Homework One

Theory of Computation 2016

Important Note:

Please remember that you should return your answer at 3/24 (Thursday) 6:10pm. We will take your HW during the class. Please handwriting the answer. After 3/24 6:10pm, you must upload your HW to moodle. But remember penalty for late submission: 20% per day.

Q1: For $\Sigma = \{a, b\}$, construct dfa's that accept the sets consisting of

(a) all strings with exactly one a.
(b) all strings with at least two a's.
(c) all strings with no more than two a's.
(d) all strings with at lest one b and exactly two a's.
(e) all strings with exactly two a's and more than three b's.

Q2: A run in a string is a substring of length at least two, as long as possible, and consisting entirely of the same symbol. For instance, the string $abbbaab$ contains a run of $b's$ of length three and a run of $a's$ of length two. Find dfa's for the following languages on $\{a, b\}$:

(a) $L = \{w : w$ contains no runs of length less than three$\}$.
(b) $L = \{w :$ every run of $a's$ has length either two or three$\}$.

Q3: Show that the language $L = \{a^n : n \geq 0, n \neq 3\}$ is regular.

Q4: Find a dfa that accepts the language defined by the nfa in Figure 1.

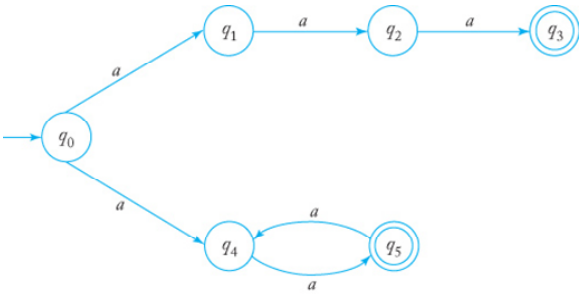

Figure 1: NFA diagram

Q5: (a) Find an nfa with three states that accepts the language $L = \{a^n : n \geq 1\} \cup \{b^m a^k : m \geq 0, k \geq 0\}$.

(b) Do you think the language in part (a) can be accepted by an nfa with fewer than three states?

Q6: Convert the following nfa in Figure 2 into an equivalent dfa.

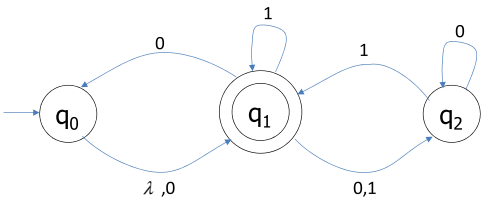

Figure 2: NFA diagram.