哈工大2023形式语言与自动机春季学期期末考试

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1. Design a DFA that accepts the language $L = \{w|w$ has at least one b between any two $a's\}$.

2. Design a NFA for the regular expression $a^*b^*c^+$ with only three states.

3. Give regular expressions for each of the following languages over the alphabet {0,1}.

3.1. All strings having at most two occurences of the substring aa

3.2. All strings start with bb whose length is divisible by 4

4. Prove that the language $L = \{w = \{0, 1\}|w$ has more $0s$ than $1s\}$ is not regular with pumping lemma

5. Prove that $L_1 \cup L_2$ is not regular if L_1 is regular, L_2 is nonregular and $L_1 \cap L_2 = \emptyset$.

6. $\Sigma = \{a, b\}$,$L = \{a^n b^n\}$, design a CFG for $\bar{L}$.

7. Design a DPDA for $L = \{a^n b^m \mid n \geq 1, m \geq n + 3\}$.

8. Begin with the grammar:
$S \to aAA|aBB$

$A \to aaA|\varepsilon$

$B \to bB|bbC$

$C \to B$

8.1. Eliminate any ε-productions

8.2. Eliminate any unit productions in the resulting grammar.

8.3. Put the resulting grammar into Chomsky Normal Form.

9. This question concerns the grammar from Exercise 5.1.2 which we reproduce here:

$S \to AB|aaB$

$A \to Aa|a$

$B \to b$

9.1. Show that this grammar is ambiguous.

9.2. Find a grammar for the same language that is umambiguous.

10. Design a TM

$f(0^n) = 0^{n \bmod 5}$, **n is a positive number.**

(这里题干忘了大体意思就是设计一个图灵机 图灵机运算结果就是0的数量%5)

有几个值得注意的点：

1. 题3.1要注意没有aa，一个aa，两个aa，和aaa的情况，注意到aaa的情况就可以了

2. 题6要求的补并不是a^n b^m其中n和m不同，而是（a+b）*中a，b数量不同的字符串

3. 题10要注意n大于0的条件