Exercises

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1 Exercise 1

Fill in the following table by YES or NO.

	Intersection	Complement	Morphisms	Product	Quotients
Rational languages are closed under					
Star-free languages are closed under					
Commutative languages are closed under					

2 Exercise 2

Let $A = \{a, b\}$. Indicate, for each of the languages L_1, L_2, L_3, L_4 whether it is rational, star-free or commutative.

(1) $L_1 = bA^*abA^* \cap A^*bbA^*$,

(2) $L_2 = \{u \in A^* \mid |u| \equiv 2 \bmod 5\}$

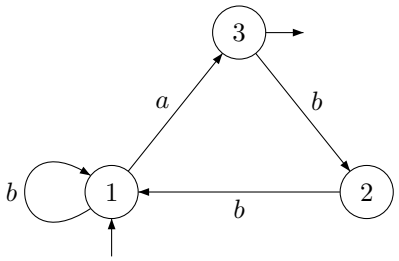
(3) $L_3 = (A^2)^*(a + bb)$,

(4) $L_4 = A^*(ab + ba)A*$.

Briefly justify your answers.

3 Exercise 3

Let L be the language accepted by the following partial automaton



Compute the syntactic monoid of L. If you fill comfortable, you can also compute its syntactic order.

Is this monoid aperiodic?

Show that L is star-free and give a star-free expression for representing L.

Give a first-order formula defining L.