CS338 HW1

Brock Ellefson

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1.1 State Diagrams of DFA

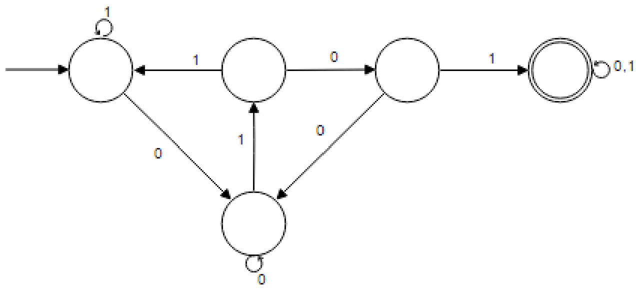

Figure 1: {w|w contains the substring 0101 (i.e., w = x0101y for some x and y)}

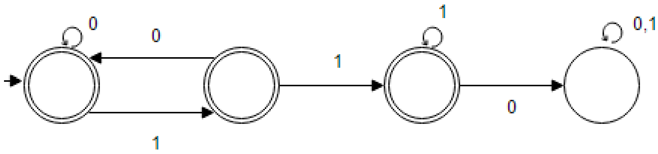

Figure 2: {w|w doesn't contain the substring 110}

1.2 State Diagrams of NFA

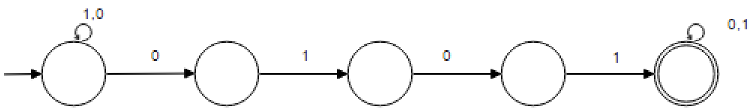

Figure 3: {w|w contains the substring 0101 (i.e., w = x0101y for some x and y)}

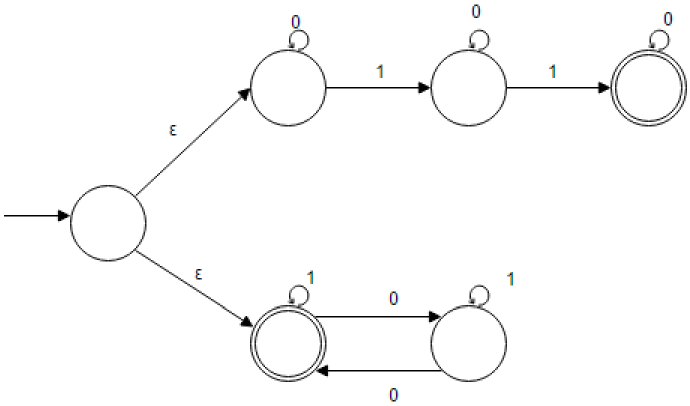

Figure 4: {w|w has either an even amount of 0's or exactly 2 1's}

2 NFA to DFA

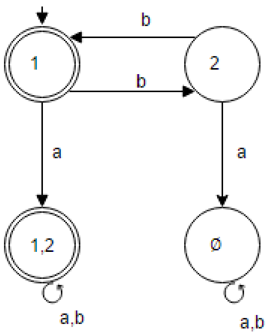

Figure 5: 1.16 part a

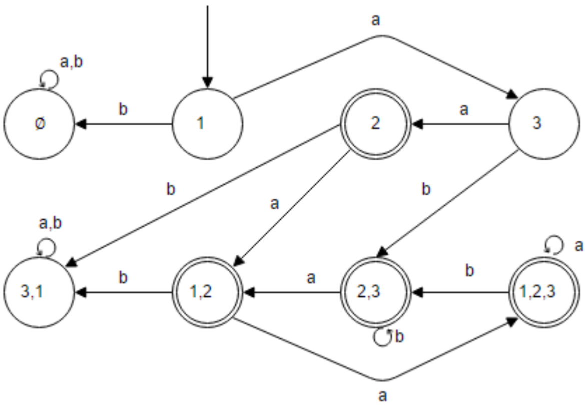

Figure 6: 1.16 part b

3 Regular Expression to NFA

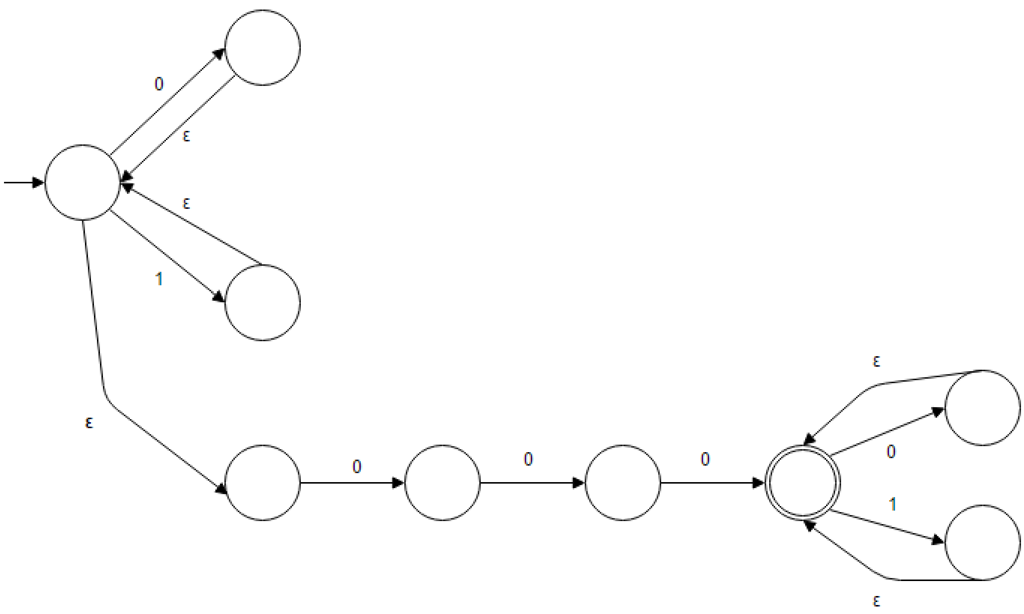

Figure 7: (0 U 1)∗ 000 (0 U 1)∗

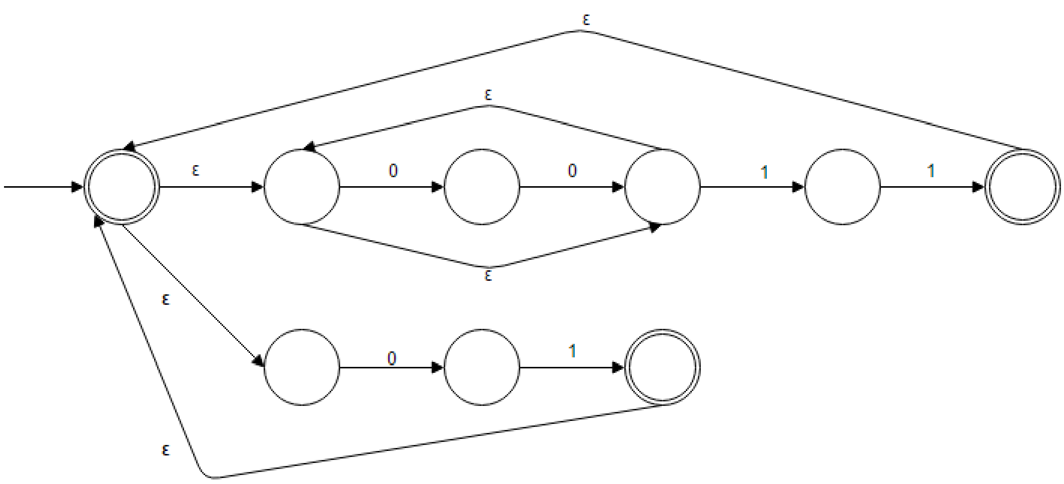

Figure 8: (((00)∗(11)) U 01)∗

4 Finite Automata to Regular Expression

(a^*ba^*) U $(a^*ba^*b)^*a^*ba^*$

5 Pumping Lemma

5.1 A = $\{a^{n3}|n \geq 0\}$

Assume that A is a regular language. S = a^{p3}
By the pumping lemma, S can be decomposed into xyz such that
$xy^iz \in A$
$|y| > 0$
$|xy| \leq P$
As $xy^iz \in A$, y can only contains 1 'a' per pump
So, if we pump 2 times (i = 2),
xyz:
00000000
xyyz:
000000000
Then there will be 9 'a's after the second pump. This is not in the language.
This contradicts the pumping lemma
Therefore B is not a regular language.

5.2 B = $\{0^n1^m0^n|m,n \geq 0\}$

Assume that B is a regular language. S = 0^p10^p
By the pumping lemma, S can be decomposed into xyz such that
$xy^iz \in A$
$|y| > 0$
$|xy| \leq P$

As $|xy| \leq P$, y can only contains $k > 0$ amount of 0's.
So, if we pump 0 times (i = 0),
xy^0z
Then there will be 0^{p-k} on the first set of 0's and 0^p on the second set of 0's
This contradicts the pumping lemma
Therefore B is not a regular language.