

Midterm

CS 440
Fall 2000
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- 1 Let e be a regular expression composed of 5 alphabet symbols, 2 unions, 2 concatenations, 1 Kleene closure, and 1 positive Kleene closure. How many states will be in the NFA $N(e)$ constructed from e by the method `Lexicon.put`?
- 2 Let $N = (Q, \Sigma, \delta, q_0, F)$ be the following NFA:
- a) Compute $\delta(\{0, 1, 5, 12, 13, 15\}, 0)$.
 - b) Compute $\delta^*(\{0\}, \varepsilon)$.
 - c) Compute $\hat{\delta}(\{0\}, 010)$.
 - d) Compute $\delta^2(\{6, 11\}, \varepsilon)$.
 - e) Draw the DFA D that would be constructed from NFA N by the implementation of `Lexicon.grab`.
- 3 Let L be the set of strings $\{1:00, 1:01, 1:02, \dots, 12:58, 12:59\}$ representing times that can appear on a digital clock (without leading zeroes). Give an extended regular expression (ERE)—as used in the `egrep` command—that denotes L . Recall that a range of characters can be expressed, e.g., by `[a-d]`.

4 Let G be the following CFG:

$$\begin{aligned} S &\rightarrow D \\ A &\rightarrow \mathbf{a}A \mid \varepsilon \\ B &\rightarrow \mathbf{b}AC \mid AcD \\ C &\rightarrow \mathbf{b}C \mid Ac \\ D &\rightarrow BA \mid \mathbf{d} \end{aligned}$$

- a) Give a parse tree for the sentence \mathbf{cda} .
- b) Give a leftmost derivation for the sentence \mathbf{cda} .

5 Recall that the DFA constructed from a regular definition is used to implement a greedy grab lexical analyzer. During a call to `Lexicon.grab`, how is the DFA used to know...

- a) when to stop grabbing source characters?
- b) which prefixes of the remaining source characters are words defined by the regular definition?
- c) when a lexical error has occurred?
- d) which terminal was recognized?