

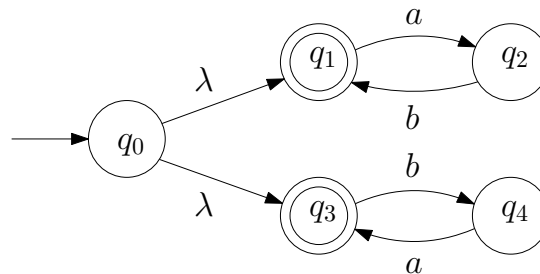
CONCORDIA UNIVERSITY
 Dept. of Computer Science and Software Engineering
 COMP 335 – Introduction to Theoretical Computer Science
 Fall 2024

Assignment 2

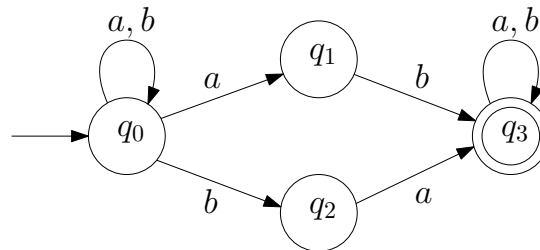
Submission through Moodle is due by Sunday, October 6th at 23:55

1. [20 Points] For each of the following languages over the alphabet $\Sigma = \{a, b\}$ give an NFA (as a transition diagram) with the specified number of states. *Hint: try simplifying a DFA and/or use λ transitions.*
 - (a) The language $\{a^n : n \geq 0\} \cup \{b^n a : n \geq 1\}$ with at most 4 states.
 - (b) The language $\{w : w \text{ either has no consecutive } a\text{'s or no consecutive } b\text{'s}\}$ with at most 5 states.
 - (c) The language $\{w : w \text{ contains an even number of } a\text{'s or exactly two } b\text{'s}\}$ with at most 6 states.
 - (d) The language $\{ab, aab, aba\}^*$ with at most 4 states.
2. [20 Points] Let $\Sigma = \{a, b\}$. Convert each NFA below to a DFA using the subset construction. Draw the transition diagram of your DFA, label the states of your DFA by subsets of states of the original NFA.

(a)



(b)



3. [20 Points] Find a regular expression for each of the following languages.
 - (a) $\{ba^n b^m : n \geq 3, m \geq 2\}$.
 - (b) $\{w \in \{a, b\}^* : \text{every maximal substring of } w \text{ consisting entirely of symbols } a \text{ is of length exactly } 3\}$.
 - (c) $\{w \in \{a, b\}^* : w \text{ does not contain } bab \text{ as a substring}\}$.
 - (d) $\{w \in \{a, b\}^* : w \text{ begins with } bb \text{ and } n_b(w) \bmod 3 = 0\}$.