

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

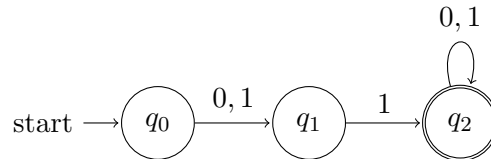
1. $L_1 = \{s \in \{0, 1\}^* : s \text{ contains at least 2 characters and } s\text{'s second character is a 1}\}$

Ans:

RE:

$$(0 + 1)1(0 + 1)^*$$

NFA:



□

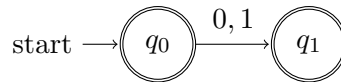
2. $L_2 = \{s \in \{0, 1\}^* : s \text{ contains fewer than 2 characters}\}$

Ans:

RE:

$$\epsilon + 0 + 1$$

NFA:



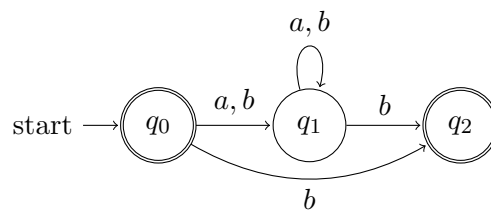
□

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

Ans:

$$(a + b)^*b + \epsilon$$

NFA:



□

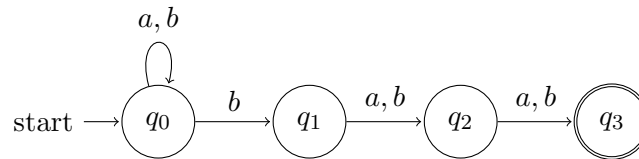
4. $L_4 = \{s \in \{a, b\}^* : \text{the third-last character of } s \text{ is a } b\}$

Ans:

RE:

$$(a + b)^*b(a + b)(a + b)$$

NFA:



□

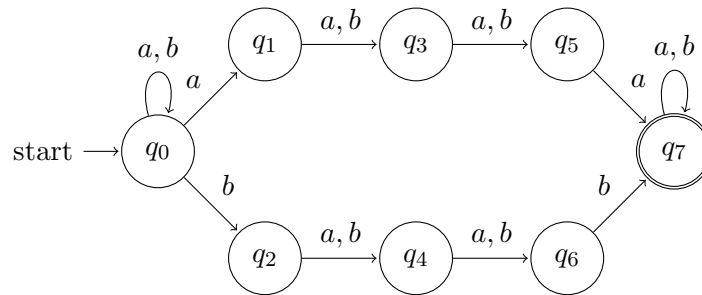
5. $L_5 = \{s \in \{a, b\}^* : s \text{ contains some substring of length 4 whose first and last characters are the same}\}$

Ans:

RE:

$$(a + b)^*(a(a + b)(a + b)a + b(a + b)(a + b)b)(a + b)^*$$

NFA:



□