1. Transition table:

<table>
<thead>
<tr>
<th>subset</th>
<th>a</th>
<th>b</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td>∅</td>
<td>∅</td>
<td>∅</td>
<td>∅</td>
</tr>
<tr>
<td>q₁</td>
<td>q₂</td>
<td>q₃</td>
<td>q₁, q₂</td>
</tr>
<tr>
<td>q₂</td>
<td>q₃</td>
<td>q₁, q₂, q₃</td>
<td>q₂, q₃</td>
</tr>
<tr>
<td>q₃</td>
<td>q₁, q₂</td>
<td>q₂, q₃</td>
<td>q₂, q₃</td>
</tr>
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<td>q₁, q₂, q₃</td>
<td>q₂, q₃</td>
<td>q₁, q₂, q₃</td>
<td>q₂, q₃</td>
</tr>
</tbody>
</table>

DFA:

2. The languages are different in both cases. Indeed,

\[ abb \in L((aa \cup ab^*)^*) \text{ but } abb \notin L((aa \cup ab^*)^*) \]

and

\[ abb \in L((ba \cup ab^*)^*) \text{ but } abb \notin L((ba \cup ab^*)^*) \]

3. (a) \( a(a \cup b)^*b(a \cup b)^* \text{ or } aa^*b(a \cup b)^* \)

(b) \( (bb)^*(aa)^* \cup (bb)^*ba(aa)^* \)

(c) \( (aa \cup bb \cup (ab \cup ba)(aa \cup bb)^*(ab \cup ba))^* \)

(d) A string that does not have both the substrings \( bba \) and \( abb \) is a string that does not contain \( bba \) or does not contain \( abb \). The language of all strings that do not contain \( bba \) can be defined by the regular expression \( a^*(baa^*)^*b^* \). The language of all strings that do not contain \( abb \) can be defined by the regular expression \( b^*(a^*ab)^*a^* \). This gives the following answer:

\[ (a^*(baa^*)^*b^*) \cup (b^*(a^*ab)^*a^*). \]
4. (a) DFA:

\[ \text{(b) Note that } L[(aa \cup ab^*)^*] = L[(ab^*)^*] = L[\varepsilon \cup a(a \cup b)^*]. \text{ This gives the following DFA:} \]

5. (a) NFA:
DFA:

(b) NFA:
6. (a) yes, regular expression: $(aa)^*$
   (b) yes, regular expression $a(aa)^*$
   (c) no, the pumping argument from the lecture slides can be used in this case.