

Exercise Sheet 1

Assignment 1.1 Regular Expressions

Give regular expressions (containing terminals, parenthesis, '|', and '*') where '|' is used at most once such that the language of the regular expression satisfies the given constraints.

1. Language includes:

- ca
- cccccc
- ccaa

but does not include:

- ccc
- ccccc
- a

2. Language includes:

- abc
- abca
- abcabc

but does not include:

- abcab
- abcaa
- a

3. Language includes:

- j
- iiij
- ixxxxxxxj
- ixxij

but does not include:

- jj
- xij

Suggested Solution 1.1

1. $ca|((cc)^*(aa)^*)$ or $(c|(cc)^*)a^*$
2. $(abc)(a|(abc)^*)$ or $abc(a|abc)?$
3. $(ix^*)^*j$ or $i^*x^*(ii)^*j$

Assignment 1.2 Languages of Regular Expressions

Give the languages described by the following regular expressions.

For example $\llbracket a^* \rrbracket = \{a^n \mid n \in \mathbb{N}\}$

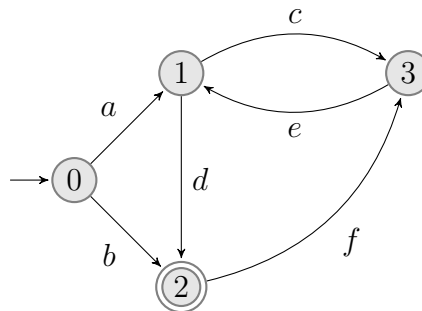
1. $\llbracket x^*y^* \rrbracket$
2. $\llbracket (a|b|\epsilon)c(a|\epsilon) \rrbracket$
3. $\llbracket (x|y^*)z \rrbracket$

Suggested Solution 1.2

1. $\llbracket x^*y^* \rrbracket = \{x^m y^n \mid m, n \in \mathbb{N}\}$
2. $\llbracket (a|b|\epsilon)c(a|\epsilon) \rrbracket = \{a^n b^m c a^k \mid n, m, k \in \{0, 1\}, nm = 0\} = \{aca, bca, ca, ac, bc, c\}$
3. $\llbracket (x|y^*)z \rrbracket = \{xz\} \cup \{y^n z \mid n \in \mathbb{N}\}$

Assignment 1.3 Automata Implementation

Come up with an implementation of the following given automata in Java. Do not make use of any “fancy” library, i.e., YOU should do the implementation ;-)

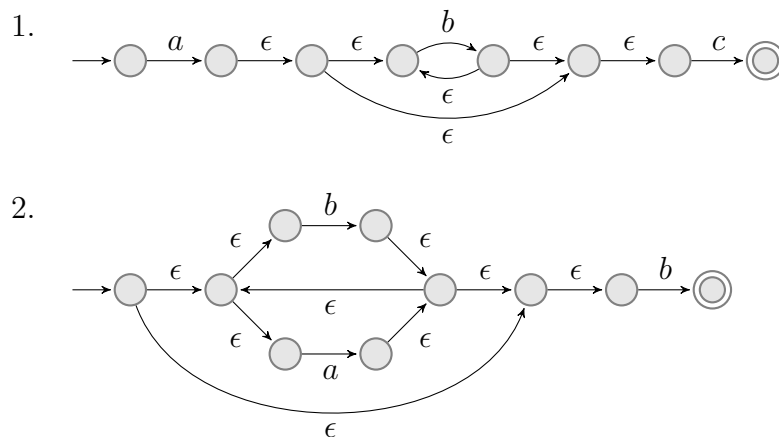


Assignment 1.4 Thompson's Algorithm

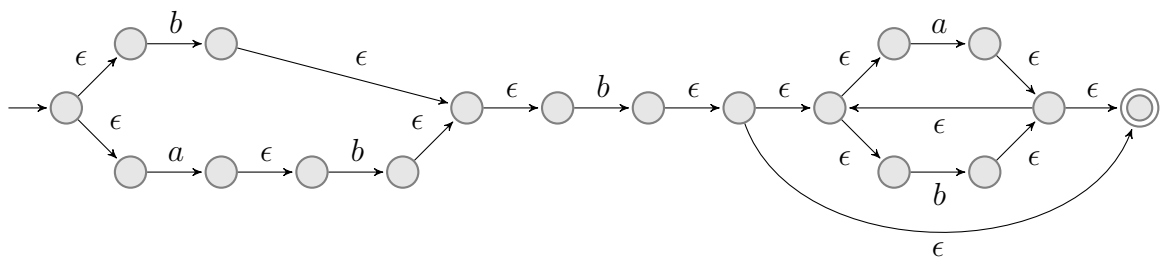
Using Thompson's Algorithm, transform the following regular expressions to NFAs.

1. ab^*c
2. $(b|a)^*b$
3. $(b|ab)b(a|b)^*$

Suggested Solution 1.4



3.



Assignment 1.5 Berry-Sethi Algorithm (Naive Approach)

Give the transitions for the naive Berry-Sethi approach for the expression r^+ where r is any regular expression.

Suggested Solution 1.5

$$(\bullet r^+, \epsilon, \bullet r) \quad (r \bullet, \epsilon, \bullet r) \quad (r \bullet, \epsilon, r^+ \bullet)$$