A Hands-on Approach to FLA with JFLAP

Recursively Enumerable Languages

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JFLAP – Recursively Enumerable Languages

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

• Parsing
  – Unrestricted grammar with brute force parser
Turing Machine for $a^{2^n}$
Trace example string aaaaaaaaaaaa

• Start with string

• After several steps

• After several steps
Trace for aaaaaaaaa (cont)

- After several steps

- Accept!
2-Tape Turing Machine for $f(a^n b^n c^n) = 1^n$
undefined for input not in the correct format
Trace aaabbbccc

- Start
- For each a, write a on tape 2
- Match a’s/b’s
- Match a’s/c’s, erase a’s
- Erase c’s/b’s, replace a’s with 1’s
Universal Turing Machine

- 3-Tape TM, 34 states, partly shown below
Turing Machine Building Blocks

- SIGCSE 2006 paper
- Copy, $f(w) = w0w$, $E = \{a,b,c\}$
Trace of aabcb
Unrestricted Grammar

- Multiple symbols on the left side of a rule

Start of parse tree

Parse tree one step later

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Unrestricted Grammar (cont)
Final tree
Exercises

• Load the TM ex9-a2n and run input
• Write a TM for $f(n)=3n$, $n$ is unary, $E=\{1\}$
• Load the 2-Tape TM tm2TAPEanbncn
• Load the TM BB example, duplicateString
• Load the Universal TM ex9-universal
• Enter the unrestricted grammar example