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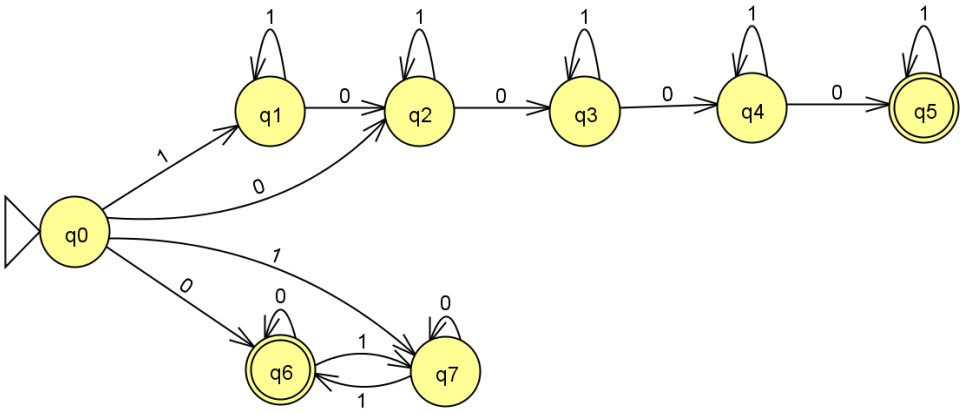
Projetos
LFA / Teoria da Computação

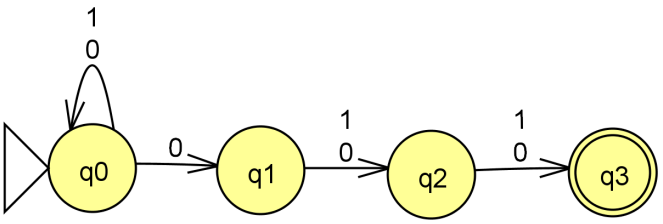
Projeto 03

.: Projetar um NFA para as seguintes linguagens (considere $\Sigma = \{0, 1\}$).

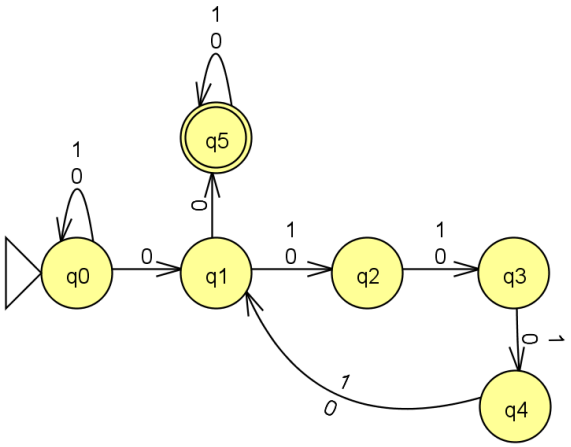
A) L_1 = {w | w contém exatamente 4 0's ou um número par de 1's} (8 estados)



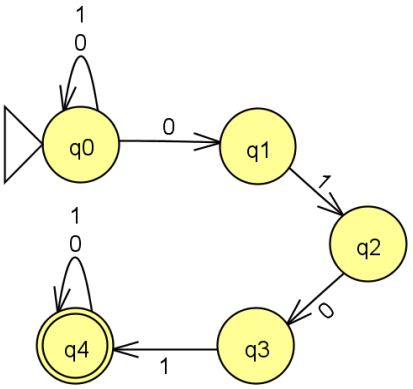
B) L_2 = {w | w possui o terceiro símbolo a partir da direita igual a 0} (4 estados)



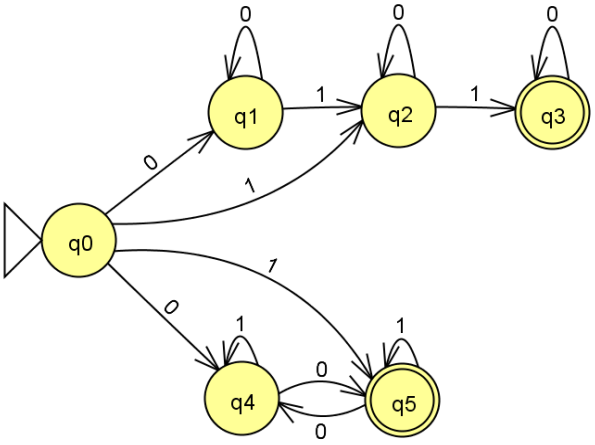
C) L_3 = {w | w possui dois 0's separados por um string de comprimento 4i para algum i ≥ 0} (6 estados)



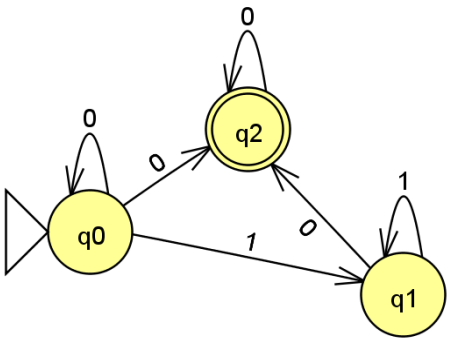
D) L_4 = {w | w contém a substring 0101} (5 estados)



E) L_5 = {w | w contém um número par de 0's ou exatamente dois 1's} (6 estados)



F) L_6 = {w | w = 0*1*0*0} (3 estados)[2]



[2] 0*, por exemplo, significa que pode haver qualquer quantidade de 0's (inclusive nenhum).

.: Função de Transição Estendida para NFAs

Para cada string, aplicar a função de transição estendida para verificar se a string pertence à

linguagem.

A) L1 => 00100, 1100

$\hat{\delta}(q0,\ 00100) = \delta(\hat{\delta}(q0,\ 0010),\ 0) = \delta(q4, 0) \cup \delta(q7, 0) = \{q5\} \cup \{q7\} = \{q5, q7\}$
$\hat{\delta}(q0,\ 0010) = \delta(\hat{\delta}(q0,\ 001),\ 0) = \delta(q3, 0) \cup \delta(q7, 0) = \{q4\} \cup \{q7\} = \{q4, q7\}$
$\hat{\delta}(q0,\ 001) = \delta(\hat{\delta}(q0,\ 00),\ 1) = \delta(q3, 1) \cup \delta(q6, 1) = \{q3\} \cup \{q7\} = \{q3, q7\}$
$\hat{\delta}(q0,\ 00) = \delta(\hat{\delta}(q0,\ 0),\ 0) = \delta(q2, 0) \cup \delta(q6, 0) = \{q3\} \cup \{q6\} = \{q3, q6\}$
$\hat{\delta}(q0,\ 0) = \delta(\hat{\delta}(q0,\ \epsilon),\ 0) = \delta(q0,\ 0) = \{q2,\ q6\}$
$\hat{\delta}(q0,\ \epsilon) = \{q0\}$
✅ Aceito

$\hat{\delta}(q0,\ 1100) = \delta(\hat{\delta}(q0,\ 110),\ 0) = \delta(q2, 0) \cup \delta(q6, 0) = \{q3\} \cup \{q6\} = \{q3, q6\}$
$\hat{\delta}(q0,\ 110) = \delta(\hat{\delta}(q0,\ 11),\ 0) = \delta(q1, 0) \cup \delta(q6, 0) = \{q2\} \cup \{q6\} = \{q2, q6\}$
$\hat{\delta}(q0,\ 11) = \delta(\hat{\delta}(q0,\ 1),\ 1) = \delta(q1, 1) \cup \delta(q7, 1) = \{q1\} \cup \{q6\} = \{q1, q6\}$
$\hat{\delta}(q0,\ 1) = \delta(\hat{\delta}(q0,\ \epsilon),\ 1) = \delta(q0,\ 1) = \{q1,\ q7\}$
$\hat{\delta}(q0,\ \epsilon) = \{q0\}$
✅ Aceito

B) L2 => 0011, 0100

$\hat{\delta}(q0,\ 0011) = \delta(\hat{\delta}(q0,\ 001),\ 1) = \delta(q0,1) \cup \delta(q2,1) \cup \delta(q3,1) = \{q0\} \cup \{q3\} \cup \{\epsilon\} = \{q0, q3\}$
$\hat{\delta}(q0,\ 001) = \delta(\hat{\delta}(q0,\ 00),\ 1) = \delta(q0,1) \cup \delta(q1,1) \cup \delta(q2,1) = \{q0\} \cup \{q2\} \cup \{q3\} = \{q0, q2, q3\}$
$\hat{\delta}(q0,\ 00) = \delta(\hat{\delta}(q0,\ 0),\ 0) = \delta(q0,0) \cup \delta(q1,0) = \{q0, q1\} \cup \{q2\} = \{q0, q1, q2\}$
$\hat{\delta}(q0,\ 0) = \delta(\hat{\delta}(q0,\ \epsilon),\ 0) = \delta(q0,\ 0) = \{q0,\ q1\}$
$\hat{\delta}(q0,\ \epsilon) = \{q0\}$
✅ Aceito

$\hat{\delta}(q0,\ 0100) = \delta(\hat{\delta}(q0,\ 010),\ 0) = \delta(q0,0) \cup \delta(q1,0) \cup \delta(q3,0) = \{q0, q1\} \cup \{q2\} \cup \{\epsilon\} = \{q0, q1, q2\}$
$\hat{\delta}(q0,\ 010) = \delta(\hat{\delta}(q0,\ 01),\ 0) = \delta(q0,0) \cup \delta(q2,0) = \{q0, q1\} \cup \{q3\} = \{q0, q1, q3\}$
$\hat{\delta}(q0,\ 01) = \delta(\hat{\delta}(q0,\ 0),\ 1) = \delta(q0,1) \cup \delta(q1,1) = \{q0\} \cup \{q2\} = \{q0, q2\}$
$\hat{\delta}(q0,\ 0) = \delta(\hat{\delta}(q0,\ \epsilon),\ 0) = \delta(q0,\ 0) = \{q0,\ q1\}$
$\hat{\delta}(q0,\ \epsilon) = \{q0\}$
❌ Não Aceito

C) L3 => 0101, 0101101

$\hat{\delta}(q0,\ 0101) = \delta(\hat{\delta}(q0,\ 010),\ 1) = \delta(q0,1) \cup \delta(q1,1) \cup \delta(q3,1) = \{q0, q1\} \cup \{q2\} \cup \{\epsilon\} = \{q0, q1, q2\}$
$\hat{\delta}(q0,\ 010) = \delta(\hat{\delta}(q0,\ 01),\ 0) = \delta(q0,0) \cup \delta(q2,0) = \{q0, q1\} \cup \{q3\} = \{q0, q1, q3\}$
$\hat{\delta}(q0,\ 01) = \delta(\hat{\delta}(q0,\ 0),\ 1) = \delta(q0,1) \cup \delta(q1,1) = \{q0\} \cup \{q2\} = \{q0, q2\}$
$\hat{\delta}(q0,\ 0) = \delta(\hat{\delta}(q0,\ \epsilon),\ 0) = \delta(q0,\ 0) = \{q0,\ q1\}$
$\hat{\delta}(q0,\ \epsilon) = \{q0\}$
❌ Não Aceito

$\hat{\delta}(q0, 0101101) = \delta(\hat{\delta}(q0, 010110), 1) = \delta(q0,1) \cup \delta(q1,1) \cup \delta(q4,1) \cup \delta(q5,1) = \{q0\} \cup \{q2\} \cup \{q1\} \cup \{q5\} = \{q0, q2, q1, q5\}$
$\hat{\delta}(q0,\ 010110) = \delta(\hat{\delta}(q0,\ 01011),\ 0) = \delta(q0,0) \cup \delta(q3,0) \cup \delta(q1,0) = \{q0, q1\} \cup \{q4\} \cup \{q5\} = \{q0, q1, q4, q$
$\hat{\delta}(q0,\ 01011) = \delta(\hat{\delta}(q0,\ 0101),\ 1) = \delta(q0,1) \cup \delta(q2,1) \cup \delta(q4,1) = \{q0\} \cup \{q3\} \cup \{q1\} = \{q0, q3, q1\}$
$\hat{\delta}(q0,\ 0101) = \delta(\hat{\delta}(q0,\ 010),\ 1) = \delta(q0,1) \cup \delta(q1,1) \cup \delta(q3,1) = \{q0\} \cup \{q2\} \cup \{q4\} = \{q0, q2, q4\}$
$\hat{\delta}(q0,\ 010) = \delta(\hat{\delta}(q0,\ 01),\ 0) = \delta(q0,0) \cup \delta(q2,0) = \{q0, q1\} \cup \{q3\} = \{q0, q1, q3\}$
$\hat{\delta}(q0,\ 01) = \delta(\hat{\delta}(q0,\ 0),\ 1) = \delta(q0,1) \cup \delta(q1,1) = \{q0\} \cup \{q2\} = \{q0, q2\}$
$\hat{\delta}(q0,\ 0) = \delta(\hat{\delta}(q0,\ \epsilon),\ 0) = \delta(q0,\ 0) = \{q0,\ q1\}$
$\hat{\delta}(q0,\ \epsilon) = \{q0\}$
✅ Aceito

D) L4 => 0001, 00101

$\hat{\delta}(q0,\ 0001) = \delta(\hat{\delta}(q0,\ 000),\ 1) = \delta(q0,1) \cup \delta(q1,1) = \{q0\} \cup \{q2\} = \{q0, q2\}$
$\hat{\delta}(q0,\ 000) = \delta(\hat{\delta}(q0,\ 00),\ 0) = \delta(q0,0) \cup \delta(q1,0) = \{q0, q1\} \cup \{\epsilon\} = \{q0, q1\}$
$\hat{\delta}(q0,\ 00) = \delta(\hat{\delta}(q0,\ 0),\ 0) = \delta(q0,0) \cup \delta(q1,0) = \{q0, q1\} \cup \{\epsilon\} = \{q0, q1, \epsilon\}$
$\hat{\delta}(q0,\ 0) = \delta(\hat{\delta}(q0,\ \epsilon),\ 0) = \delta(q0,\ 0) = \{q0,\ q1\}$
$\hat{\delta}(q0,\ \epsilon) = \{q0\}$
❌ Não Aceito

$\hat{\delta}(q0,\ 00101) = \delta(\hat{\delta}(q0,\ 0010),\ 1) = \delta(q0,1) \cup \delta(q1,1) \cup \delta(q3,1) = \{q0\} \cup \{q2\} \cup \{q4\} = \{q0, q2, q4\}$
$\hat{\delta}(q0,\ 0010) = \delta(\hat{\delta}(q0,\ 001),\ 0) = \delta(q0,0) \cup \delta(q2,0) = \{q0, q1\} \cup \{q3\} = \{q0, q1, q3\}$
$\hat{\delta}(q0,\ 001) = \delta(\hat{\delta}(q0,\ 00),\ 1) = \delta(q0,1) \cup \delta(q1,1) = \{q0\} \cup \{q2\} = \{q0, q2\}$
$\hat{\delta}(q0,\ 00) = \delta(\hat{\delta}(q0,\ 0),\ 0) = \delta(q0,0) \cup \delta(q1,0) = \{q0, q1\} \cup \{\epsilon\} = \{q0, q1\}$
$\hat{\delta}(q0,\ 0) = \delta(\hat{\delta}(q0,\ \epsilon),\ 0) = \delta(q0,\ 0) = \{q0,\ q1\}$
$\hat{\delta}(q0,\ \epsilon) = \{q0\}$
✅ Aceito

E) L5 => 0001, 0101

$\hat{\delta}(q0,\ \epsilon) = \{q0\}$
$\hat{\delta}(q0,\ 0) = \delta(\hat{\delta}(q0,\ \epsilon),\ 0) = \{q1,\ q4\}$
$\hat{\delta}(q0,\ 00) = \delta(\hat{\delta}(q0,\ 0),\ 0) = \delta(q1,\ 0) \cup \delta(q4,\ 0) = \{q1,\ q5\}$
$\hat{\delta}(q0,\ 000) = \delta(\hat{\delta}(q0,\ 00),\ 0) = \delta(q1,\ 0) \cup \delta(q5,\ 0) = \{q1,\ q4\}$
$\hat{\delta}(q0,\ 0001) = \delta(\hat{\delta}(q0,\ 000),\ 1) = \delta(q1,\ 1) \cup \delta(q4,\ 1) = \{q2,\ q4\}$
❌ Não Aceito

$\hat{\delta}(q0,\ \epsilon) = \{q0\}$
$\hat{\delta}(q0,\ 0) = \delta(\hat{\delta}(q0,\ \epsilon),\ 0) = \{q1,\ q4\}$
$\hat{\delta}(q0,\ 01) = \delta(\hat{\delta}(q0,\ 0),\ 1) = \delta(q1,\ 1) \cup \delta(q4,\ 1) = \{q2,\ q4\}$
$\hat{\delta}(q0,\ 010) = \delta(\hat{\delta}(q0,\ 01),\ 0) = \delta(q2,\ 0) \cup \delta(q4,\ 0) = \{q2,\ q5\}$
$\hat{\delta}(q0,\ 0101) = \delta(\hat{\delta}(q0,\ 010),\ 1) = \delta(q2,\ 1) \cup \delta(q5,\ 1) = \{q3,\ q5\}$
✅ Aceito

F) L6 => 00110, 01010

$\hat{\delta}(q0,\ \epsilon) = \{q0\}$
$\hat{\delta}(q0,\ 0) = \delta(\hat{\delta}(q0,\ \epsilon),\ 0) = \{q0,\ q2\}$
$\hat{\delta}(q0,\ 00) = \delta(\hat{\delta}(q0,\ 0),\ 0) = \delta(q0,\ 0) \cup \delta(q2,\ 0) = \{q0,\ q2\}$
$\hat{\delta}(q0,\ 001) = \delta(\hat{\delta}(q0,\ 00),\ 1) = \delta(q0,\ 1) \cup \delta(q2,\ 1) = \{q1\}$
$\hat{\delta}(q0,\ 0011) = \delta(\hat{\delta}(q0,\ 001),\ 1) = \delta(q1,\ 1) = \{q1\}$
$\hat{\delta}(q0,\ 00110) = \delta(\hat{\delta}(q0,\ 0011),\ 0) = \delta(q1,\ 0) = \{q2\}$
✅ Aceito

$\hat{\delta}(q0,\ \epsilon) = \{q0\}$
$\hat{\delta}(q0,\ 0) = \delta(\hat{\delta}(q0,\ \epsilon),\ 0) = \{q0,\ q2\}$
$\hat{\delta}(q0,\ 01) = \delta(\hat{\delta}(q0,\ 0),\ 1) = \delta(q0,\ 1) \cup \delta(q2,\ 1) = \{q1\}$
$\hat{\delta}(q0,\ 010) = \delta(\hat{\delta}(q0,\ 01),\ 0) = \delta(q1,\ 0) = \{q2\}$
$\hat{\delta}(q0,\ 0101) = \delta(\hat{\delta}(q0,\ 010),\ 1) = \delta(q2,\ 1) = \{\}$
$\hat{\delta}(q0,\ 01010) = \delta(\hat{\delta}(q0,\ 0101),\ 0) = \{\}$
❌ Não Aceito