1 DFA Exercises

1. Determine which of $\varepsilon$, 11, 010, 10, 0101 is accepted by this DFA.

![DFA Diagram]

- $q_1$ to $q_2$ with 1
- $q_2$ to $q_3$ with 0
- $q_2$ to $q_3$ with 0, 1
2. The DFA state diagram below is defined on the alphabet $\Sigma = \{a, b, c\}$. Write out its formal definition (as a 5-tuple). When specifying the transition function $\delta$, draw a table.

![DFA State Diagram]

$q_0$ $\xrightarrow{a} q_1$ $\xrightarrow{b} q_2$ $\xrightarrow{c} q_3$

$q_1$ $\xrightarrow{a} q_2$ $\xrightarrow{b} q_3$

$q_2$ $\xrightarrow{a} q_3$

$q_3$ $\xrightarrow{a, b, c}$
3. Draw a DFA that recognizes:

(a) All strings with the prefix 01.

Bonus Question: Draw a computation tree on string 1101.

(b) $L = \{11, 101, 010, 0110\}$.

(c) $L = \{w \in \{0, 1\}^* | $ the number of 1’s in $w$ is not an integer multiple of 5\}.$
2 NFA Exercises

1. Draw an NFA that recognizes:

   (a) All strings that contain 101.

   (b) \( L = \{ w \in \{0, 1\}^* | w \text{ has exactly two 0’s or an even number of 1’s} \} \).
3 Miscellaneous Exercises

1. Prove the following languages are regular:

   (a) \( L = \{0^m1^n \mid m, n \geq 0, \text{ and } m + n \text{ is odd} \} \)

   (b) \( L = \{x \in \{0,1\}^* \mid x \text{ contains a substring of two 1's separated by an odd number of characters} \} \)
2. Convert this NFA to a DFA using subset construction:
3. (a) What is the language recognized by this NFA?

(b) What is the language recognized by this NFA?