

Continuation of

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$L \circ L$ and L^*

Building an NFA for these are explained in the book

L^* cannot be proven to be regular by assuming it to be $\epsilon \cup L \cup L^2 \cup \dots$ because this is an infinite union, as infinite unions are not necessarily regular.

Building Regular Languages

Can we build a regular language with the following - “ ϵ ”, singletons, $\{\}$ and operations \cup , \circ , * ? We know all languages built by such a construction are regular.

Thm: All regular languages can be built in such a way

Regular Expressions

Defn: R is a regex over Σ if R is

- a for some $a \in \Sigma$
- ϵ
- \emptyset
- finite $R_1 \cup R_2$
- finite $R_1 \circ R_2$
- R

Examples

If $\Sigma = \{0,1\}$ 1. 0 2. 1 3. 01 } $0 \cup 1$ 4. $(01)^*$ 5. $011 \circ (0 \cup 1)$ 6. $(0 \cup 1) \circ 111$ 7. $011 \circ (0 \cup 1) \circ 111$

Why regex?

Regex is a terse way to describe a DFA. A computer can then simulate the DFA and then do a pattern matching. Eg commands on linux-

- grep
- sed

Hence we try to build a regex from a DFA. Take a DFA, and break it down to the minimal states as above. We remove one state and replace it with a “black” box denoted by a set of regex’s for all the possible state changes.

- forks can be a set of tuples (1a, 1b, 2a, 2b)
- loops can be replaced by a *.