EXERCISES ABOUT PROPERTIES OF REGULAR LANGUAGES

1 Pumping Lemma. **[SELECTED]**

a) Show using the pumping lemma that the language $L=\{0^n1^{2n} \mid n\geq 1\}$ is not a regular language.

b) Show using the pumping lemma that the language of the strings $v1^m$, in which v is an arbitrary string over the alphabet {0,1} with length m, is not regular.

c) Try to show using the pumping lemma that the language of the strings given by (00+11)* is not regular.

d) Idem for the language given by 01*0*1.

e) Idem for the language $\{0^n \mid$ n is a perfect square$\}$.

2 Being L a language and a a symbol, we define: **[SELECTED]**

L/a (**quotient** of L and a) – the set of strings w in which wa belongs to L;

a\L (**derivate** of L in order to a) – the set of strings w in which aw belongs to L.

For example, given L={a, aab, baa}; then L/a={ε, ba} and a\L={ε, ab}.

a) Prove that if L is regular then L/*a* is also regular. Suggestion: use the DFA of L and analyze the final states.

b) Prove that if a language L is regular, then *a*\L is also regular. Suggestion: the regular languages are closed for the reverse and quotient operations.

c) Which of the following equalities are true?

- $(L/a)a = L$
- $a(a\backslash L) = L$
- $(La)/a = L$
- $a\backslash(aL) = L$

3 The closure properties can be also used to show that certain languages are not regular. Beginning with the knowledge that $L_{0^n1^n} = \{0^n1^n \mid n \geq 0\}$ is not regular, show that $\{0^i1^j \mid i\neq j\}$ is not regular, using the operations closed to regular languages. **[SELECTED]**

4 Suppose a language L defined over the alphabet Σ. **[SELECTED]**

a) Show an algorithm to determine if the language is infinite. Suggestion: use the pumping lemma and the length of the strings.

b) Show an algorithm to identify if L=Σ*, i.e., if the language accepts all the strings over the alphabet.

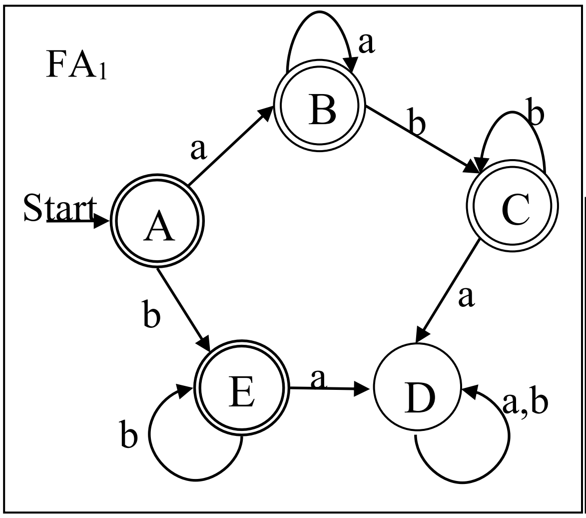
5 Consider the following DFA. **[SELECTED]**

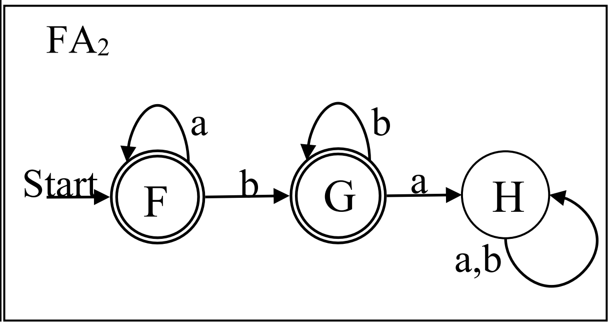
	0	1
→A	B	E
B	C	F
*C	D	H
D	E	H
E	F	I
*F	G	B
G	H	B
H	I	C
*I	A	E

a) Build the table of distinguishable states.

b) Obtain the minimum DFA equivalent to the one given above.

6 Consider the following DFAs: **[SELECTED]**





a) Obtain the minimum DFA equivalent to FA_1.

b) The automata FA_1 and FA_2 are equivalent? Justify.