4. Use a general algorithm to transform the following finite automaton into the corresponding regular expression. This automaton has two states: the starting state q1 and the final state q2. In the state q1, 1 leads to q2, and 0 leads to q1. In the state q2, 1 leads to q2, and 0 leads to q1.

\[ R_{ij} = R_{ij} U (R_{ik} R_{k}^* R_{kj}) \]

---

Let's eliminate state q1 first (k=q1)

Let's eliminate state q2

\[ R_{nf} = R_{nf} U (R_{nq2} R_{q2q2}^* R_{q2q2}) \]
\[ \phi U (\lambda 0^* 1) = 0^*1 \]

\[ R_{nf} = R_{nf} U (R_{nq1} R_{q1q1}^* R_{q1q1}) \]
\[ \phi U (\lambda 0^* \phi) = \phi \]

\[ R_{q1q2} = R_{q1q2} U (R_{q1q1} R_{q1q1}^* R_{q1q2}) \]
\[ 1 U (0 0^* 1) = 00^*1 U 1 \]

\[ R_{q2q2} = R_{q2q2} U (R_{q2q1} R_{q2q1}^* R_{q2q2}) \]
\[ \lambda U (0 0^* \phi) = \lambda \]