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Problem Set I

Computing Models
April 27, 2023

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1 Models

Given the language L above the abc $\{a, b\}$, which is defined the folowing way:
$L = \{a^n b^n \mid n > 0, m \geq 0, m \,\%\, 4 = n \,\%\, 2\}$

Problem 1.1. Determine which words are part of the language.

- a
- ab
- $aaabbb$
- $aaabbbbb$
- $aabb$
- $aaab$
- aa
- $bbbb$
- $aaaa$
- $abbb$

Solution.

- a: $n = 1, m = 0 \implies n \,\%\, 2 = 1, m \,\%\, 4 = 0 \implies n \,\%\, 4 \neq m\% \implies a \notin L$
- ab: $n = 1, m = 1 \implies n \,\%\, 2 = 1, m \,\%\, 4 = 1 \implies n \,\%\, 4 = m\% \implies ab \in L$
- aaabbb: $n = 3, m = 3 \implies n \,\%\, 2 = 1, m \,\%\, 4 = 3 \implies n \,\%\, 4 \neq m\% \implies aaabbb \notin L$

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- aaabbbbb: $n = 3, m = 5 \Longrightarrow n \,\%\, 2 = 1, m \,\%\, 4 = 1 \Longrightarrow n \,\%\, 4 = m\% \Longrightarrow aaabbbbb \in L$
- aabb: $n = 2, m = 2 \Longrightarrow n \,\%\, 2 = 0, m \,\%\, 4 = 2 \Longrightarrow n \,\%\, 4 \neq m\% \Longrightarrow aabb \notin L$
- aaab: $n = 3, m = 1 \Longrightarrow n \,\%\, 2 = 1, m \,\%\, 4 = 1 \Longrightarrow n \,\%\, 4 = m\% \Longrightarrow aaab \in L$
- aa: $n = 2, m = 0 \Longrightarrow n \,\%\, 2 = 0, m \,\%\, 4 = 0 \Longrightarrow n \,\%\, 4 = m\% \Longrightarrow aa \in L$
- bbbb: $n = 0, m = 4 \Longrightarrow n \not> 0 \Longrightarrow bbbb \notin L$
- aaaa: $n = 4, m = 0 \Longrightarrow n \,\%\, 2 = 0, m \,\%\, 4 = 0 \Longrightarrow n \,\%\, 4 = m\% \Longrightarrow a \in L$
- abbb: $n = 1, m = 3 \Longrightarrow n \,\%\, 2 = 1, m \,\%\, 4 = 3 \Longrightarrow n \,\%\, 4 \neq m\% \Longrightarrow a \notin L$

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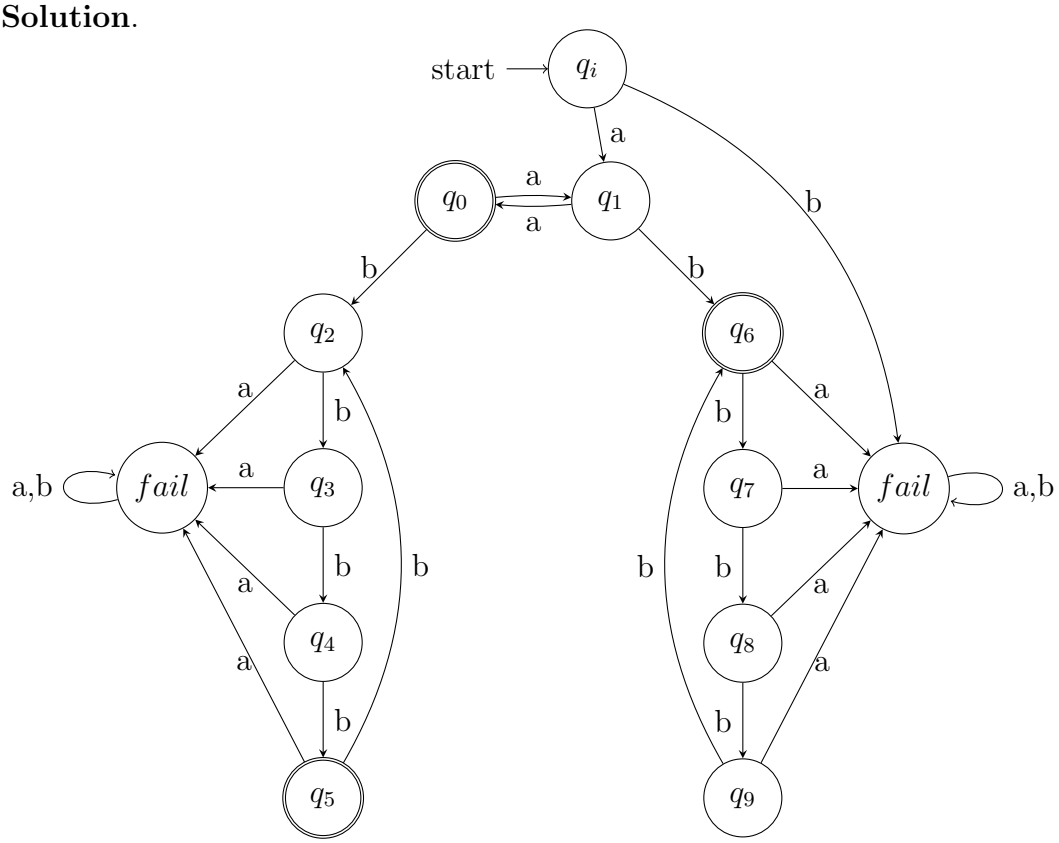
Problem 1.2. *Build a finite deterministic automata accept the language:*

Solution.



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2 Models

Given the language L above the abc $\{a, b, c\}$*, which is defined the folowing way:*
$L_1 = \{c^{1+k+n} b^k a^{2n} \mid n, k \geq 1\}$

Problem 2.1.
Determine what would be the shortest would acceptable by the language:

Solution.
Should we like for a word to be short, we would be obliged to decrease n and k. Should we like for a word to be of the minimal size, we would have to decrease n and k to their minimums. Thus the value 1 is chosen for n and k and therefore the word is: $c^{1+1+1}b^1a^{2n}$*, or in other word: cccbaa* ■