Assignment #2: Question 1

- Use JFLAP to construct the transition graph for the DFA that accepts all strings (and only those strings) on the alphabet \{a, b, c\} that have an odd number of a’s.
Assignment #2: Question 2

- Use JFLAP to construct the transition graph for the DFA that accepts all strings (and only those strings) on the alphabet \{a, b, c\} that have the symbols in alphabetical order.
Describe in words the strings that the following DFA accepts and demonstrate your answer with some sample strings.
- All strings that contain an even number of 0’s or an even number of 1’s.
Assignment #2: Question 4

- Describe in words the strings that the following DFA accepts and demonstrate your answer with some sample strings.
  - All strings that contain either two consecutive 0’s or two consecutive 1’s.
Assignment #2: Question 5

- Describe in words the strings that the following NFA accepts and demonstrate your answer with some sample strings.
  - All strings that contain all 1’s or end with a 0.
NFA start state $q_0$ has $\lambda$-transitions to states $q_1$ and $q_2$, so label the DFA start state $\{q_0, q_1, q_2\}$.
Assignment #2: Question 6, cont’d

□ NFA: \( \delta(q_0, 0) = \phi \) and \( \delta(q_1, 0) = \phi \) and \( \delta(q_2, 0) = \{q_2, q_3\} \), so DFA \( \delta(\{q_0, q_1, q_2\}, 0) = \{q_2, q_3\} \). Perform the union.

□ NFA: \( \delta(q_0, 1) = \{q_0\} \) and \( \delta(q_1, 1) = \phi \) and \( \delta(q_2, 1) = \{q_2\} \), so DFA \( \delta(\{q_0, q_1, q_2\}, 1) = \{q_0, q_2\} \).
NFA: \( \delta(q_0, 0) = \phi \) and \( \delta(q_2, 0) = \{q_2, q_3\} \), so DFA \( \delta(\{q_0, q_2\}, 0) = \{q_2, q_3\} \).

NFA: \( \delta(q_0, 1) = \{q_0\} \) and \( \delta(q_2, 1) = \{q_2\} \), so DFA \( \delta(\{q_0, q_2\}, 1) = \{q_0, q_2\} \).
NFA: \( \delta(q_2, 0) = \{q_2, q_3\} \) and \( \delta(q_3, 0) = \emptyset \), so DFA \( \delta(\{q_2, q_3\}, 0) = \{q_2, q_3\} \).

NFA: \( \delta(q_2, 1) = \{q_2\} \) and \( \delta(q_3, 1) = \emptyset \), so DFA \( \delta(\{q_2, q_3\}, 1) = \{q_2\} \).
Assignment #2: Question 6, cont’d

- NFA: $\delta(q_2, 0) = \{q_2, q_3\}$ so DFA $\delta(\{q_2\}, 0) = \{q_2, q_3\}$.
- NFA: $\delta(q_2, 1) = \{q_2\}$ so DFA $\delta(\{q_2\}, 1) = \{q_2\}$.
Since NFA $q_0$ and $q_3$ are final states, DFA $\{q_0, q_1, q_2\}$, $\{q_0, q_2\}$, and $\{q_2, q_3\}$ must be final states.
Assignment #2: Question 7

- Construct the NFA where $\Sigma = \{0, 1\}$, $q_0$ is the starting state, and $q_2$ is the final state.

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>$q_0$</td>
<td>$q_0, q_1$</td>
<td>$q_2$</td>
</tr>
<tr>
<td>$q_1$</td>
<td>$q_2$</td>
<td>$q_1$</td>
</tr>
<tr>
<td>$q_2$</td>
<td>$q_1$</td>
<td>$q_2$</td>
</tr>
</tbody>
</table>

The NFA diagram and the table below shows the transitions and acceptance of strings.
NFA: start state $q_0$, so DFA start state $\{q_0\}$
Assignment #2: Question 8, cont’d

- NFA: $\delta(q_0, 0) = \{q_0, q_1\}$, so DFA $\delta(\{q_0\}, 0) = \{q_0, q_1\}$
- NFA: $\delta(q_0, 1) = \{q_2\}$, so DFA $\delta(\{q_0\}, 1) = \{q_2\}$
Assignment #2: Question 8, cont’d

- NDA: $\delta(q_2, 0) = \{q_1\}$, so DFA $\delta(\{q_2\}, 0) = \{q_1\}$
- NDA: $\delta(q_2, 1) = \{q_2\}$, so DFA $\delta(\{q_2\}, 1) = \{q_2\}$
Assignmengt #2: Question 8, cont’d

- NDA: $\delta(q_1, 0) = \{q_2\}$, so DFA $\delta(\{q_1\}, 0) = \{q_2\}$
- NDA: $\delta(q_1, 1) = \{q_1\}$, so DFA $\delta(\{q_1\}, 1) = \{q_1\}$
Assignment #2: Question 8, cont’d

- **NFA:** $\delta(q_0, 0) = \{q_0, q_1\}$ and $\delta(q_1, 0) = \{q_2\}$, so DFA $\delta(\{q_0, q_1\}, 0) = \{q_0, q_1, q_2\}$

- **NFA:** $\delta(q_0, 1) = \{q_2\}$ and $\delta(q_1, 1) = \{q_1\}$, so DFA $\delta(\{q_0, q_1\}, 1) = \{q_1, q_2\}$
Assignment #2: Question 8, cont’d

- NDA: $\delta(q_1, 0) = \{q_2\}$ and $\delta(q_2, 0) = \{q_1\}$, so DFA $\delta(\{q_1, q_2\}, 0) = \{q_1, q_2\}$

- NDA: $\delta(q_1, 1) = \{q_1\}$ and $\delta(q_2, 1) = \{q_2\}$, so DFA $\delta(\{q_1, q_2\}, 1) = \{q_1, q_2\}$
NDA: $\delta(q_0, 0) = \{q_0, q_1\}$ and $\delta(q_1, 0) = \{q_2\}$ and $\delta(q_2, 0) = \{q_1\}$, so DFA $\delta(\{q_0, q_1, q_2\}, 0) = \{q_0, q_1, q_2\}$

NDA: $\delta(q_0, 1) = \{q_2\}$ and $\delta(q_1, 1) = \{q_1\}$ and $\delta(q_2, 1) = \{q_2\}$, so DFA $\delta(\{q_0, q_1, q_2\}, 1) = \{q_1, q_2\}$
NDA final state $q_2$, so DFA final states $\{q_2\}$, $\{q_1, q_2\}$, and $\{q_0, q_1, q_2\}$
Assignment #2: Question 9

- Construct the DFA where $\Sigma = \{a, b\}$, $q_0$ is the starting state, and $q_2$ is the final state.
State $q_2$ is final: $0 \ 1 \ 3 \ | \ 2$

From states $q_0$ and $q_1$, all strings lead to final state $q_2$:

$0 \ 1 \ | \ 3 \ | \ 2$

No further partitioning is possible.
Assignment #2: Question 10, cont’d

- Original: $\delta(q_0, w) = \delta(q_1, w) = q_2$ for all $w$ in $\Sigma$
  Minimized: $\delta^*(\{q_0, q_1\}, w) = \{q_2\}$

- Original: $\delta(q_3, b) = q_1$
  Minimized: $\delta(\{q_3\}, b) = \{q_0, q_1\}$