Compiles construction

Assignment 2

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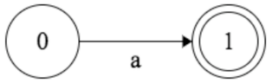
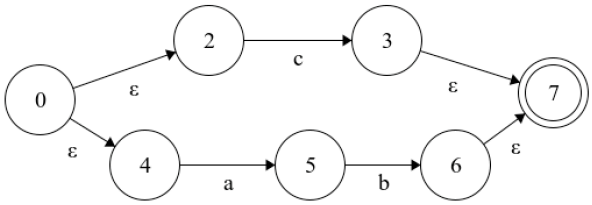
Regex to NFA (using Thompson's Construction)

We are going to generate a NFA based on the regex a(c|ab)*, but first we will split the regex in smaller automatons.

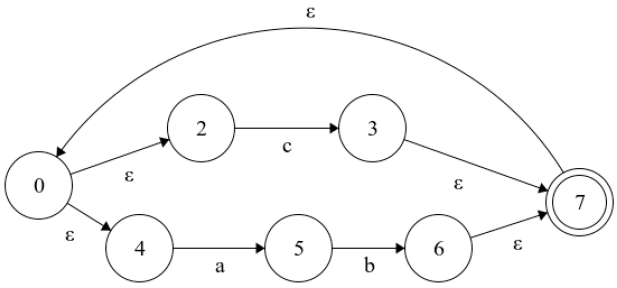
1. [a] -> a(c|ab)*



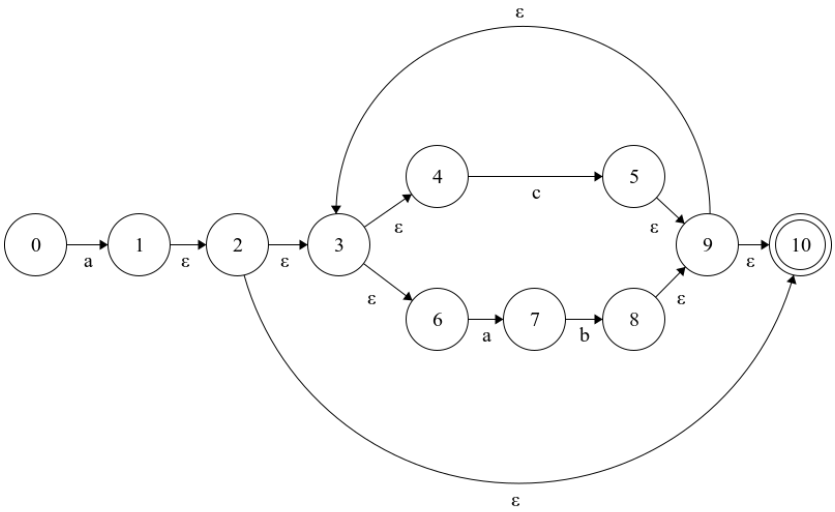
2. [c|ab] -> a(c|ab)*



3. [(c|ab)*] -> a(c|ab)*



We can now complete the NFA from the parts we created.



NFA to DFA (using Subset Construction)

1. E-closures from states given in the NFA:

For each state in Q', find the possible set of states for each input symbol using transition function of NFA. If this set of states is not in Q', add it to Q'.

state	e-closures
0	{0}
1	{1, 2, 3, 4, 6, 10}
2	{2, 3, 4, 6, 10}
3	{3, 4, 6}
4	{4}
5	{5, 9, 3, 4, 6, 10}
6	{6}
7	{7}
8	{8, 9, 3, 4, 6, 10}
9	{9, 3, 4, 6, 10}
10	{10}

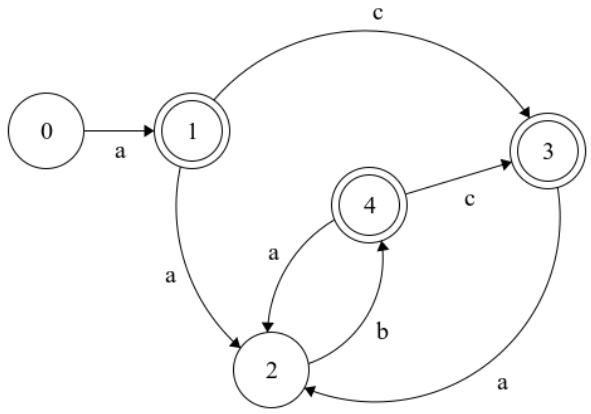
2. Transition table

Currently, state in Q' is q0, find moves from q0 on the input symbols using transition function of NFA and update the transition table of DFA.

	N	states	a	a	b	c
->	0	[0]	[1, 2, 3, 4, 6, 10]	-	-	-
*	1	[1, 2, 3, 4, 6, 10]	-	7	-	[5, 9, 3, 4, 6, 10]
	2	[7]	-	-	[8, 9, 3, 4, 6, 10]	-
*	3	[5, 9, 3, 4, 6, 10]	-	7	-	[5, 9, 3, 4, 6, 10]
*	4	[8, 9, 3, 4, 6, 10]	-	7	-	[5, 9, 3, 4, 6, 10]

3. DFA-diagram:

The DFA based on the transition table

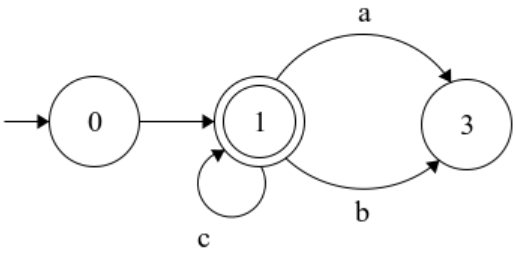


DFA to Min DFA (based on Hopcroft's Algorithm)

Group states that behave identically

	N		a	a	b	c
->	0	[0]	x	-	-	-
*	1	[1, 3, 4]	-	x	-	x
	2	[2]	-	-	x	-

Min DFA diagram



Direct-coded Scanner

Now that we created the min-DFA we can create a DC scanner based on that data.

```
/**
 *  Scanner for the a(c|ab)* regex
 *
 *  @param  char *      the string to parse
 *  @param  int         the length of the string
 *  @return char *|NULL
 */
char *scanner(char *stream, int pos = 0)
{
    char c;

// label to scan for a character
state_init:
    c = stream[pos++];
    if (c == 'a') goto state_ca;
    if (pos == 1) goto state_err;
    else goto state_done;

// label to scan for a|ab characters recursively
state_ca:
    c = stream[pos++];
    if (c == 'c') goto state_ca;
    else if (c == 'a') goto state_ab;
    else goto state_done;

// label to scan for b character
state_ab:
    c = stream[pos++];
    if (c == 'b') goto state_ca;
    else goto state_err;

// label to check if the end of the regex was reached
state_done:
    c = stream[pos-1];
    if (c == 32) goto state_succ;
    else goto state_err;

// label for success
state_succ:
    return stream;

// label for errors
state_err:
    return NULL;
}
```