

Questions

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Question 1

Construct a state transition diagram for a DFA that recognizes the following language over the alphabet $\Sigma = \{a, b\}$:

$$L_1 = \{ w \mid w \neq ba \text{ and } w \text{ does not contain } bab \}.$$

Question 2

Construct a state transition diagram for a 5-state NFA that recognizes the language given by the regular expression

$$a(cb)^* \cup c(ba)^*.$$

Question 3

Give a regular expression for the language

$L_2 = \{ w \mid w \text{ starts with } 1, \text{ ends with } 0, \text{ and contains an even number of substrings } 01 \}$
over $\Sigma = \{0, 1\}$.

Question 4

Consider the language

$$L_6 = \{ w w w \mid w \text{ starts with } 0 \}$$

over $\Sigma = \{0, 1\}$.

Prove that L_6 is not regular.

Question 5

Prove by induction that for any two languages A and B , if

$$A \subseteq B,$$

then

$$A^n \subseteq B^n \quad \text{for all } n \geq 1,$$

where $A^2 = AA$, $A^3 = AAA$, etc.

Question 6

Write down the CFG rules of the grammar G that generates

$$L(G) = \{ a b^n a^n a \mid n \geq 0 \}.$$

Question 7

Convert the following grammar to Chomsky Normal Form (CNF):

$$S \rightarrow ASA \mid aB,$$

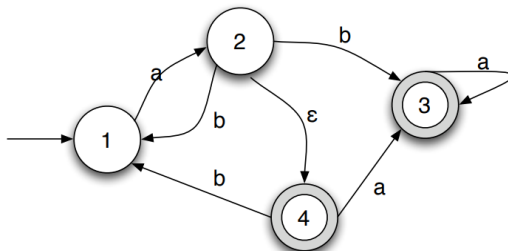
$$A \rightarrow B \mid S,$$

$$B \rightarrow b \mid \epsilon.$$

Question 8

Convert the following NFA to a DFA:

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Question 9

Let

$$B = \{ a^i b^j \mid i \leq j \leq 2i \}.$$

Give an unambiguous context-free grammar (CFG) generating B .

Question 10

Construct a pushdown automaton (PDA) for the language

$$L = \{ a^n b^m \mid n, m \geq 1 \text{ and } n < m \leq 2n \}.$$