2020 春 形式语言与自动机 试题 C

主管领导审核签字

姓名______ 学号______ 班号______

密 封 线

1. [10 points] Design a DFA for $L = \{w \in \{0,1\}^* \mid w \text{ has exactly three 0s.}\}$

2. [10 points] Design an NFA for the language:

$$L = \{w \in \{a,b,c\}^* \mid w \text{ starts with } ac \text{ and ends with } cb.\}$$

ac

3. [10 points] Design regular expressions for languages over $\Sigma = \{a, b\}$.

   (1) All strings that do not end with aba.

   (2) $L = \{w \mid w \text{ has no more than 5 } a\text{'s.}\}$

4. [10 points] Prove that the language $L = \{w \in \{a,b\}^* \mid w = w^R\}$ is not regular with pumping lemma.

$0^n 1^n$

5. [10 points] Consider the following ε-NFA.

	ε	a	b	c
$\rightarrow p$	$\{q, r\}$	$\emptyset$	$\{q\}$	$\{r\}$
q	$\emptyset$	$\{p\}$	$\{r\}$	$\{p, q\}$
$*r$	$\emptyset$	$\emptyset$	$\emptyset$	$\emptyset$

   (1) Compute the ε-closure of each state.

   (2) Give all the strings of length three or less accepted by the automaton.

   (3) Convert the automaton to a DFA by subset construction. (diagram of transition function)

6. [10 points] Give a CFG for $L = \{a^i b^j c^k \mid i, j, k \geq 0 \text{ and } i = j + k\}$.

7. [10 points] Find a grammar equivalent to

$$\begin{aligned} S &\rightarrow AB \mid CA \\ A &\rightarrow a \\ B &\rightarrow BC \mid AB \\ C &\rightarrow aB \mid b \end{aligned}$$

   with no useless symbols.

8. [10 points] Design a PDA for $L_{eq} = \{w \in \{0,1\}^* \mid w \text{ contains the same number of 0's and 1's}\}$.

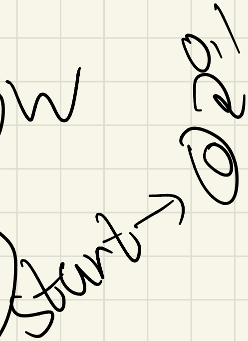
9. [10 points] Prove or disprove: if L_1 is CFL and $L_1 \cup L_2$ is also CFL, then L_2 must be CFL.

10. [10 points] Design Turing machine for the language $\{0^{2n}1^n \mid n \geq 0\}$.

$\Sigma = \{0,1\}$

$L_1 = \{ww \mid w \in \Sigma^*\}$ $(0+1)^*$

not ww



$L_2 = \overline{L_1}$

$L_1 \cup L_2 = \Sigma^*$

L_1

$L_2 = \Sigma^*$

$L_1 \cup L_2 = \Sigma^*$

OP

$L_1 \text{ OP } L_2 = L_3$

× √

$L_1 \cup L_2 = L_3$

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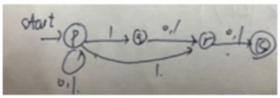
Design a DFA for the language L = {w∈{0,1}* | w contains both 01 and 10 as substrings}.

Design a NFA within four states for the language {a}*∪{ab}*.

Design regular expressions for language over Σ = {0,1}.
(1).All strings contain the substring 001.
(2).All strings expect the string 001.

Prove that $L = \{0^m1^n \mid m/n \text{ is an integer}\}$ is not regular with pumping lemma.

Convert the following NFA into DFA with subset construction.



Give a context-free grammar for $L = \{ a^ib^jc^{i+j} \mid i,j>=0\}$

Let L be the language generated by the grammar G below
S->AB|BBB
A->Bb|ε
B->aB|A
(1).消除空产生式
(2).消除单元产生式
(3).转换到CNF

Design a PDA for L = {w∈{a,b}*|w has more a's than b's}

Prove : for every context free language L, the language $L' = \{0^{|w|} \mid w \in L\}$ is also context free.

Design a Turing Machine that computes the following function $f:0^n$->Binary(n)
Where integer n>=1 and binary(n) is the binary representation of n.
For example: $f(0^3) = 11$ $f(0^5) = 101$.

Prove : for every context free language L, the language $L' = \{0^{|w|} \mid w \in L\}$ is also context free.

构造映射 $h: \Sigma \to \Sigma^*$ $\Sigma = \{0, 1\}$

令 $h(0) = 0$ $h(1) = 0$

$h(L) = \{0^{|w|} \mid w \in L\} = L'$

归纳前提 $|w| = 1$ 时

$h(0) = 0$, $h(1) = 0$

故 $|w| = 1$ 时, $h(w) = \{0\}$

假设 $|w| = k$ 时，命题成立， $w = x$

$w = xa$ $a = 0$ 或 1

$$h(xa) = h(x)h(a)$$
$$= \{0^{|x|}0^1\}$$
$$= \{0^{|x|+1}\} = \{0^{k+1}\}$$

$|0|$

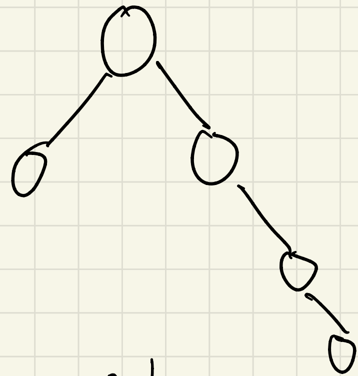
$\therefore h(L) = L'$

$(0 \mid 1 + 10)^* (0 + 1 + \varepsilon)$

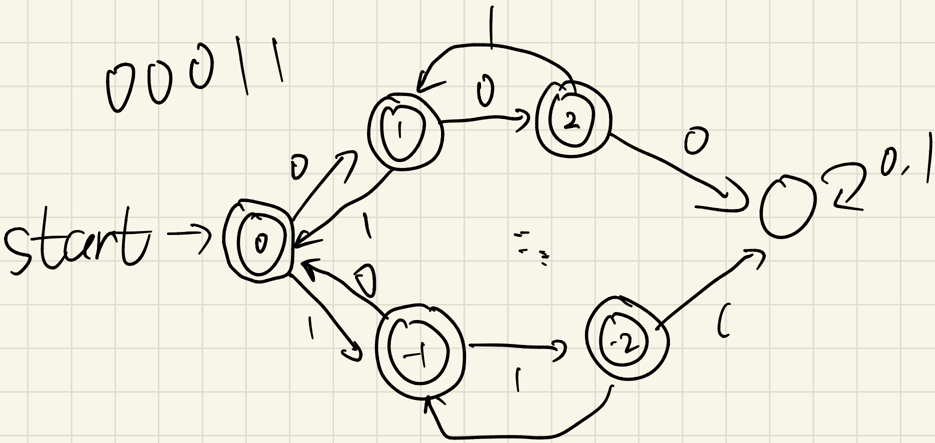
0101 0111

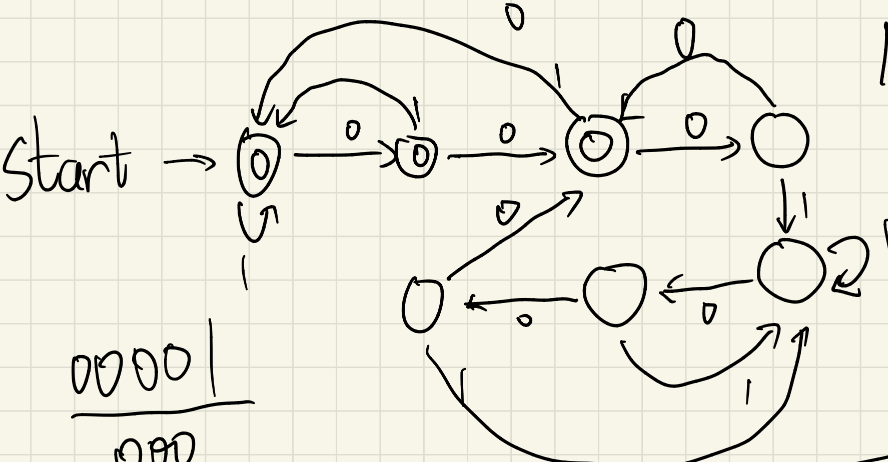
0000

[0110]



00011





11000 or 0

$\frac{00001}{000}$

~~000+00001+00010+00100+01000+10000)*~~

$(0+10)^*(1+10)^*$

① ②

start → ⓪

$00+11$

1001101

$(a+b+c)^* a (a+b+c)^* b (a+b+c)^*$

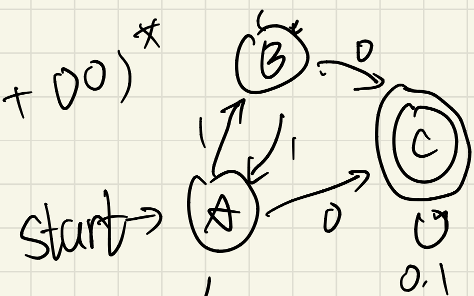
+ ~ b ~ a ~

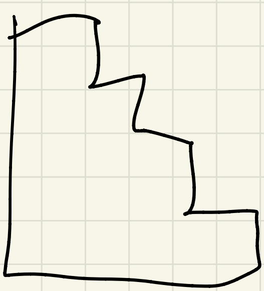
$(0+1)^* 1 (0+1)^9$

$(10+0)^*(11+\varepsilon)(01+0)^*$

$1^* (1^* 0 1^* 0 1^* 0 1^* 0 1^* 0 1^*)^* 1^*$

$(1+00)^*$





B	~~A~~B	
C	X	X
	A	B

$A : C \Rightarrow D \cdot E$

$D : E \Rightarrow A \cdot C$