

Homework 1, Due June 7th

Solve any TEN problems.

Each problem carries 4 points.

Extra credit for extra problems solved.

1. Describe in English the language accepted by the Finite Automata whose transition diagram is given in Figure 1.

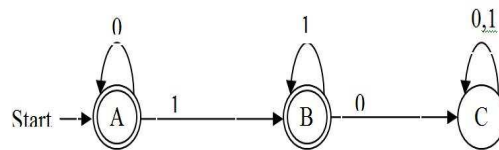


Figure 1.

2. Describe in English the language accepted by the Finite Automata whose transition diagram is given in Figure 2.

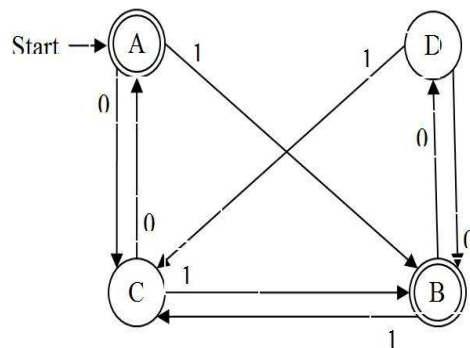


Figure 2.

Give state diagrams of DFAs recognizing the following languages. In all cases the alphabet is $\{0, 1\}$.

3. $L_1 = \{w \mid w \text{ contains the substring } 0101, \text{ i.e., } w = x0101y \text{ for some } x \text{ and } y\}$.
4. $L_2 = \{w \mid w \text{ starts with } 0 \text{ and has odd length, or starts with } 1 \text{ and has even length}\}$.
5. $L_3 = \{w \mid \text{every odd position of } w \text{ is a } 1\}$.
6. $L_4 = \{w \mid w \text{ contains an even number of } 0\text{'s or exactly two } 1\text{s}\}$.
7. $L_5 = \{w \mid w \text{ begins with } 1 \text{ and which when interpreted as the binary representation of an integer is congruent to } 0 \text{ modulo } 5\}$.

Give state diagrams of NFAs recognizing the following languages. In all cases the alphabet is $\{0, 1\}$.

8. $L_6 = \{w \mid \text{the } 10^{\text{th}} \text{ symbol from the right end in } w \text{ is a } 1\}$.
9. $L_7 = \{w \mid w \text{ ends with } 00\}$.
Use at most 3 states in your NFA.
10. $L_1 = \{w \mid w \text{ contains the substring } 0101, \text{ i.e., } w = x0101y \text{ for some } x \text{ and } y\}$.
Use at most 5 states in your NFA.
11. $L_4 = \{w \mid \text{contains an even number of } 0\text{'s or exactly two } 1\text{'s}\}$.
Use at most 6 states in your NFA.
12. If L_1 and L_2 are regular languages, prove that $L_1 \cap L_2$ is regular.