

CMSC 330: Organization of Programming Languages

Project 2 – Finite Automata Interpreter

Overview

- Write Ruby program to implement finite automata
 - Compose automata representing NFAs
 - Concatenate
 - Union
 - Closure
 - Convert automata representing NFAs to ones representing DFAs
 - Subset construction
 - Complement automata representing DFAs
 - Add explicit dead state
 - Flip final & non-final states

Starting Ruby Code – fa.rb

- Class FiniteAutomaton
 - Can already represent DFAs

```
class FiniteAutomaton
  def initialize
    @start = nil      # start state
    @state = { }      # all states
    @final = { }      # final states
    @transition = { } # transitions
    @alphabet = [ ]    # symbols on transitions
  end
```
 - You need to extend it to also represent NFAs

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Starting Ruby Code – fa.rb

- Interpreter and stack
 - Reads commands, operates on stack

```
def interpreter
  dfaStack = [ ]
  loop do
    case word
    when /SIZE/
      f = dfaStack.last
      puts f.num_states
    when /DFA/
      f = dfaStack.pop
      f2 = f.to_dfa
      dfaStack.push f2
    end
  end
```
 - You need to implement functions called by interpreter

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Input Format

- Commands to interpreter
 - Consisting of
 - Symbols in alphabet (plus E for empty string)
 - a, b, c, ... z, E
 - Operators
 - . | *
 - Commands to interpreter
 - SIZE, DFA, PRINT, COMPLEMENT, STATS, DONE
 - Input strings to be tested
 - Example
 - a a a | . DFA PRINT "" "a" "aa" "aaa" DONE

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Output of fa.rb Script

- Run as
 - ruby fa.rb input_file.in
- Output
 - Results of commands
 - Values (e.g., # of states in finite automata)
 - Accept / reject for string
 - List of strings accepted for GenStr method
 - Lists all strings accepted under some length
 - All output beginning in % ignored by test script

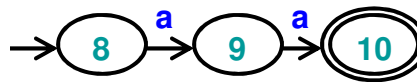
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Example Session

- Input
 - a a a | . DFA PRINT "" "a" "aa" "aaa" DONE
- Output

```
% Start 8
% Final { 10 }
% States { 8 9 10 }
% Alphabet { a }
% Transitions {
% (8 a 9)
% (9 a 10)
% }
Reject
Reject a
Accept aa
Reject aaa
```



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Administration

- Project description & files
 - [Download from class web page](#)
- Due midnight Wed, March 5th
 - 10% penalty for 1 day late
- Submit fa.rb to submit server
 - submit.cs.umd.edu
- Public test cases
 - [Sample inputs & outputs available](#)

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