

CS241 Tutorial 5

Graham Cooper

June 12, 2015

Topics:

- Regular Languages
- DFA's
- Regular Expressions

Regular Language Review

Alphabet(Σ) - finite set of symbols

Word(over Σ) - finite sequence of symbols from Σ

Language - Set of words

Regular Language is a language where either:

- $R = \{\}$
- $R = \{w\}$ for some word w
- $R = R_1 \cup R_2$
- $R = R_1 \cdot R_2$
- $R = R_1^* = \bigcup_{i=0}^{\infty} R^i$ where $R^0 = \{\epsilon\}$ and for $i > 0$, $R^i = R \cdot R^{i-1}$

DFA's

- Σ - input/alphabet
- Q - finite set of states
- $q_0 \in Q$ - start state
- $A \subseteq Q$ - set of accepting states
- $\delta : Q \times \Sigma \rightarrow Q$ - transition function

Regular Expressions

- Concatentation (ab)
- Alternation ($a \mid b$)
- Repetition (a^*)

Practice with DFA's

0.1 1)

$\Sigma\{a, b, c\}$

$L = \{\text{One } a, \text{ and an even number of } c\text{'s}\}$

See notes for picture

2)

$\Sigma = \{0, 1\}$

$L = \{\text{strings ending in } 1011\}$

3)

$\Sigma = \{0, 1, 2, 3\}$

$L = \{\text{integers whose digit sum is } 3\}$

Practice with Regular Expressions

1)

$\Sigma\{0, 1\}$

$L = \{\text{Second letter is } 0, \text{ and } 5\text{th is } 1\}$

Regular language $\{0,1\}^*\{0\}\{0,1\}^*\{1\}\{0,1\}^*$
or Regular expression:

$$(0|1)0(0|1)(0|1)1(0|1)^*$$

2)

$$\Sigma = \{x, y\}$$

$$L = \{xx, xy, yx, yy\}$$

Regular Expression:

$$(x|y)(x|y)$$

3)

$$\Sigma = \{G, A, C, T\}$$

$$L = \{\text{strings containing GACAT}\}$$

Regular Expression:

$$(G—A—C—T)^*GACAT(G—A—C—T)^*$$

4)

$$\Sigma = \{0, 1, 2\}$$

$$L = \{x \in \Sigma^* | x \text{ contains even zeros and at least one } 1\}$$

$$2^*(02^*02^*)^*(1|02^*1(1|2)^*0)(1|2)^*(0(1|2)^*0(1|2)^*)^*$$