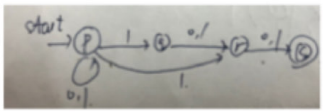
哈尔滨工业大学2019年《形式语言与自动机》期末试题

1. Design a DFA for the language L = {w∈{0,1}* | w contains both 01 and 10 as substrings}.
2. Design a NFA within four states for the language {a}*∪{ab}*.
3. Design regular expressions for language over Σ = {0,1}.
   (1).All strings contain the substring 001.
   (2).All strings expect the string 001.
4. Prove that L = {0^m1^n | m/n is an integer} is not regular with pumping lemma.
5. Convert the following NFA into DFA with subset construction.



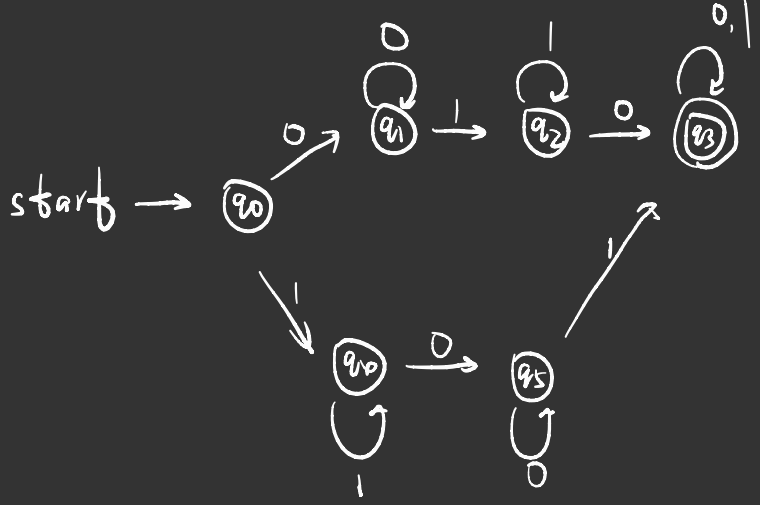
6. Give a context-free grammar for L = { $a^ib^jc^{i+j}$|i,j>=0}
7. Let L be the language generated by the grammar G below
   S->AB|BBB
   A->Bb|ε
   B->aB|A
   (1).消除空产生式
   (2).消除单元产生式
   (3).转换到CNF
8. Design a PDA for L = {w∈{a,b}*|w has more a’ s than b’ s}
9. Prove : for every context free language L, the language L’ = {$0^{|w|}$|w∈L} is also context free.
10. 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.

查看原图(355K)

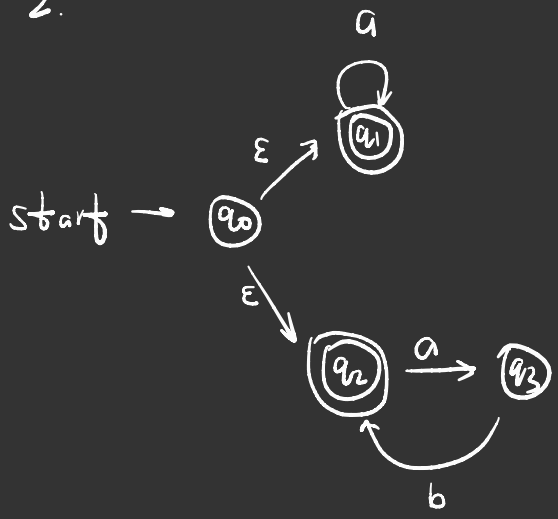
1.

0 000 1 1 1 0

1 0 - - 1



2.



3.

(1) $(0+1)^*001\,(0+1)^*$

(2) $(0+1)^4\,(0+1)^*$

$+\,(0+1)^1 + (0+1)^2 + 000 + 010$

$+\,011 + 100 + 101 + 110 + 111$

4. ① 假设 L 是正则语言

② 取 $W = 0^{2N}1^{2N}$，$2N/2N = 1$，故 $W \in L$

③ $|W| = 4N \geq N$，

④ 故 $\exists x, y, z$，使得 $W = xyz$ 且满足 $|y| > 0$，$|xy| \leq N$

$\forall i \in N$，$xy^i z \in L$

⑤ 即 $|xy| \leq N$，不妨设 $x = 0^a$，$y = 0^b$，

有 $a \geq 0$，$b > 0$，$a + b \leq N$

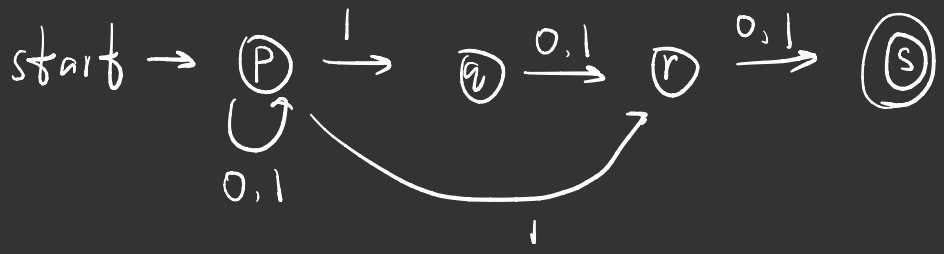
⑥ $xy^2z = 0^{2N+b}0^{2N}$

$2N < 2N + b \leq 3N$

即 $2N < 2N + b < 4N$，故 $(2N+b)/2N$ 不是整数

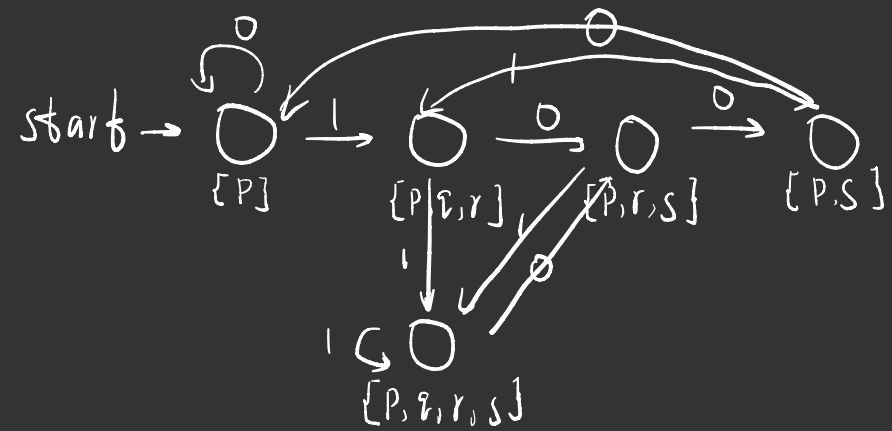
⑦ 不满足泵引理，故 L 不是正则语言

5.



	0	1
→ P	[P]	[P, q, r]
q	[r]	[r]
r	[s]	[s]
* S	∅	∅

	0	1
→ [P]	[P]	[P, q, r]
[P, q, r]	[P, r, S]	[P, q, r, s]
*[P, r, S]	[P, S]	[P, q, r, s]
*[P, q, r, s]	[P, r, s]	[P, q, r, s]
*[P, S]	[P]	[P, q, r]



6. $S \to aSc \mid D$

$D \to bDc \mid \varepsilon$

7. $S \to AB \mid BBB$

$A \to Bb \mid \varepsilon$

$B \to aB \mid A$

(1) 消空

$S \to AB \mid A \mid B \mid BBB \mid BB$

$A \to Bb \mid b$

$B \to aB \mid a \mid A$

(2) 消单元

$S \to AB \mid Bb \mid b \mid aB \mid a \mid BBB \mid BB$

$A \to Bb \mid b$

$B \to aB \mid a \mid Bb \mid b$

(2) 消单元

$S \to AB \mid Bb \mid b \mid aB \mid a \mid BBB \mid BB$

$A \to Bb \mid b$

$B \to aB \mid a \mid Bb \mid b$

(3) $S \to AB \mid BC_b \mid b \mid C_aB \mid a \mid D_bB \mid BB$

$C_a \to a$

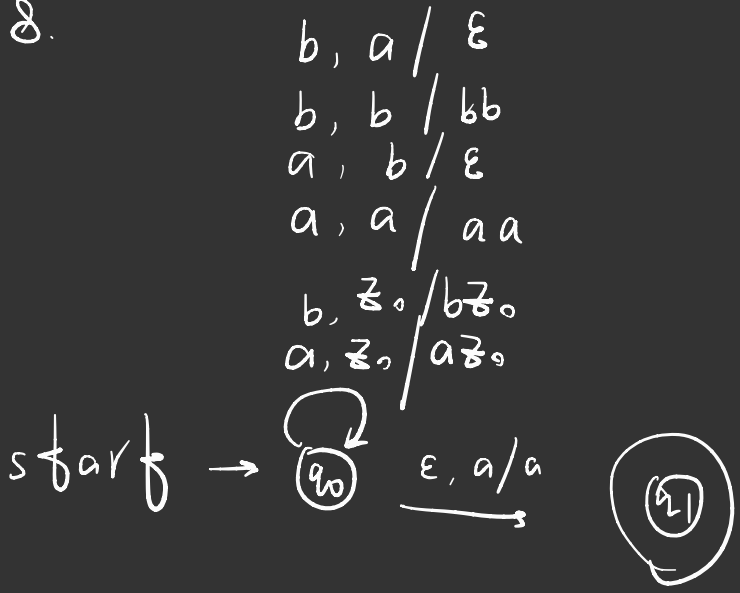
$C_b \to b$

$D_b \to BB$

$A \to BC_b \mid b$

$B \to C_aB \mid a \mid BC_b \mid b$

8.



9. 有同态

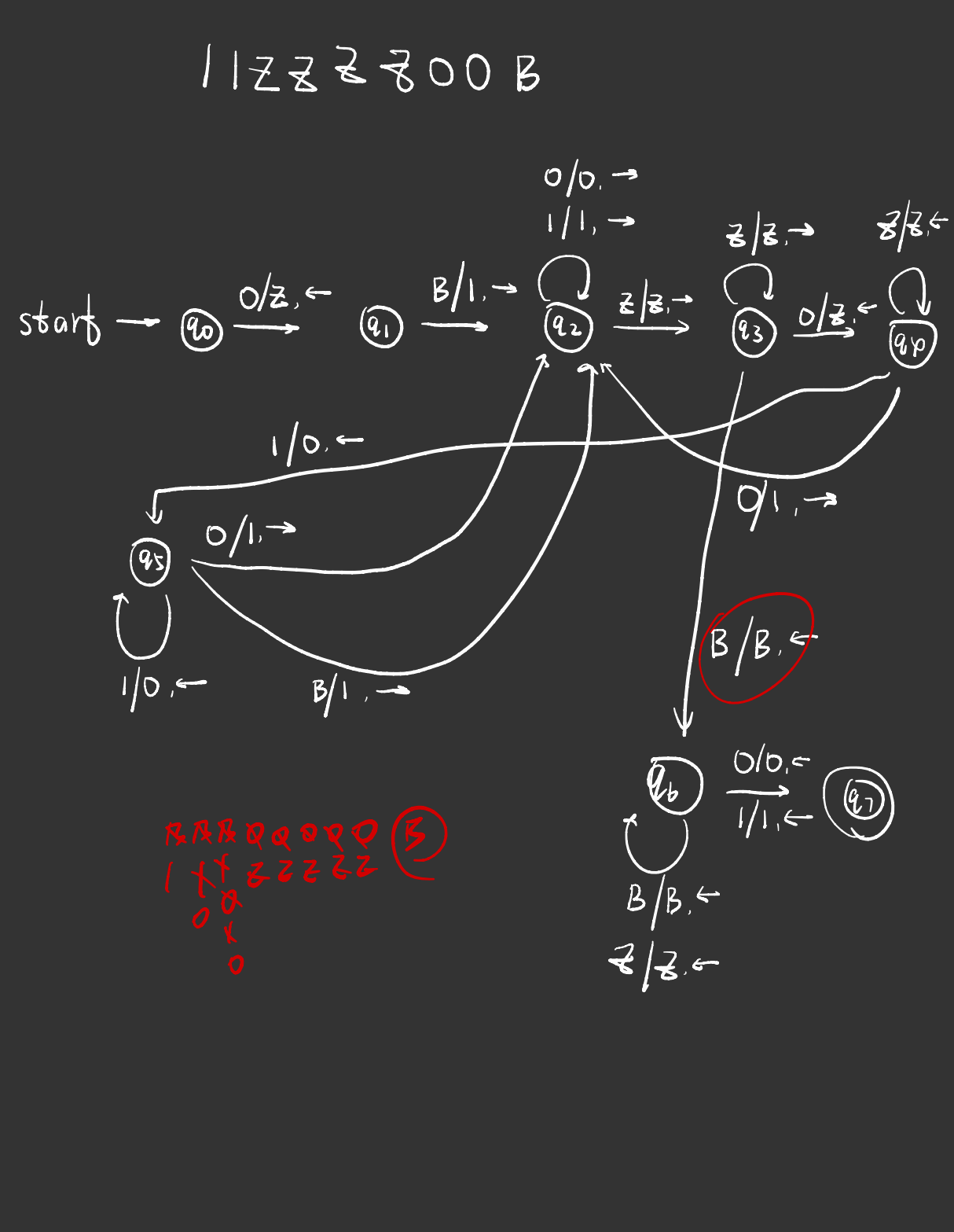
$h(a) = 0$

即 $h(w) = 0^{|w|}$

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

由于 CFL 对同态封闭.

L 是 CFL, 和 L' 也是 CFL


start
q0
q1
q2
q3
qp
q5
q6
q7
0/Z, ←
B/1, →
0/0, →
1/1, →
Z/Z, →
Z/Z, ←
0/Z, ←
1/0, ←
0/1, →
1/1, →
1/0, ←
B/1, →
B/B, ←
0/0, ←
1/1, ←
B/B, ←
Z/Z, ←