CSCI 301 M8 Homework

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May 29, 2020

Collaboration statement: By submitting this assignment, I am attesting that this homework is in full compliance with the course's https://wwu.instructure.com/courses/1340003/pages/academic-dishonesty-guidelines Homework Collaboration Policy and with all the other relevant academic honesty policies of the course and university. I discussed this homework with no one and wrote this solution without input from anyone else.

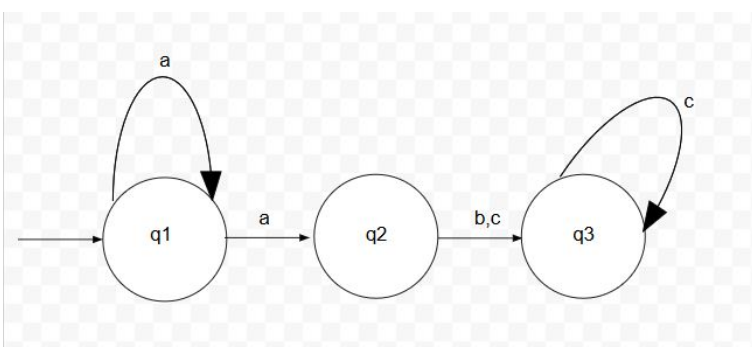
1. (a) $S \to A$ (using $S \to A$.
   $\to aA$ (using $A \to aA$)
   $\to aaA$ (using $A \to aA$
   $\to aaB$ (using $aA \to aB$
   $\to aabB$ (using $B \to bB$
   $\to aabb$ (using $B \to bB$
   $\to aabb$ (using $B \to \varepsilon$)

   (b) i. $aaabbb$
   ii. $aaaabbbb$
   iii. $aaaaabbbbb$
   iv. $aAb\varepsilon$
   v. $aab\varepsilon$
   vi. $abb\varepsilon$

   (c) $\varepsilon \cup a^*b|ab^*$

   (d) If you were to remove $B \to b$ as it breaks the rule of right-regular grammars in which $v \to a$, where $v \in V$ and $a \in \sum$.

2. $((a \cup b \cup c)(a \cup b \cup c))^*$

3. 

4. $\varepsilon \cup (a^*|a^*b|a^*ccb|b)$

5. We will prove with contradiction
   Suppose that $\{a^n b^n c^{2n} : n \geq 0\}$ is regular.
   Let The string $s = p \geq 1$ be the pumping length, as given by the pumping lemma. Consider the string $s = a^p b^p c^{2p}$.

It is clear that $s \in A$ and $|s| = 2p \geq p$.
Hence, by the pumping lemma, s ca be written as $s = xyz$, where $y \neq \varepsilon$, $|xy| \leq p$, and $xy^iz \in A$ for all $i \geq 0$.
Observe that, since $|abc| \leq p$, the a string will contain 0s. Moreover, since $y \neq \varepsilon$, abc contains at least one 0. No strings $a^0bc, = bc, ab^2c = abbc, abc^3 = abccc, \ldots$, is contained in our set.
However, by the pumping lemma, all these strings must be in our set.
Hence, we have a contradiction and we conclude that $\{a^nb^nc^{2n} : n \geq 0\}$ is not a regular language.