

TD1 - Introduction to Formal Languages

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1. Infer and describe in plain English the corresponding languages:
 - (a) $L_1 = \{c, ac, abc, bc, bac, baabaac, ababac, \dots\}$ over $\Sigma_1 = \{a, b, c\}$.
 - (b) $L_2 = \{\varepsilon, a, ab, aabb, aaa, aaabb, aaaab, \dots\}$ over $\Sigma_2 = \{a, b\}$.
 - (c) $L_3 = \{ab, abab, aaab, baab, bbbab, \dots\}$ over $\Sigma_3 = \{a, b\}$.
2. Let $\Sigma = \{a, b, c\}$. Give finite-state automata that recognise the following languages:
 - (a) $L_1 = \{aa, ab, bac\}$.
 - (b) $L_2 = \{\varepsilon\}$.
 - (c) $L_3 = \emptyset$.
 - (d) $L_4 = \Sigma^*$.
3. Let $\Sigma = \{a, b, c\}$. Give finite state automata that accept the following languages:
 - (a) The set of words with even length.
 - (b) The set of words where the number of occurrences of b is divisible by 3.
 - (c) The set of words ending with a b .
 - (d) The set of non-empty words not ending with a b .
 - (e) The set of words containing at least a b .
 - (f) The set of words containing at most a b .
 - (g) The set of words containing exactly one b .
 - (h) The set of words not containing any b .
 - (i) The set of words with even length ending with ab .
4. Let $\Sigma = \{a, b\}$. Let $L_1 = \{a, ab, ba\}$ and $L_2 = \{\varepsilon, b, ab\}$ be two languages.
 - (a) Compute the following operations:

$$L_1.L_2 \quad L_2.L_1 \quad L_2 \setminus L_1 \quad L_1.\{\varepsilon\} \quad \emptyset.L_2$$
 - (b) If $L_3.L_4 = \{\varepsilon\}$, what can be said about languages L_3 and L_4 ?
 - (c) If $L_3.L_4 = \emptyset$, what can be said about languages L_3 and L_4 ?