FU08 - Automata and Languages
Exercise 6

NGUYEN Tuan Dung
s1312004

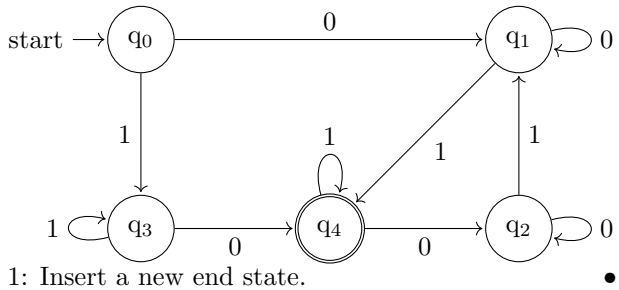
December 27, 2024

Question 1: Convert the folowing finite automata into equivalent regular expressions

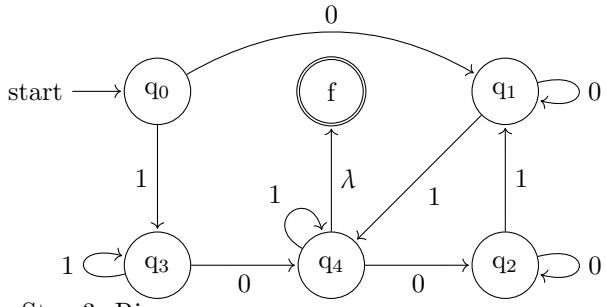
$M = (Q, \sum, \delta, q_0, F)$ with
$Q = \{q_0, q_1, q_2, q_3, q_4\}$
$\sum = \{0, 1\}$
$F = \{q_4\}$, and δ is defined by

δ	0	1
q_0	q_1	q_3
q_1	q_1	q_4
q_2	q_2	q_1
q_3	q_4	q_3
q_4	q_2	q_4

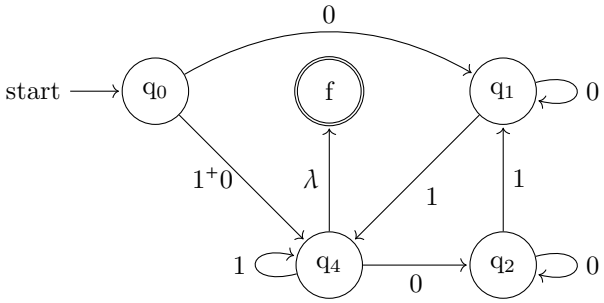
Solution:
From the state transition table, we construct the DFA.



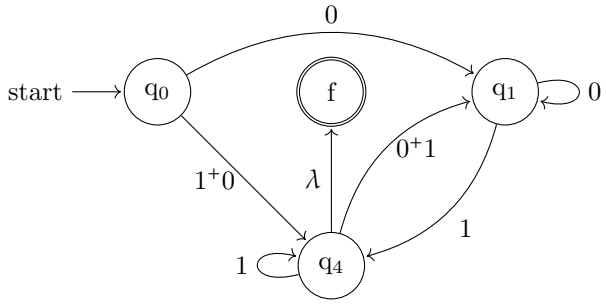
- Step 1: Insert a new end state.



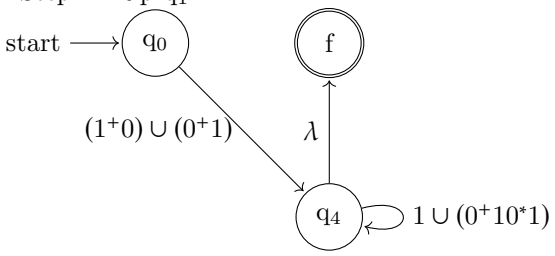
- Step 2: Rip q_3.



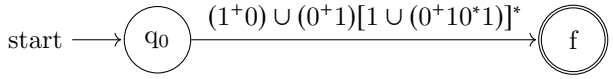
- Step 3: Rip q_2.



- Step 4: Rip q_1.



- Step 5: Rip q_4.



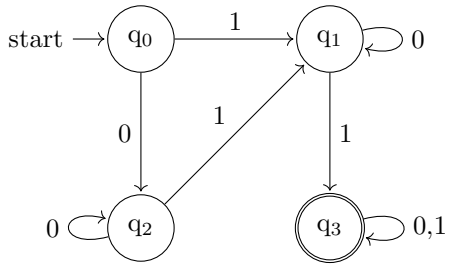
$\Longrightarrow$ Hence, the regular expression for the finite automata is: $(1^+0) \cup (0^+1)[1 \cup (0^+10^*1)]^*$.

Question 2: Convert the folowing finite automata into equivalent regular expressions

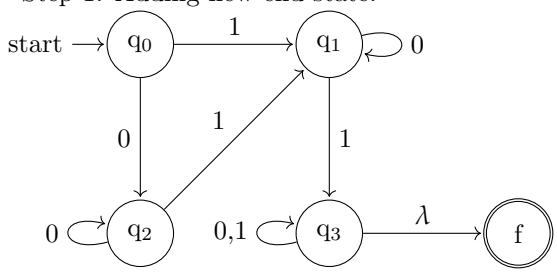
$M = (Q, \sum, \delta, q_0, F)$ with
$Q = \{q_0, q_1, q_2, q_3\}$
$\sum = \{0, 1\}$
$F = \{q_3\}$, and delta is defined by

δ	0	1
q_0	q_2	q_1
q_1	q_1	q_3
q_2	q_2	q_1
q_3	q_3	q_3

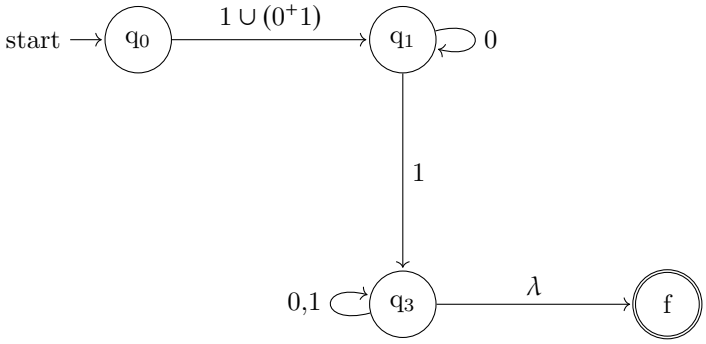
Solution:
From the state transition table, we construct the NFA.



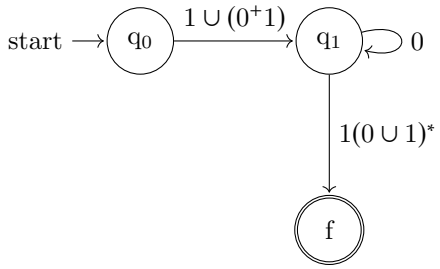
- Step 1: Adding new end state.



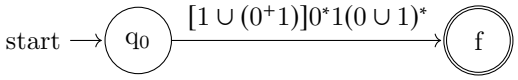
- Step 2: Rip q_2.



- Step 3: Rip q_3.



- Step 4: Rip q_1.



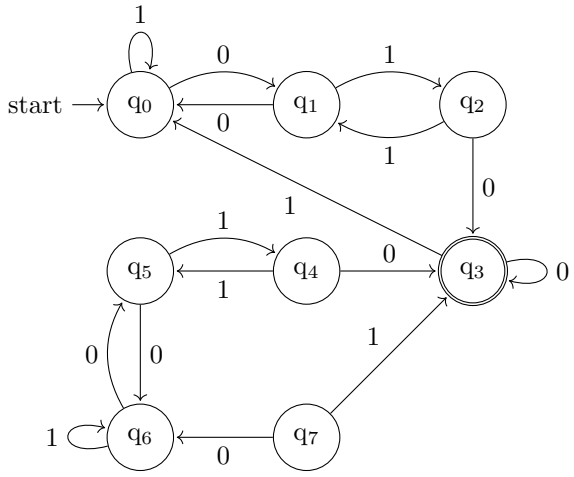
$\Longrightarrow$ Hence, the regular expression for the finite automata is: $[1 \cup (0^+1)]0^*1(0 \cup 1)^*$.

Question 3: Convert the folowing finite automata into equivalent regular expressions

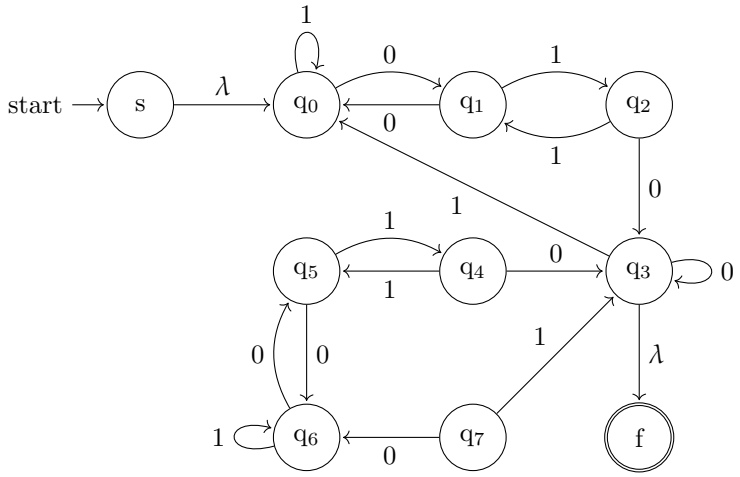
$M = (Q, \sum, \delta, q_0, F)$ with
$Q = \{q_0, q_1, q_2, q_3, q_4, q_5, q_6, q_7\}$
$\sum = \{0, 1\}$
$F = \{q_3\}$, and δ is defined by

δ	0	1
q_0	q_1	q_0
q_1	q_0	q_2
q_2	q_3	q_1
q_3	q_3	q_0
q_4	q_3	q_5
q_5	q_6	q_4
q_6	q_5	q_6
q_7	q_6	q_3

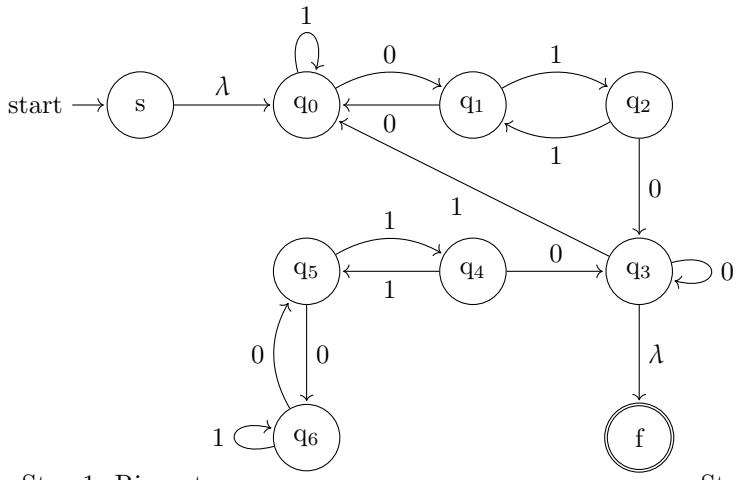
Solution:
From the above information, let us construct the corresponding NFA.



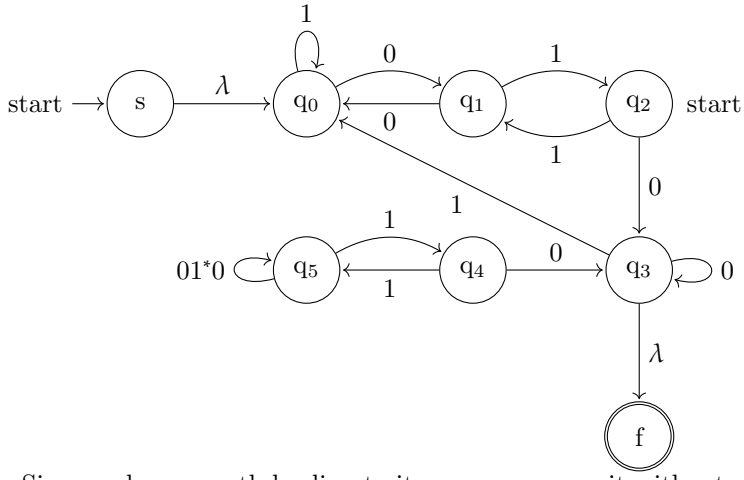
Let us insert new ending state and starting state.



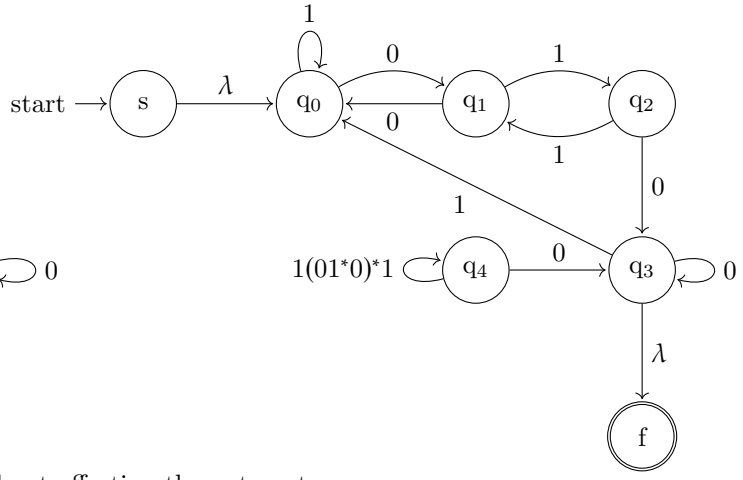
• Since q_7 has no path leading to it, we can remove it without affecting the automaton.



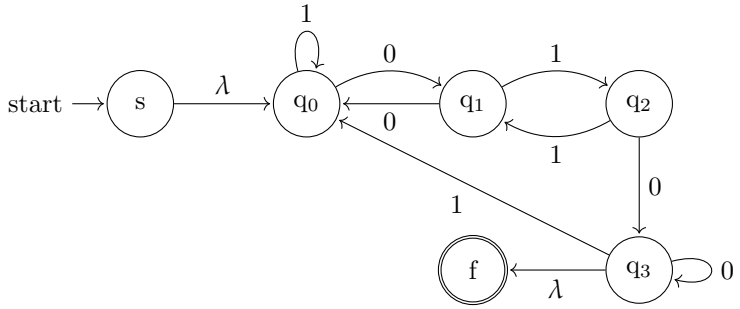
• Step 1: Rip out q_6.



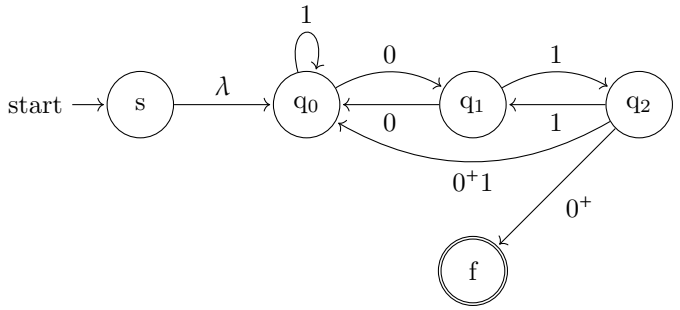
• Step 2: Rip out q_5.



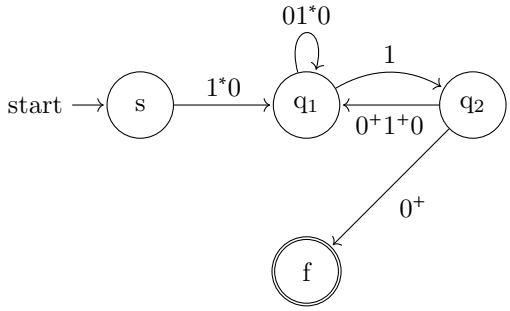
• Since q_4 has no path leading to it, we can remove it without affecting the automaton.



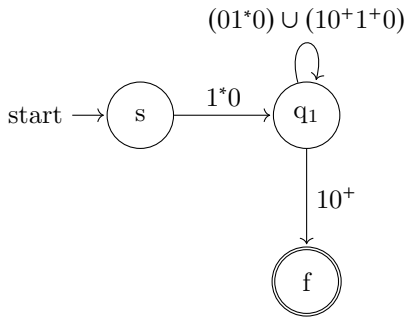
• Step 3: Rip q_3.



• Step 4: Rip q_0.



• Step 5: Rip q_2.



• Step 6: Rip q_1.