Problem 1 Solution

Problem 1 Rubric

- Any Correct Solution: 15/15
- Almost correct solution:
  - deduct 1 point per edge that needs to be fixed
- Not close to correct solution: 0/15.
Problem 2 Solution

\begin{center}
\begin{tikzpicture}
  \node[state,initial] (q0) at (0,0) {$\equiv 0 \pmod{3}$};
  \node[state] (q1) at (2,0) {$\equiv 1 \pmod{3}$};
  \node[state] (q2) at (4,0) {$\equiv 2 \pmod{3}$};

  \draw[->] (q0) edge node {1} (q1);
  \draw[->] (q1) edge node {0} (q2);
  \draw[->] (q2) edge [loop above] node {1} (q1);
  \draw[->] (q0) edge [loop above] node {0} (q0);

  \node at (-1,0) {start};
\end{tikzpicture}
\end{center}

Problem 2 Rubric

- Any Correct Solution: 25/25
- Almost correct solution:
  - deduct 5 points per edge that needs to be fixed
- Not close to correct solution: 0/25.

Problem 3 Part 1: Prefix Solution (20 points)

- Let $(Q, \delta, q_0, F)$ be the DFA that accepts $L$.
- Let $G$ be the set of nodes that can reach some node in $F$. Formally, let $p(x, y)$ indicate that there is a path from node $x$ to node $y$. Then, $G = \{x | \exists y \in F, p(x, y)\}$.
- The DFA $(Q, \delta, q_0, F \cup G)$ accepts prefix(L).

Problem 3 Part 1: Prefix Rubric (20 points)

- Any correct solution: 20/20.
- Incorrect solution fixable by changing “make all states final states” to “make all states that can reach the final state a final state”: 15/20
- Completely wrong ideas: 0/20.

Problem 3 Part 2: Suffix Solution (20 points)

- Let $(Q, \delta, q_0, F)$ be the DFA that accepts $L$.
- Create a new NFA $(Q \cup \{q'_0\}, \delta', q'_0, F)$ as follows:
  - $q'_0$ is a new state
  - construct $\delta'$ by taking $\delta$, then adding an $\epsilon$ transition from $q'_0$ to every state in $Q$
Problem 3 Part 2: Suffix Rubric (20 points)

• Any correct solution: 20/20.
• Incorrect solution that creates $\epsilon$ transitions from $q_0$ instead of $q'_0$: 15/20
• Completely wrong ideas: 0/20.

Problem 3 Part 3: Mid Solution (20 points)

• Apply the Prefix process.
• Then apply the Suffix process.

Problem 3 Part 3: Mid Rubric (20 points)

• Any correct solution: 20/20.
• Completely wrong ideas: 0/20.