1. \( \Sigma = \{0, 1\} \). \( L \) is ranging over \( \Sigma^* \) of all strings of 0's and 1's of len. 4 in an eq. # of 0's and 1's.

\[ L = \{0011, 0101, 1001, 1010, 1100, 10011\} \]

5. \( L \) is ranging over \( \Sigma = \{0, 1\}^* \) of all strings in which #15 is evenly divisible by 4.

A regexp that defines \( L \) is \((0+1)^*1(0^*1)^*0^*\)

8. **Input**

\[
\begin{array}{c|cc}
\text{Next-State Table} & a & b \\
\hline
u_0 & u_2 & u_1 \\
u_1 & u_3 & u_2 \\
u_2 & u_2 & u_2 \\
\circ u_3 & u_3 & u_3 \\
\end{array}
\]

**Transition Diagram**

b) Accepted strings: babb, ba

c) All strings beginning with "ba"

d) ba(a1b)*
11. REG. EXP. $0^*10^*10^*0^*$
   2) All strings of 0's and 1's that have either exactly one 1 or two 1's.

b) 

\[ R_0: S_0, S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_{10}, S_{11} \]
\[ R_1: S_0, S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_{10}, S_{11} \]
\[ R_2: S_0, S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_{10}, S_{11} \]
\[ R_3: S_0, S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_{10}, S_{11} \]

\[ R_0 \rightarrow R_3: \frac{S_0}{a_0}, \frac{S_1}{a_1}, \frac{S_2}{a_2}, \frac{S_3}{a_3} \]

14.

\[ \text{EQUI CLASSES} \]

\[ R_0: S_0, S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_{10}, S_{11} \]
\[ R_1: S_0, S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_{10}, S_{11} \]
\[ R_2: S_0, S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_{10}, S_{11} \]
\[ R_3: S_0, S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_{10}, S_{11} \]

\[ R_0 \rightarrow R_3: \frac{S_0}{b_0}, \frac{S_1}{b_1}, \frac{S_2}{b_2}, \frac{S_3}{b_3} \]

\[ R_0 \rightarrow R_3: \frac{S_0}{b_0}, \frac{S_1}{b_1}, \frac{S_2}{b_2}, \frac{S_3}{b_3} \]

\[ \overline{A} \] and \[ \overline{A'} \] are isomorphic so \[ A \] and \[ A' \] are equivalent.