

Classwork 1

CS304: Automata and Formal Languages

August 8, 2025

Question 1. Over the alphabet $\Sigma = \{a, b, c\}$, design a DFA that accepts all strings that start and end with the same symbol.

Question 2. Over the alphabet $\Sigma = \{x, y, z\}$, design a DFA that accepts all strings that do not contain any repeated consecutive characters.

Question 3. Over the alphabet $\Sigma = \{0, 1\}$, design a DFA that accepts strings containing exactly two 0s.

Question 4. Over the alphabet $\Sigma = \{0, 1\}$, design a DFA that accepts all non-empty binary strings which, when interpreted as a number, are divisible by 4.

Question 5. Over the alphabet $\Sigma = \{a, b\}$, design a DFA that accepts strings that contain at least two 'a's AND at most one 'b'.

Question 6. Over $\Sigma = \{a, b\}$, let the value of a string be calculated by $(2 * \text{number of 'a's'}) + (\text{number of 'b's'})$. Design a DFA that accepts all strings whose value is a multiple of 4.

Question 7. Over the alphabet $\Sigma = \{0, 1\}$, design a NFA that accepts all non-empty binary strings which, when interpreted as a number, are divisible by 4.

Question 8. Over the alphabet $\Sigma = \{a, b, c\}$, design an NFA that accepts strings that are missing at least one character of Σ .

Question 9. Over the alphabet $\Sigma = \{a, b\}$, design an NFA that accepts all strings that either start with the substring ab or end with the substring ba .

Question 10. Over $\Sigma = \{0, 1\}$, design an NFA that accepts any string containing either the substring 000 or the substring 111.

Question 11. Design an NFA for the language over $\Sigma = \{a, b, c\}$ that accepts strings consisting of zero or more a's, followed by zero or more b's, followed by zero or more c's.

Question 12. Over the alphabet $\Sigma = \{x, y, z\}$, design an NFA that accepts strings where every x is eventually followed by a y at some point later in the string.

Question 13. Consider a regular language L and its DFA $A = \{Q, \Sigma, \delta, q_0, F\}$. How would you design a DFA B that accepts $K = \{w \mid \text{reverse}(w) \in L\}$? Can you design an NFA instead?

Question 14. Consider the alphabet $\Sigma = \{a, b\}$ and the language $L = \{w \mid w \text{ has more } a\text{'s than } b\text{'s}\}$. Can you design a DFA/NFA for this language?