EXERCISES ABOUT REGULAR EXPRESSIONS (REs) AND REGULAR LANGUAGES (RLs)

1 Regular Languages: **[SELECTED]**

a) Write a regular expression for the strings over the alphabet {a,b} in which each substring with length 4 has exactly one b and each substring of length less than 4 has at most one b.

b) For recognizing the language of the previous question, do you prefer a DFA or an NFA? Why?

c) Draw the state diagram of the finite automaton of the previous question.

2 Regular Languages: **[SELECTED]**

a) Write a regular language for the strings over the alphabet {a,b} with odd length and with exactly 2 b's.

b) Given an RE over the alphabet Σ for a language L, one would like to obtain an RE for the language which is the complement of L. Can this RE be obtained by a systematic way? If so, describe the process. If not, justify why.

3 Write a regular expression for the strings over the alphabet {0,1} with a maximum of one pair of consecutive 1's.

4 Describe in English the languages specified by the following regular expressions. **[SELECTED]**

a) (0+10)* 1*

b) (0* 1*)* 000 (0+1)*

c) (1+ε) (00*1)* 0*

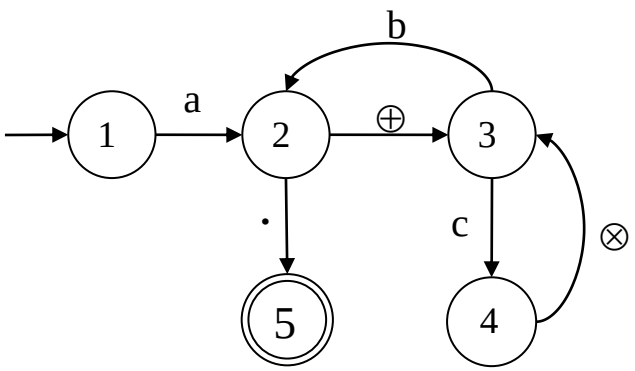
5 Identify the following sentences as true or false: **[SELECTED]**

a) The regular expressions (a+b)* and (a*b)* are equivalent.

b) Given an NFA with ε transitions it is possible to obtain a regular expression that represents the same language.

c) Given a language S, the operation of concatenation for S* is idempotent.

d) For every language defined with the operators of concatenation, union, and closure it is possible to build a DFA that accepts the strings of that language.



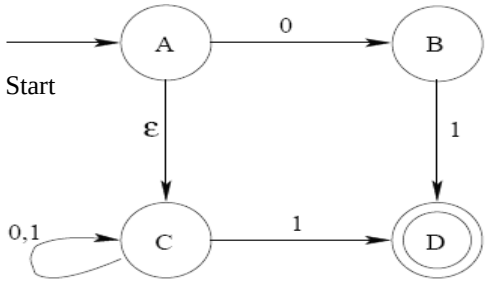
6 Consider the automaton presented. **[SELECTED]**

a) Write a regular expression for the language recognized by the automaton, obtained by the state elimination method.

b) Give the shortest string of the language recognized by the automaton.

c) How many strings does the language of the automaton contain?

7 Consider the following ε-NFA:



a) Convert it to an equivalent DFA using the subset construction method.

b) Obtain the regular expression for the language recognized by the automaton.

8 Consider the NFA given by the following transition table:

		A	b
*→	**0**	{1}	∅
	1	∅	{2,3}
	2	{3}	∅
*	**3**	{1}	∅

a) Which of the following strings are accepted by the automaton: **ε**, **ab**, **abab**, **aba**, **abaa**?

b) Describe in English the language accepted by the automaton.

c) Obtain the regular expression representing the same language of the automaton using the elimination state method.

d) Obtain an equivalent DFA using the subset construction method.

9 The language T over the alphabet {a,b,c} is the language of the strings consisting of 0 or more successive blocks of length 3 in which each block contains one 'a', one 'b' and one 'c' (any order). The regular expression for T is:

☐ (a+b+c)*

☐ (abc+acb+bac+bca+cab+cba)*

☐ (abc)*

☐ ((a+b+c)(a+b+c)(a+b+c))*

10 Consider the DFA given by the following transition table: **[SELECTED]**

	0	**1**
*→ **q1**	q2	q3
q2	q1	q3
* **q3**	q2	q1

a) Obtain a regular expression for the language represented by the automaton using the path construction method.

b) Obtain the regular expression for the language represented by the automaton using the state elimination method.

11 Select the automation representing the language given by the regular expression: (0+11)* 1