

P03: Exercises about NFAs [SELECTED]

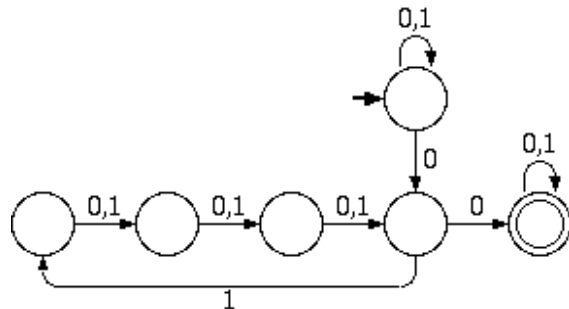
Solutions for the selected exercises: 1,3,4,5(2)

1. a) We will use a state q_i ($i = 0, \dots, 9$). This state will be reached (from the start state, q_s) if we receive an input different from i . After that, the final state will be achieved by the acceptance of an input i . To include the chains with just one digit, we use a transition $(0, \dots, 9)$ from the initial state to the final one (q_f).

	0	1	...	9
$\rightarrow q_s$	$\{q_1, q_2, \dots, q_9, q_f\}$	$\{q_0, q_2, \dots, q_9, q_f\}$...	$\{q_0, \dots, q_8, q_f\}$
q_0	$\{q_f\}$	$\{q_0\}$...	$\{q_0\}$
q_1	$\{q_1\}$	$\{q_f\}$...	$\{q_1\}$
...
q_9	$\{q_9\}$	$\{q_9\}$...	$\{q_f\}$
* q_f	\emptyset	\emptyset	...	\emptyset

b)

	0	1
$\rightarrow q_s$	$\{q_s, q_0\}$	$\{q_s\}$
q_0	$\{q_f\}$	$\{q_1\}$
q_1	$\{q_2\}$	$\{q_2\}$
q_2	$\{q_3\}$	$\{q_3\}$
q_3	$\{q_0\}$	$\{q_0\}$
* q_f	$\{q_f\}$	$\{q_f\}$



3. a) NFA (or incomplete DFA – absence of dead state).

b) Complete the automaton:

	a	b
$\rightarrow \{1\}$	$\{2\}$	$\{3\}$
* $\{2\}$	$\{1\}$	\emptyset
$\{3\}$	\emptyset	$\{2\}$
\emptyset	\emptyset	\emptyset

c) The non-accept states become accept states and vice versa (on the complete DFA).

4. a) True. It is just necessary to apply the construction of paths.

b) False. A cycle can be part of a DFA, thus it's possible to recognize character chains with length greater than the number of states.

5. Use DFA conversion, used in the exercise 2:

	0	1
$\rightarrow \{p\}$	$\{q, s\}$	$\{q\}$
* $\{q, s\}$	$\{r\}$	$\{p, q, r\}$
* $\{q\}$	$\{r\}$	$\{q, r\}$

	0	1
$\rightarrow A$	B	C
* B	D	E
* C	D	F

$\{r\}$	$\{s\}$	$\{p\}$	\Rightarrow	D	G	A
* $\{p,q,r\}$	$\{q,r,s\}$	$\{p,q,r\}$		* E	H	E
* $\{q,r\}$	$\{r,s\}$	$\{p,q,r\}$		* F	I	E
* $\{s\}$	$\{\}$	$\{p\}$		* G	J	A
* $\{q,r,s\}$	$\{r,s\}$	$\{p,q,r\}$		* H	I	E
* $\{r,s\}$	$\{s\}$	$\{p\}$		* I	G	A
$\{\}$	$\{\}$	$\{\}$		J	J	J

Then, convert the previous DFA's accept states into 'normal' states and the 'normal' states from the previous DFA into accept states.

	0	1
\rightarrow *A	B	C
B	D	E
C	D	F
* D	G	A
E	H	E
F	I	E
G	J	A
H	I	E
I	G	A
* J	J	J