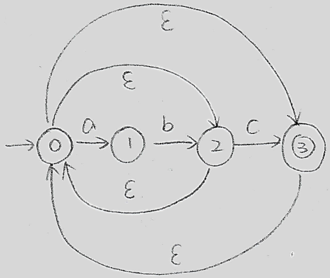
Assignment 2 Sample Answers

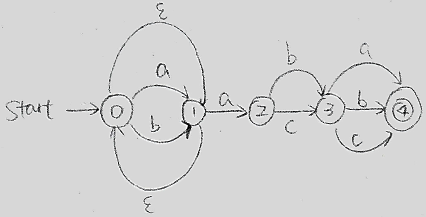
Exercise 1

1. The language is equivalent to $L(((ab)^*c)^*)$. Below is a possible NFA to recognize the language:



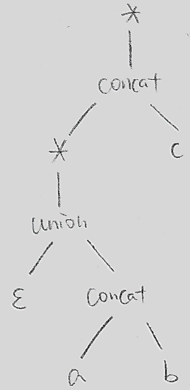
⇒ Not a DFA.

2. A possible NFA is given below:



Exercise 2 : We provide the sample answer for the first regex.

1. Below is a syntax tree for $((\varepsilon | ab)^* c)^*$

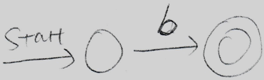


If we traverse the tree in postorder, we visit these nodes one by one : ε, a, b, concat, union, $*$, c, concat, $*$

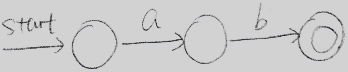
For subexpression ε, we construct NFA following the basis rule #1

For subexpression a, we construct NFA following the basis rule # 2:

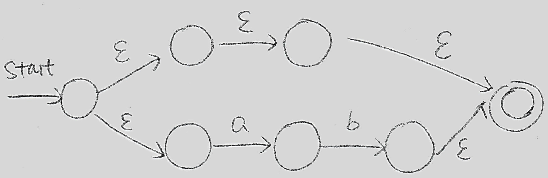
For subexpression b, we construct NFA following the basis rule # 2:



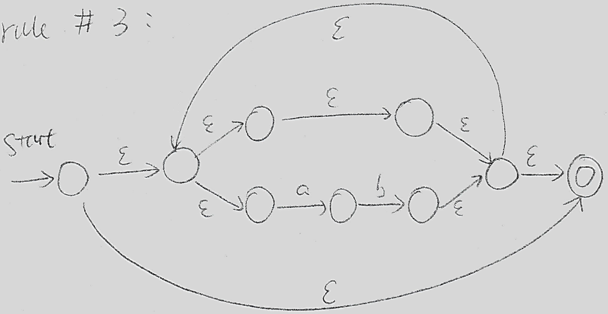
Then construct NFA for ab using inductive rule #2:



Next, construct NFA for $\varepsilon \mid ab$ using inductive rule # 1:

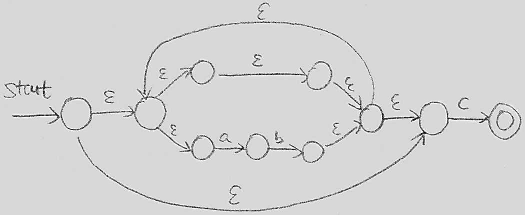


Then, Construct NFA for $(\varepsilon | ab)^*$ using the inductive rule # 3 :

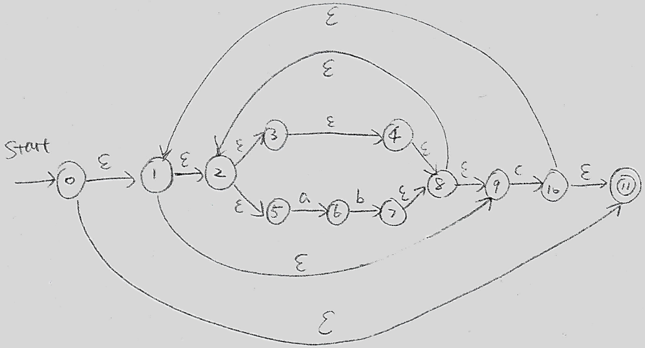


Next, construct NFA for subexpression c following the basis rule # 2 :

Then, construct NFA for $(\varepsilon|ab)^*c$ using the inductive rule #2:



Lastly, construct NFA for $((\varepsilon|ab)^*c)^*$ using the inductive rule #3:



We provide state numbers in the last step.

Exercise 3: We provide sample answer for the above NFA only. The steps for the other NFA are similar.

Step 0:

First, compute ε-closure($\{0\}$) $= \{0, 1, 11, 2, 9, 3, 5, 4, 8\}$.

We name the state S_0 and add it to Dstates.

$\boxed{\text{Status : Dstates} = \{S_0\}, \text{ marked states} = \phi}$

Step 1: process S_0, marked states $= \{S_0\}$

① move $(S_0, a) = \{6\}$

ε-closure $(\{6\}) = \{6\}$ ⇒ name it S_1

Add S_1 to Dstates, Dstates $= \{S_0, S_1\}$

Dtran $[S_0, a] = S_1$

② move $(S_0, c) = \{10\}$

ε-closure($\{10\}$) $= \{10, 1, 11, 2, 9, 3, 5, 4, 8\}$ ⇒ name it S_2

Add S_2 to Dstates, Dstates $= \{S_0, S_1, S_2\}$

Dtran $[S_0, c] = S_2$

$\boxed{\text{Status : Dstates} = \{S_0, S_1, S_2\}, \text{ marked states} = \{S_0\}}$

process state S_1, marked states = $\{S_0, S_1\}$

① move $(S_1, b) = \{7\}$

closure $(\{7\}) = \{7, 8, 2, 9, 3, 5, 4\}$ ⇒ name it S_3

Add S_3 to Dstates, Dstates = $\{S_0, S_1, S_2, S_3\}$

$D\text{-tran}[S_1, b] = S_3$

Status : Dstates = $\{S_0, S_1, S_2, S_3\}$, marked states = $\{S_0, S_1\}$

process state S_2, marked states = $\{S_0, S_1, S_2\}$

① move $(S_2, a) = \{6\}$

ε-closure $(\{6\}) = \{6\}$ ⇒ S_1

$D\text{tran}[S_2, a] = S_1$

② move $(S_2, c) = \{10\}$

ε-closure $(\{10\}) = \{10, 1, 11, 2, 9, 3, 5, 4, 8\}$ ⇒ S_2

$D\text{tran}[S_2, c] = S_2$

Status : Dstates = $\{S_0, S_1, S_2, S_3\}$, marked states = $\{S_0, S_1, S_2\}$

process S_3, marked states $= \{S_0, S_1, S_2, S_3\}$

① $move(S_3, a) = \{6\}$

$\varepsilon\text{-}closure(\{6\}) = \{6\} \Rightarrow S_1$

$Dtran(S_3, a) = S_1$

② $move(S_3, c) = \{10\}$

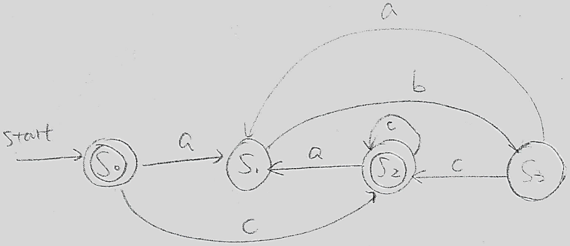
$\varepsilon\text{-}closure(\{10\}) = \{10, 1, 11, 2, 9, 3, 5, 4, 8\} \Rightarrow S_2$

$Dtran(S_3, c) = S_2$

$\boxed{\text{Status}: DStates = \{S_0, S_1, S_2, S_3\},\ \text{marked states } \{S_0, S_1, S_2, S_3\}}$

There are no unmarked state now.

NFA states	DFA state	a	b	c
$\{0, 1, 11, 2, 9, 3, 5, 4, 8\}$	S_0 → start → accept	S_1		S_2
$\{6\}$	S_1		S_3	
$\{10, 1, 11, 2, 9, 3, 5, 4, 8\}$	S_2 → accept	S_1		S_2
$\{7, 8, 2, 9, 3, 5, 4\}$	S_3	S_1		S_2


start
a
a
b
c
a
c
c
S0
S1
S2
S3