

MA0301
ELEMENTARY DISCRETE MATHEMATICS
NTNU, SPRING 2021

SET 12

Deadline: Wednesday 28th April, 2021, 23:59.

Exercise 1. Let $A = \{a, b\}$. Find a regular expression r such that $L(r)$ consists of all words w where w contains at least 3 a 's.

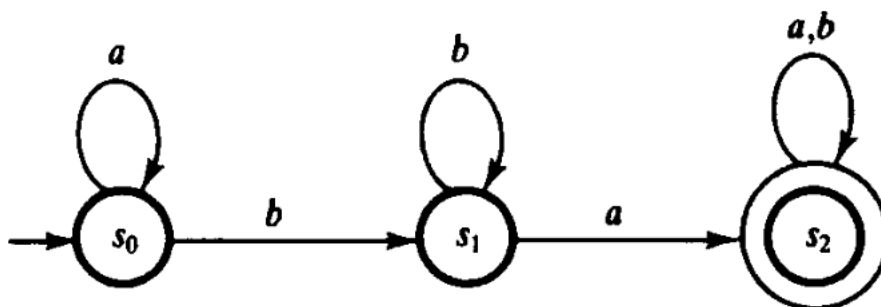
Exercise 2. Let $\Sigma := \{a, b, c, d\}$ be an alphabet. Find regular expressions that correspond to the following regular languages.

a) $\{ab, abab, ababab, abababab, \dots\}$.

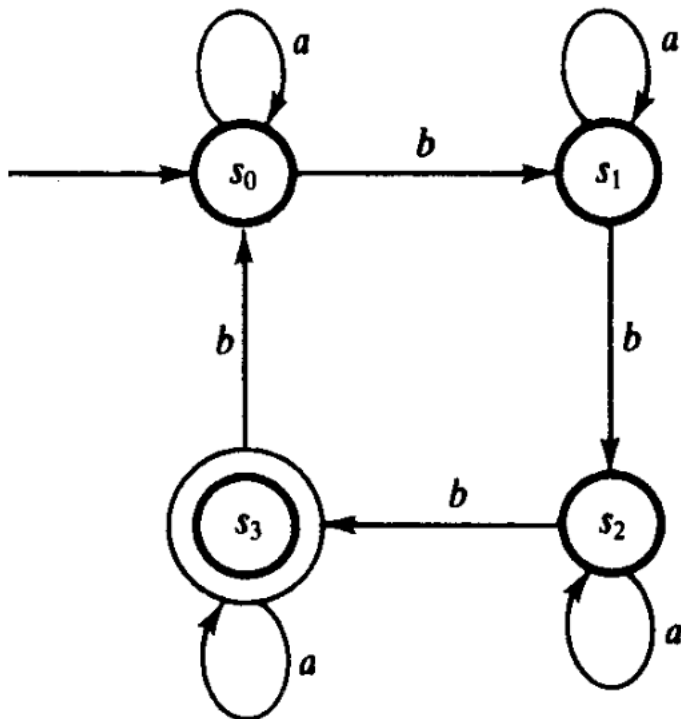
b) $\{ab, abb, aab, aabb\}$.

Exercise 3. Let $A = \{a, b\}$. Construct an automaton M which will accept those words from A which begin with an a followed by (zero or more) b 's.

Exercise 4. Describe the words w in the language L accepted by the automaton M in the figure.



Exercise 5. Describe the words w in language L accepted by the automaton M in the figure.



Exercise 6. Let $M = (S, J, \Theta, v, \omega)$ be a finite state machine where $S = \{s_0, s_1, s_2, s_3\}$, $J = \{a, b, c\}$, $\Theta = \{0, 1\}$, and v, ω are determined by the table.

	v			ω		
	a	b	c	a	b	c
s_0	s_0	s_3	s_2	0	1	1
s_1	s_1	s_1	s_3	0	0	1
s_2	s_1	s_1	s_3	1	1	0
s_3	s_2	s_3	s_0	1	0	1

- Starting at s_0 , what is the output for the input string $aabbcc$?
- Draw the state diagram for this finite state machine.

Exercise 7. Let Σ be an alphabet with $A, B \subseteq \Sigma^*$. Prove:

- $A \subseteq AB^*$.
- $A \subseteq B \implies A^* \subseteq B^*$.