450 COMPILERS

COMPUTER SCIENCE

News

- How fast can we make interpreted Python?
  - http://arxiv.org/pdf/1306.6047v2.pdf

Administrivia

- Lab 03
  - Due Thursday
- Lab 04
  - Will be available on Thursday

Review

- Design of Lexical Analyzer
  - Defined by a finite set of tokens
- Tokens
  - Ex. Integer, Keyword, Identifier, Whitespace
- Implementation of Lexical Analyzer
  - Recognize tokens
  - Returns value of tokens
- Regular Expressions

Example

- Recall
- \tif(i == j)\n\t\tz = 0;\n\telse\n\t\tz=1;

Example: Integers

- Integer: a non-empty strings of digits
  - Digit = ‘0’ + ‘1’ + ‘2’ + …
  - Integer = digit digit*

Example: Identifier

- Letter = ‘A’ + .. + ‘Z’ + ‘a’ + .. ‘z’
- Identifier = letter(letter + digit)*

Example: Whitespace

- Whitespace: a non-empty sequence of blanks, newlines, and tabs
- (‘ ‘ + ‘\n’ + ‘\t’

Example: Phone Numbers

- Consider (650)-732-3232

- Σ = digits U {-,(,)}
- Exchange = digit^3
- Phone = digit^4
- Area = digit^3

- Phone_number = ‘(‘ area ‘)-’ exchange ‘-’ phone

Example: Email Addresses

- Consider anyone@cs.csub.edu
- Σ = letters U {.,@}
- Name = letter+
- Address = name '@' name '.' name '.' name

Example

- C code ex.
- int i = '3';
- *nptr = pow(2,i) + j++; /* stuff stuff */

Finite Automata

- Finite-state machine (FSM) or finite-state automaton (FSA)
  - A mathematical model of computation used to design both computer programs and sequential logic circuits
- Singular: automaton

Finite Automata

- Regular expressions = specification
- Finite automata = implementation
- A finite automaton consists of
  - An input alphabet
  - A set of states
  - A start state
  - A set of accepting states
  - A set of transitions

Finite Automata

- Transition

$$s_1 \rightarrow^a s_2$$

- Is read

  In state s_1 on input "a" go to state s_2

- If end of input and in accepting state => accept

- Otherwise => reject

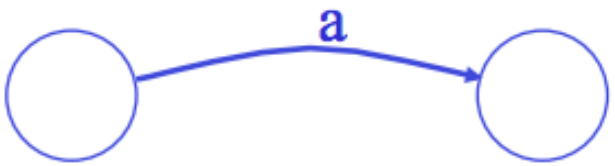
Finite Automata

- A state

- The start state

- An accepting state

- A transition

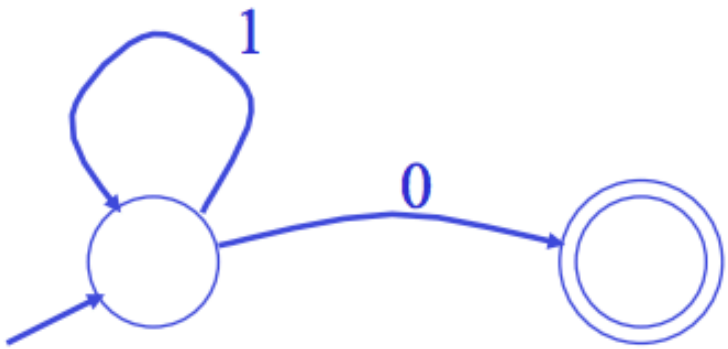


Simple Example

- A finite automaton that accepts only "1"

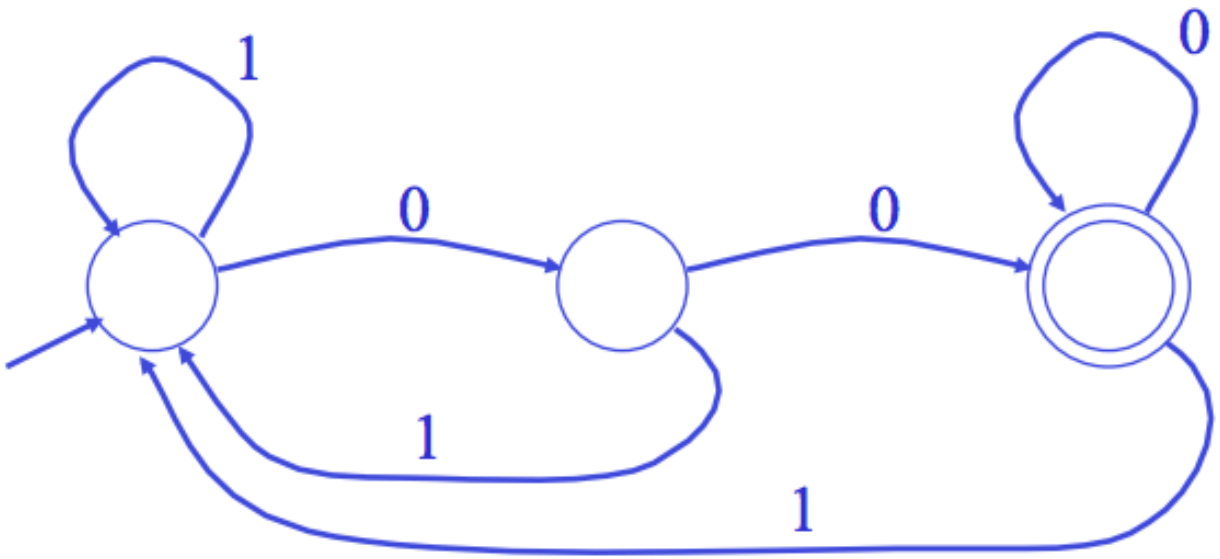
Another Simple Example

- A finite automaton accepting any number of 1's followed by a single 0
- Alphabet: {0,1}



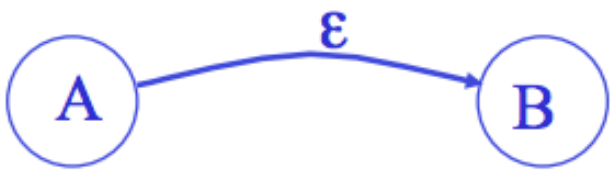
And Another Example

- Alphabet {0,1}
- What language does this recognize?



Epsilon Moves

- Another kind of transition: ε-moves



- Machine can move from state A to state B without reading input