Let $M$ be the Nondeterministic Finite Automaton

$$
\begin{array}{c}
0 & 1 & 2 \\
q_0 & \{q_0, q_1\} & \emptyset \\
q_1 & \emptyset & \{q_0, q_2\} \\
q_2 & \emptyset & \{q_1, q_2\}
\end{array}
$$

1. Construct the transition table for $M$.

There are no $\lambda$ moves so the $\lambda$-closure of a set is itself.

2. Give a regular expression for $L(M)$.

The easiest way to find the regular expression is to look at the deterministic machine from problem 3.

From that machine it is easy to see that the language consists of those strings which are non-empty, do not start with $b$, and which do not contain the substring $abba$. In fact, you can interpret the states in terms of the progress towards ending a word in $abba$:

- $q_0$ – initial state, empty string, non-accepting.
- $q_01$ – prefix does not start with $b$ and does not contain $abba$, ends in $a$.
- $q_02$ – prefix does not start with $b$ and does not contain $abba$, ends in $ab$.
- $q_12$ – prefix does not start with $b$ and does not contain $abba$, ends in $abb$.
- $q_{012}$ – prefix does not start with $b$ and does not contain $abba$, ends in $ab^k$ with $k > 2$.
- $q$ – prefix either starts with $b$ or contains $abba$.

A regular expression could be $a^+ (ba^+ \cup b^2a^+)^* b^*$

3. Construct a Deterministic Finite Automaton which accepts $L(M)$.

The states are the subsets of states. For brevity we use $q_{ijk}$ to denote $\{q_i, q_j, q_k\}$. The transition table allows us to form the diagram.