1. Exercise 1 on page 184.

Solution:
(a) The state diagram of $M$ is

(b) 

\[
\begin{align*}
\text{i) } [q_0, \text{abaa}] & \vdash [q_0, \text{baa}] & \vdash [q_1, \text{aa}] & \vdash [q_2, \lambda] \\
\text{ii) } [q_0, \text{bbabb}] & \vdash [q_1, \text{bbabb}] & \vdash [q_1, \text{abb}] & \vdash [q_2, \lambda] \\
\text{iii) } [q_0, \text{bababa}] & \vdash [q_1, \text{bababa}] & \vdash [q_2, \lambda] \\
\text{iv) } [q_0, \text{bbbaa}] & \vdash [q_1, \text{bbbaa}] & \vdash [q_1, \text{baa}] & \vdash [q_2, \lambda]
\end{align*}
\]

(c) The computations in i, iii and iv terminate in the accepting state $q_2$. Therefore the strings $\text{abaa}, \text{bababa}$ and $\text{bbbaa}$ are in $L(M)$. 

1
(d) Two regular expressions describing $L(M)$ are $a^*b^+a^+(ba^*b^+a^+)^*$ and $(a^*b^+a^+b)^*a^*b^+a^+$. (20 points)

2. Exercise 11 on page 185.

Solution:

The state diagram of a DFA is

![State Diagram](image)

(20 points)

3. Exercise 12 on page 185.

Solution:

The state diagram of a DFA is

![State Diagram](image)

(20 points)
4. Design an NFA that accepts the following language over the alphabet \( \{a, b\} \):

\[(abc)^*(ab)^*\]

**Solution:**

The state diagram of an NFA is

![NFA Diagram](image)

(20 points)

5. Exercise 36 on page 187.

**Solution:**

(a) \( \lambda - \text{closure}(q_0) = \{q_0, q_2\} \).

(b) The input transition function \( t \) is the following:

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>b</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td>( q_0 )</td>
<td>{q_0, q_2}</td>
<td>{q_1, q_2}</td>
<td>{q_1}</td>
</tr>
<tr>
<td>( q_1 )</td>
<td>\emptyset</td>
<td>\emptyset</td>
<td>{q_1}</td>
</tr>
<tr>
<td>( q_2 )</td>
<td>\emptyset</td>
<td>{q_1, q_2}</td>
<td>\emptyset</td>
</tr>
</tbody>
</table>

(c) The equivalent DFA:
(d) A regular expression is $a^*b^*c^*$. (20 points)