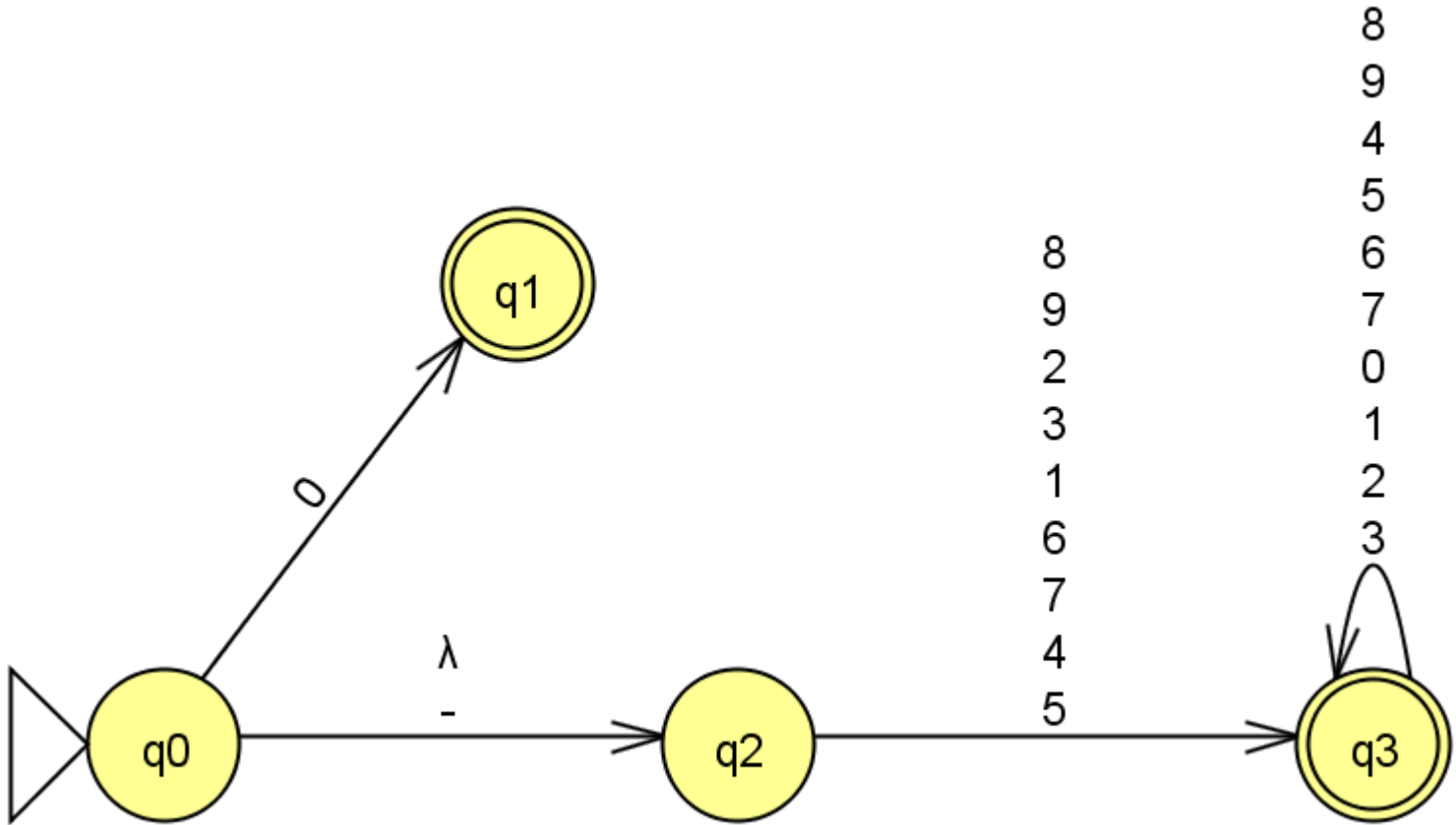# JFLAP Demos

DFA new features

- Here is a simple DFA

- New features:
  - Added trap state
  - Curved two of the transitions
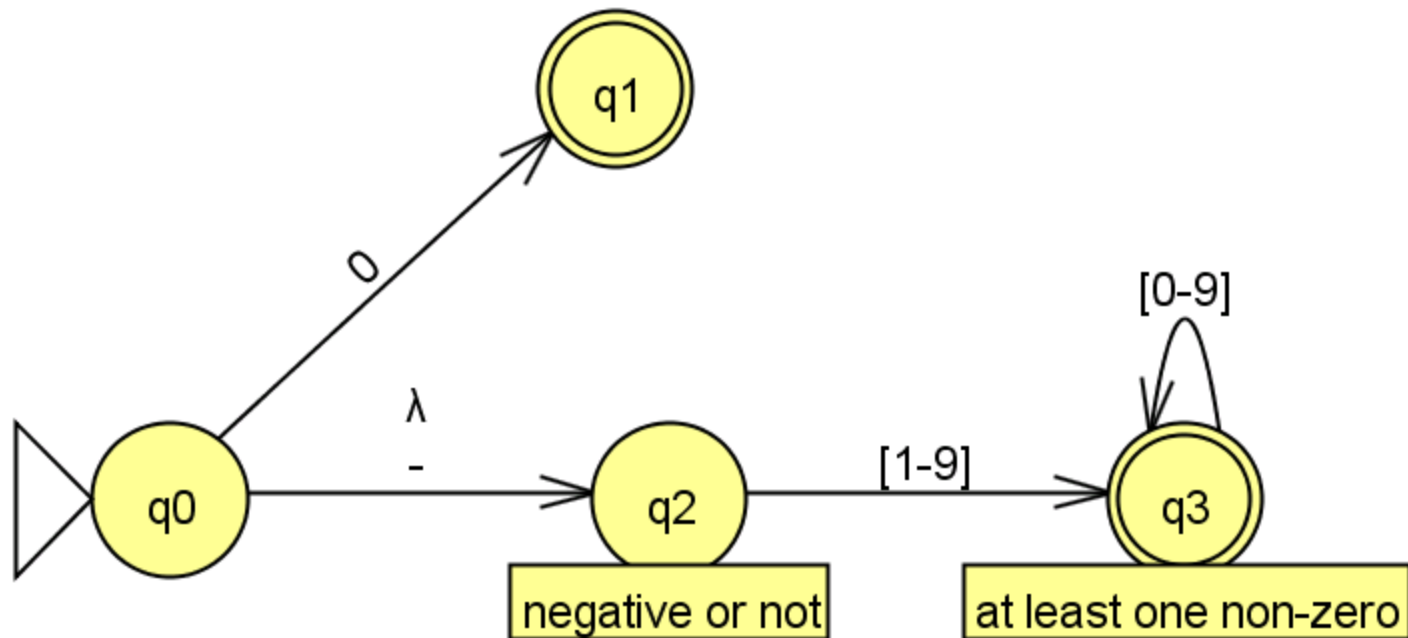
Example: Build an NFA for valid integers

- Example:
  - Valid integers {-3, 8, 0, 456, 13, 500, …}
  - Not valid: {006, 3-6, 4.5, …}

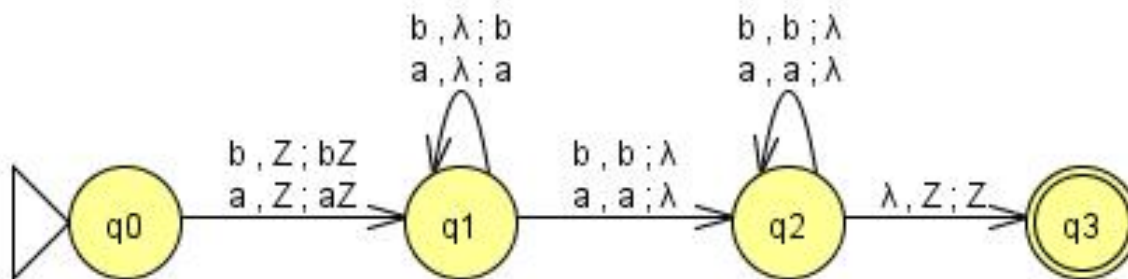# Example: NFA for all valid integers

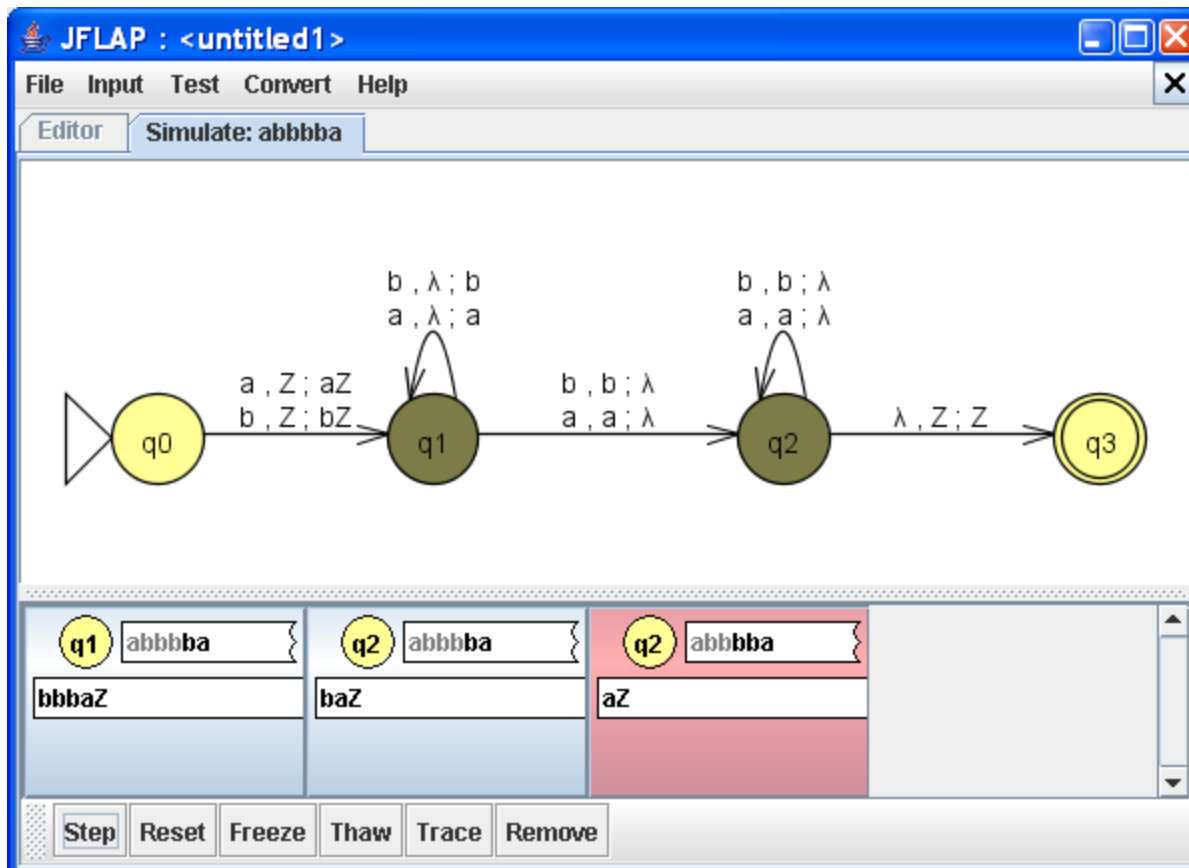# NFA annotated and shortcut

- New feature: [1-9] on labels

Example : NPDA

- NPDA for palindromes of even length
- New feature: asks for multi-char or single char for labels

Example (cont)

- Run input strings on the NPDA
  - Shows the nondeterminism

Example
Unrestricted Grammar - anbncn

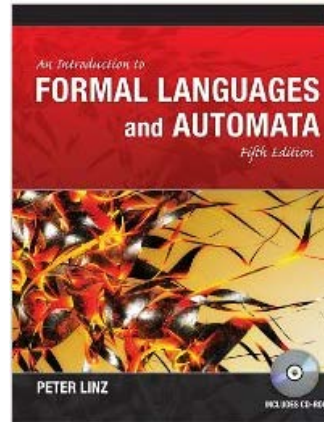|		
S	$\longrightarrow$	AX
A	$\longrightarrow$	aAbc
A	$\longrightarrow$	aBbc
Bb	$\longrightarrow$	bB
Bc	$\longrightarrow$	D
Dc	$\longrightarrow$	cD
Db	$\longrightarrow$	bD
DX	$\longrightarrow$	EXc
BX	$\longrightarrow$	λ
cE	$\longrightarrow$	Ec
bE	$\longrightarrow$	Eb
aE	$\longrightarrow$	aB

Trace aabbcc

JFLAP Materials

JFLAP book

Use with automata theory textbook

JFLAP online tutorial
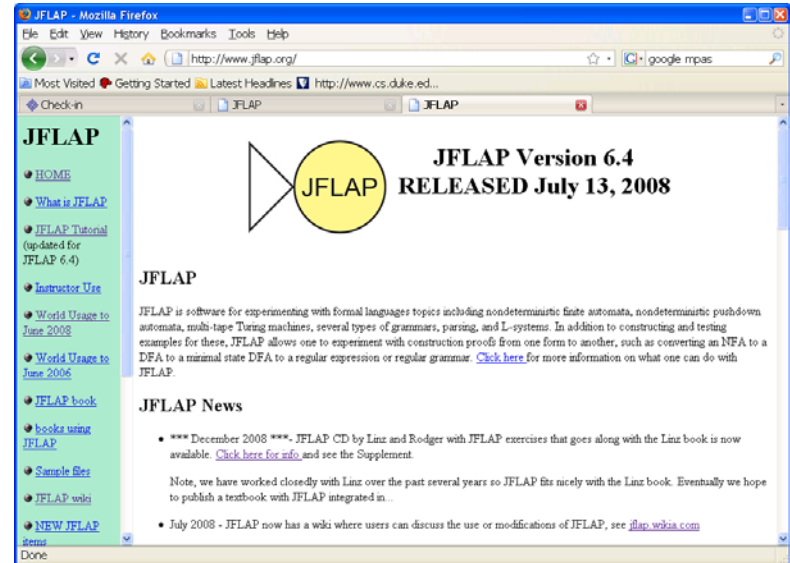
JFLAP works well with Linz book

CD supplement with JFLAP exercises to go with this book

JFLAP is FREE

Questions?