Give a RE (regexp) and an NFA for each language below.

1. \( L_1 = \{ s \in \{0,1\}^* : s \) contains at least 2 characters and \( s \)'s second character is a 1\}

   Ans:
   RE:
   \[(0 + 1)1(0 + 1)^*\]
   NFA:

   ![NFA Diagram](image)

2. \( L_2 = \{ s \in \{0,1\}^* : s \) contains fewer than 2 characters\}

   Ans:
   RE:
   \[\epsilon + 0 + 1\]
   NFA:

   ![NFA Diagram](image)

3. \( L_3 = \{ s \in \{a,b\}^* : \) every \( a \) in \( s \) is eventually followed by \( b\}\)

   Ans:
   \[(a + b)^*b + \epsilon\]
   NFA:

   ![NFA Diagram](image)
4. \(L_4 = \{s \in \{a,b\}^* : \) the third-last character of \(s\) is a \(b\}\)

**Ans:**

**RE:**

\[(a + b)^*b(a + b)(a + b)\]

**NFA:**

```
\begin{array}{c}
\text{start} \\
\rightarrow q_0 \\
\rightarrow q_1 \\
\rightarrow q_2 \\
\rightarrow q_3 \\
\end{array}
```

5. \(L_5 = \{s \in \{a,b\}^* : s \) contains some substring of length 4 whose first and last characters are the same\)

**Ans:**

**RE:**

\[(a + b)^*(a(a + b)(a + b)a + b(a + b)(a + b)b)(a + b)^*\]

**NFA:**

```
\begin{array}{c}
\text{start} \\
\rightarrow q_0 \\
\rightarrow q_1 \\
\rightarrow q_2 \\
\rightarrow q_3 \\
\rightarrow q_4 \\
\rightarrow q_5 \\
\rightarrow q_6 \\
\rightarrow q_7 \\
\end{array}
```