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Exercise 11

Task 1
Let $\Sigma = \{a, b, c\}$. Find nondeterministic Büchi automata that accept the following ω-languages:

(a) $L_a = \{w \in \Sigma^\omega \mid w \text{ does not contain the word } bab\}$

(b) $L_b = \{w \in \Sigma^\omega \mid w \text{ contains at most two distinct characters}\}$

(c) $L_c = \{w \in \Sigma^\omega \mid \text{ every } c \text{ in } w \text{ is immediately followed by the character } b\}$

(d) $L_d = \{w \in \Sigma^\omega \mid \text{ there are at least two } c\text{'s between an } a \text{ and the subsequent } b \text{ in } w\}$

(e) $L_e = \{w \in \Sigma^\omega \mid w \text{ contains the words } aa \text{ or } bb \text{ infinitely often}\}$

(f) $L_f = \{w \in \Sigma^\omega \mid w \text{ contains } a \text{ infinitely often if and only if } w \text{ contains } b \text{ infinitely often}\}$

(g) $L_g = \{w \in \Sigma^\omega \mid w \text{ contains the word } aba \text{ only finitely often}\}$

Task 2
Formulate the following properties of the structure $\mathcal{A}$ in $\exists$SO:

(a) Perfect Matching: The directed graph $\mathcal{A} = (V, E)$ has a perfect matching, i.e., there is a subset $M \subseteq E$ such that every node is an end point of exactly one edge from M.

(b) Hamilton Path: The directed graph $\mathcal{A} = (V, E)$ has a Hamilton path, i.e., there is an enumeration $v_1, \ldots, v_n$ of V such that every node from V appears exactly once in $v_1, \ldots, v_n$ and $(v_i, v_{i+1}) \in E$ for every $1 \leq i \leq n-1$

(c) Graph Isomorphism: The structure $\mathcal{A} = (V, E, F)$ with E and F binary relations is such that the directed graphs (V, E) and (V, F) are isomorphic