

Midterm



WEDNESDAY, 4 MARCH 2020
9:10–10:00 AM

There are 5 questions, each worth 6 points for a total of 30 points. Show all your work, for full credit will be awarded. Space is provided on the test for your work; if you need additional workspace, sign it and return it with the test. No notes, no collaboration.

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Problem	Credit
1	
2	
3	
4	
5	
Total	

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1. Give a NFA that accepts exactly the strings over the alphabet $\{0, 1\}$ such that the number of 01 substrings equals the number of 10 substrings. (The empty string is accepted by such a string, by the way.)
- Next, give a DFA that accepts the same language with the fewest number of states. *Do not worry if you believe that you have the minimum number of states. This is just a challenge problem. Come back to later, to see if you can improve your otherwise correct solution.*

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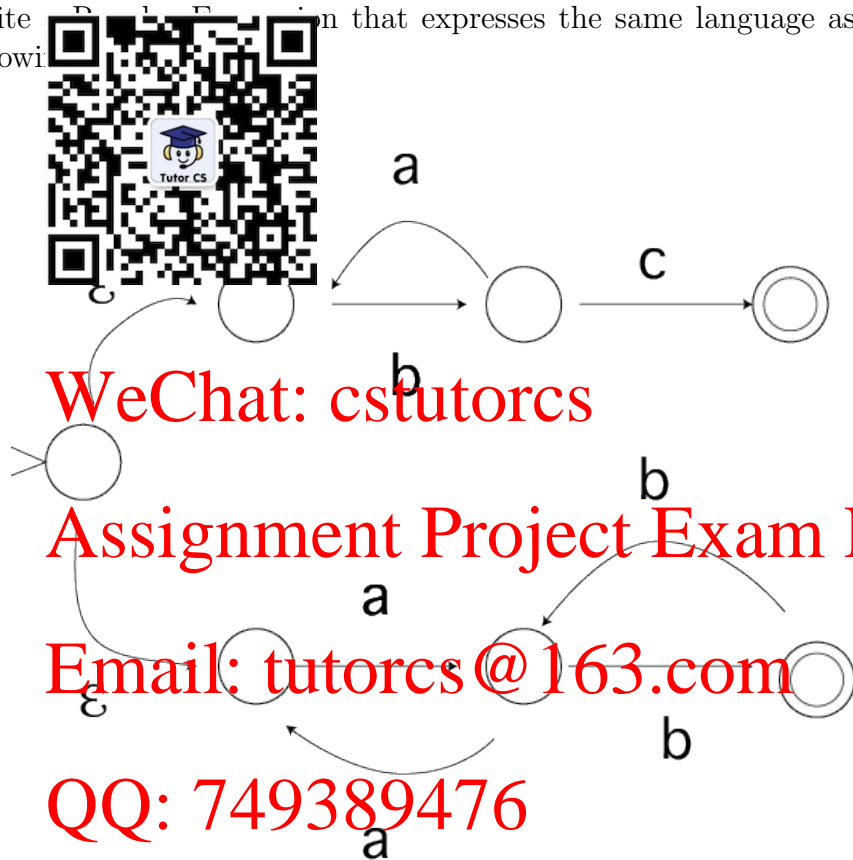
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2. Write a regular expression that expresses the same language as the following



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3. Show that



where $i, j, k \geq 0$ and $i + j + k = n$ }

is not 1

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4. Give a Grammar for the language,

$$\{b^j c^k \mid i = j \text{ or } i = k\}$$

Then show that the grammar is ambiguous by giving two parse trees in your answer for the string $bbbcc$.



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5. Give a Grammar for the Regular Expression:



$ab^*(a|b)(c(a|b))^*$

Give a Context Free Grammar, or give a logical argument why an equivalent Regular Expression

$S \rightarrow AX$

$A \rightarrow aA | a$

$X \rightarrow c|a|b|c$

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