

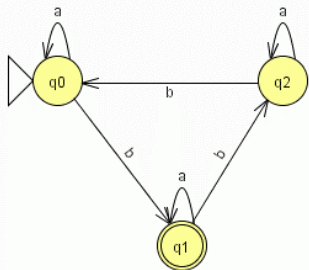
# A Hands-on Approach to FLA with JFLAP

## JFLAP with CFL

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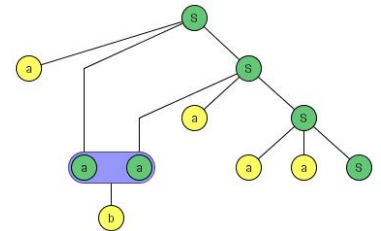
Thomas Finley, Cornell University

Peter Linz, University of California, Davis



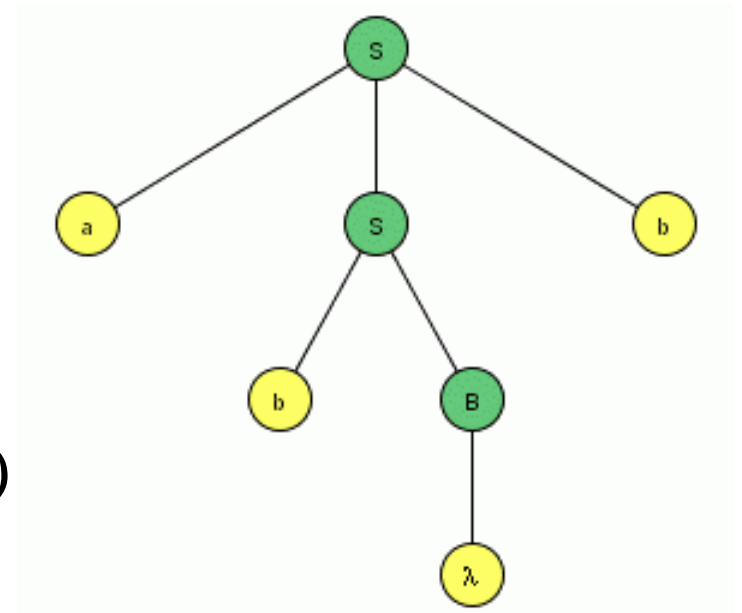
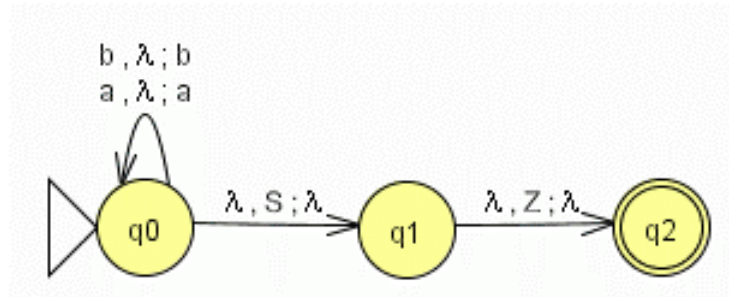
SIGCSE 2006

March 4, 2006



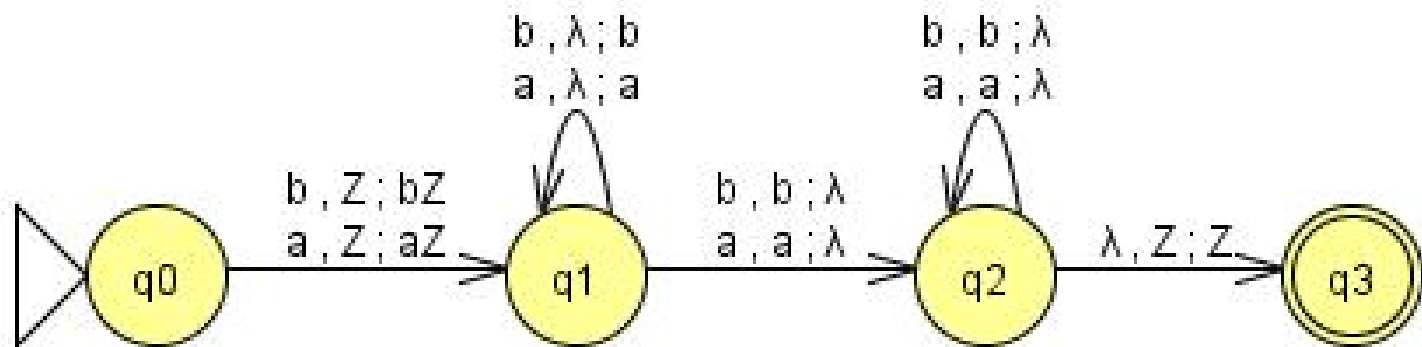
# JFLAP – Context-free Languages

- Create
  - Nondeterministic PDA
  - Context-free grammar
- 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



# Build an NPDA and Run it

- NPDA



- Test input

Input	Result
abab	Reject
abba	Accept
abbba	Reject
abaaaaba	Accept
	Reject
bbbb	Accept
bbbbbb	Reject
babbab	Accept

# CFG and Brute-Force Parser

- Enter a CFG
- Select “Input”,  
“Brute-Force Parse”

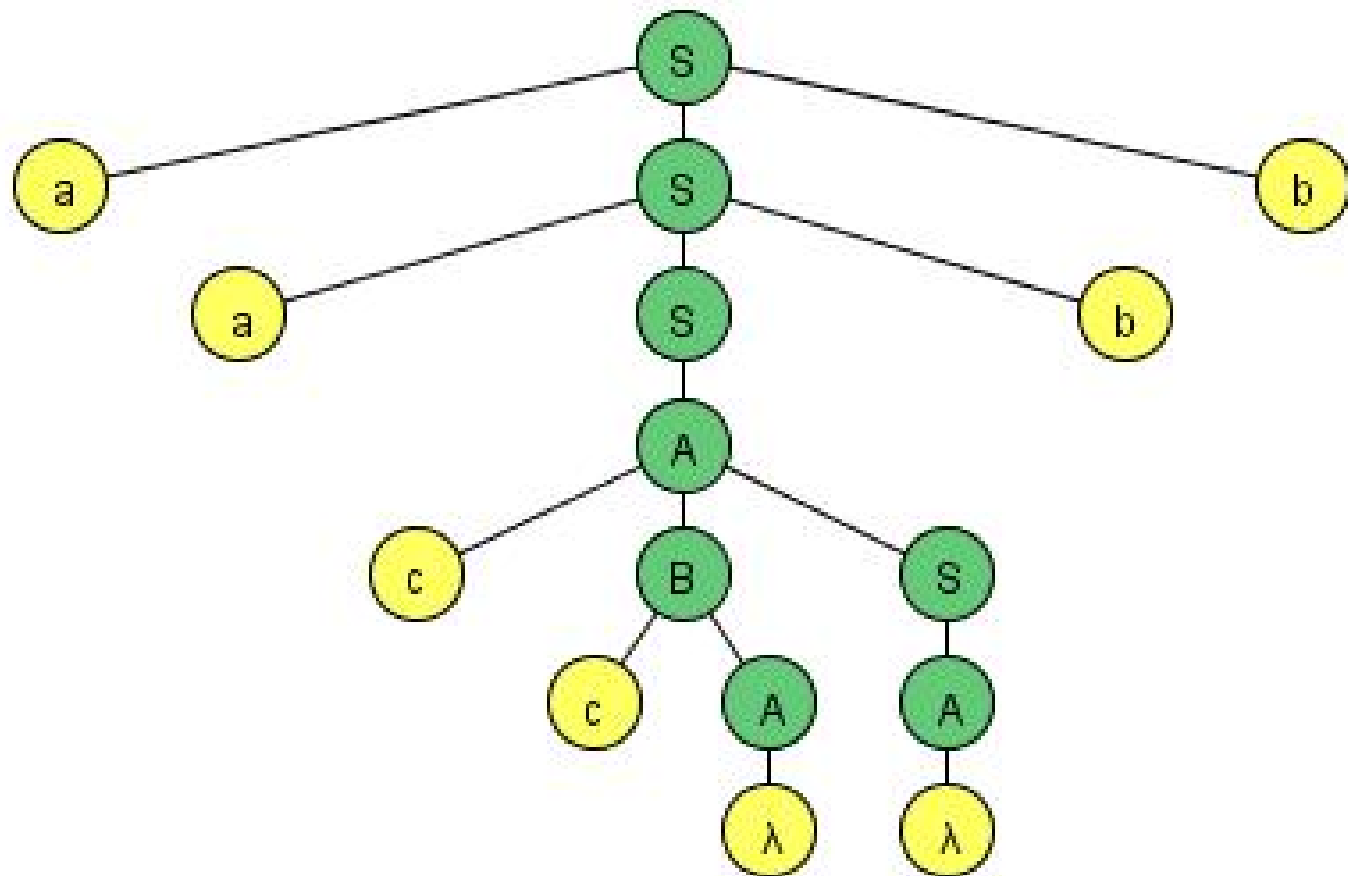
S	→	aSb
S	→	A
A	→	cBS
A	→	bA
A	→	$\lambda$
B	→	cA
B	→	bA

- Derive  
aaccbb

Production	Derivation
	S
$S \rightarrow aSb$	aSb
$S \rightarrow aSb$	aaSbb
$S \rightarrow A$	aaAbb
$A \rightarrow cBS$	aacBSbb
$B \rightarrow cA$	aaccASbb
$S \rightarrow A$	aaccAAbb
$A \rightarrow \lambda$	aaccAbb
$A \rightarrow \lambda$	aaccbb

# CFG and Brute-Force Parser (cont)

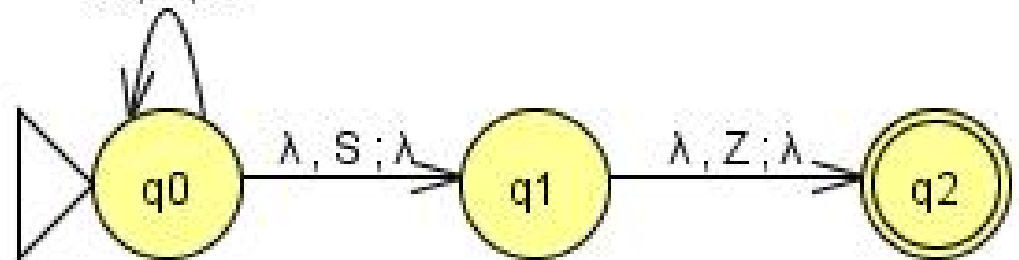
- Derive Parse Tree



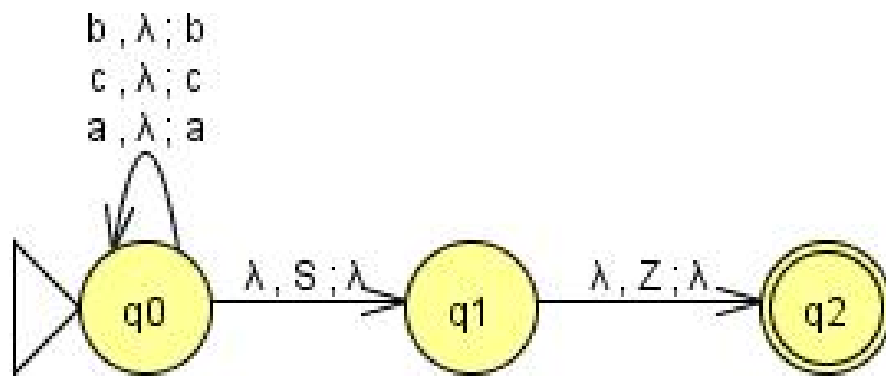
# CFG to NPDA (SLR)

S	→	aSb
S	→	A
A	→	cBS
A	→	bA
A	→	λ
B	→	cA
B	→	bA

λ, Ab ; B  
λ, SBc ; A  
λ, A ; S  
λ, λ ; A  
λ, Ab ; A  
λ, Ac ; B  
λ, bSa ; S  
b, λ ; b  
c, λ ; c  
a, λ ; a



# NPDA to CFG



$(q_1 a q_0)$	$\rightarrow$	$a(q_1 a q_0)(q_0 a q_0)$
$(q_1 a q_0)$	$\rightarrow$	$a(q_1 a q_1)(q_1 a q_0)$
$(q_1 a q_0)$	$\rightarrow$	$a(q_1 a q_2)(q_2 a q_0)$
$(q_1 a q_1)$	$\rightarrow$	$a(q_1 a q_0)(q_0 a q_1)$
$(q_1 a q_1)$	$\rightarrow$	$a(q_1 a q_1)(q_1 a q_1)$
$(q_1 a q_1)$	$\rightarrow$	$a(q_1 a q_2)(q_2 a q_1)$
$(q_1 a q_2)$	$\rightarrow$	$a(q_1 a q_0)(q_0 a q_2)$
$(q_1 a q_2)$	$\rightarrow$	$a(q_1 a q_1)(q_1 a q_2)$
$(q_1 a q_2)$	$\rightarrow$	$a(q_1 a q_2)(q_2 a q_2)$
$(q_0 Z q_0)$	$\rightarrow$	$a(q_1 a q_0)(q_0 Z q_0)$
$(q_0 Z q_0)$	$\rightarrow$	$a(q_1 a q_1)(q_1 Z q_0)$
$(q_0 Z q_0)$	$\rightarrow$	$a(q_1 a q_2)(q_2 Z q_0)$
$(q_0 Z q_1)$	$\rightarrow$	$a(q_1 a q_0)(q_0 Z q_1)$
$(q_0 Z q_1)$	$\rightarrow$	$a(q_1 a q_1)(q_1 Z q_1)$
$(q_0 Z q_1)$	$\rightarrow$	$a(q_1 a q_2)(q_2 Z q_1)$
$(q_0 Z q_2)$	$\rightarrow$	$a(q_1 a q_0)(q_0 Z q_2)$
$(q_0 Z q_2)$	$\rightarrow$	$a(q_1 a q_1)(q_1 Z q_2)$
$(q_0 Z q_2)$	$\rightarrow$	$a(q_1 a q_2)(q_2 Z q_2)$
$(q_1 a q_1)$	$\rightarrow$	$b$
$(q_1 Z q_2)$	$\rightarrow$	$\lambda$

# Exercises

1. Load file ex5.5b. What is the language?
2. Write a NPDA for  $\{a^n b^m \mid m > 0, m \leq n \leq 3m\}$
3. Load file ex6.5cfg-c. Parse strings and determine the language.
4. Write a CFG for  
$$L = \{a^n b^m c^p \mid p = n + m, n > 0, m > 0\}$$
5. Load file ex6.5cfg-c. Convert to NPDA
6. Load file ex6.5-toCFGb