Homework2: NFA-DFA

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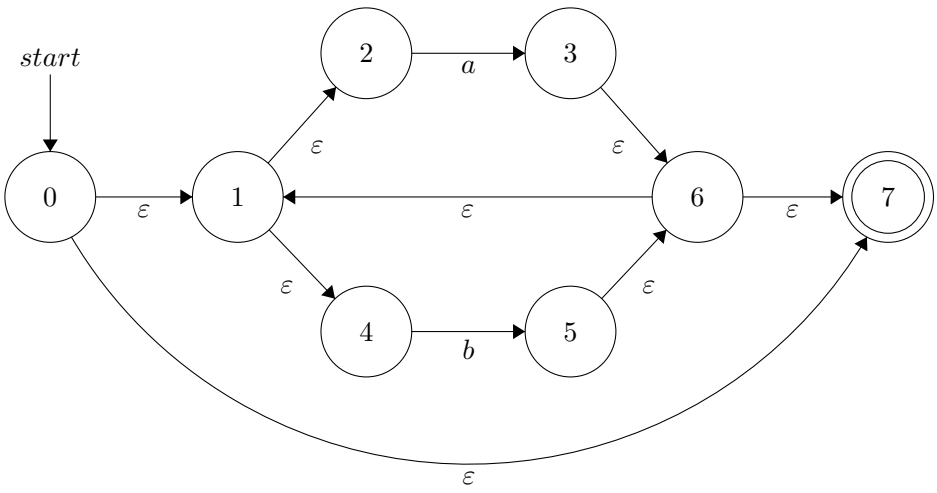
一、使用 Thompson 构造法为下列正规式构造 NFA，写出每个 NFA 处理符号串 “ababbab” 过程中的状态转换序列。

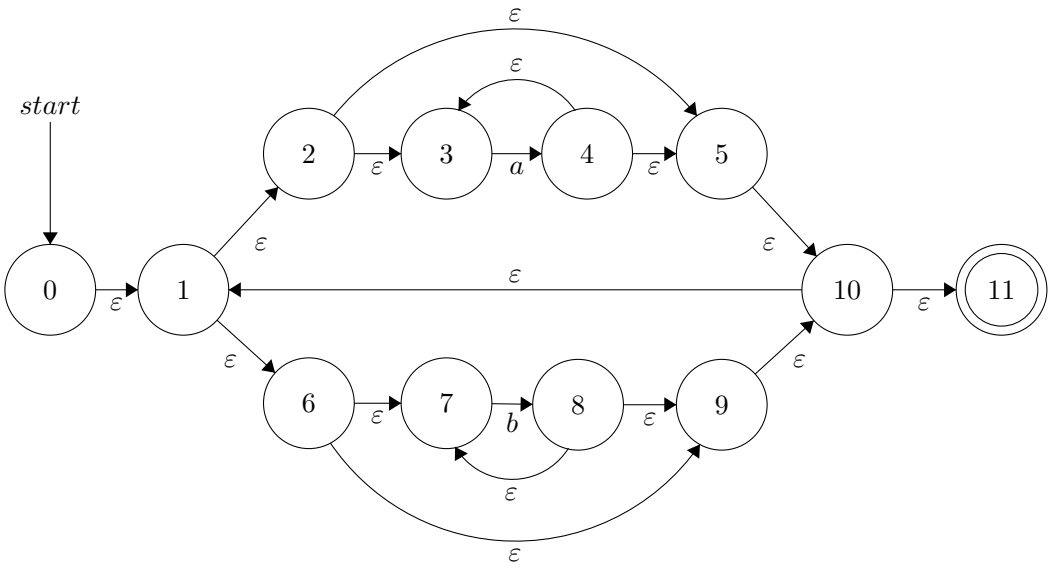
a) $(a|b)^*$



ababbab

$0 \to 1 \to 2 \to 3 \to 6 \to 1 \to 4 \to 5 \to 6$
$\to 1 \to 2 \to 3 \to 6 \to 1 \to 4 \to 5 \to 6$
$\to 1 \to 4 \to 5 \to 6 \to 1 \to 2 \to 3 \to 6$
$\to 1 \to 4 \to 5 \to 6 \to 7$

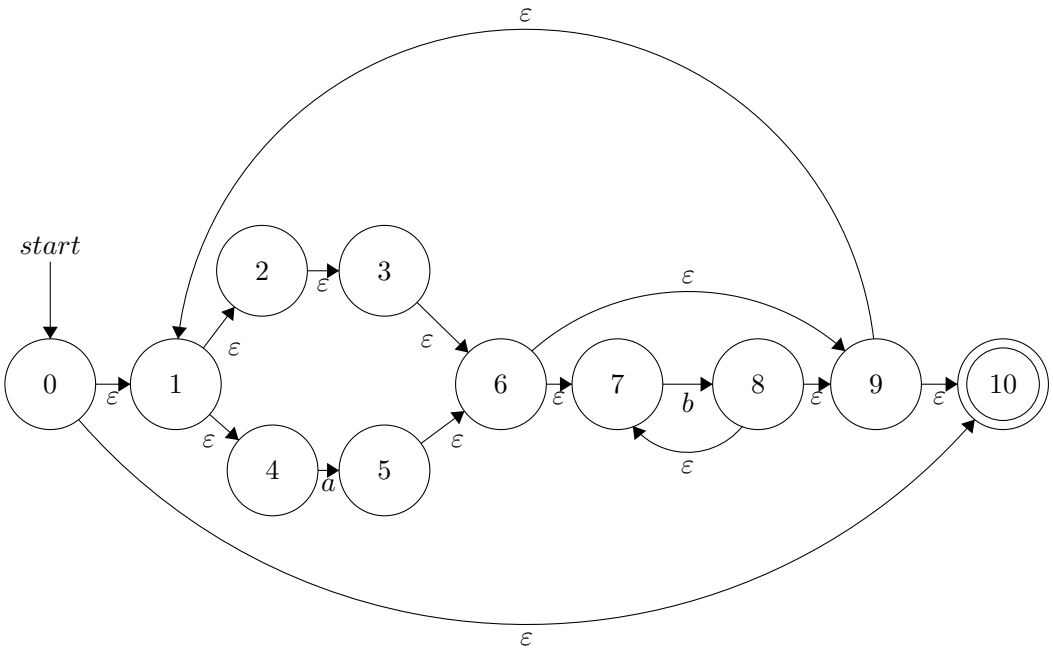
b) $(a^*|b^*)^*$



ababbab

$0 \to 1 \to 2 \to 3 \to 4 \to 5 \to 10$
$\to 1 \to 6 \to 7 \to 8 \to 9 \to 10$
$\to 1 \to 2 \to 3 \to 4 \to 5 \to 10$
$\to 1 \to 6 \to 7 \to 8 \to 7 \to 8 \to 9 \to 10$
$\to 1 \to 2 \to 3 \to 4 \to 5 \to 10$
$\to 1 \to 6 \to 7 \to 8 \to 9 \to 10 \to 11$

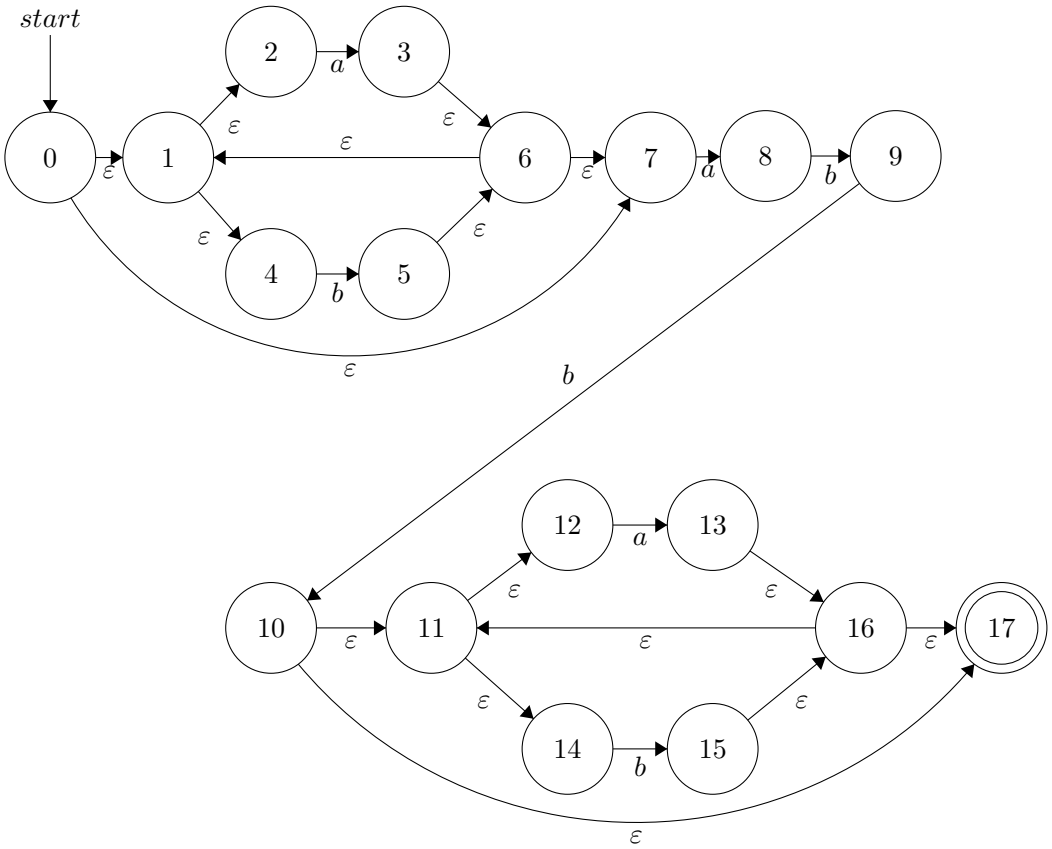
c) $((\varepsilon|a)b^*)^*$



ababbab

$0 \to 1 \to 4 \to 5 \to 6 \to 7 \to 8 \to 9$
$\to 1 \to 4 \to 5 \to 6 \to 7 \to 8 \to 7 \to 8 \to 9$
$\to 1 \to 4 \to 5 \to 6 \to 7 \to 8 \to 9 \to 10$

d) $(a|b)^*abb(a|b)^*$



ababbab

$0 \to 1 \to 2 \to 3 \to 6$
$\to 1 \to 4 \to 5 \to 6 \to 7$
$\to 8 \to 9$
$\to 10 \to 11 \to 12 \to 13 \to 16$
$\to 11 \to 14 \to 15 \to 16 \to 17$

二、利用子集构造法将第一题得到的 NFA 转换为 DFA，同样写出分析符号串 “ababbab” 过程中的状态转换。

a) $(a|b)^*$

ε-closure$(\{0\}) = \{0, 1, 2, 4, 7\} = S_0$

ε-closure$(\text{move}(S_0, a)) = \varepsilon$-closure$(\{3\}) = \{1, 2, 3, 4, 6, 7\} = S_1$

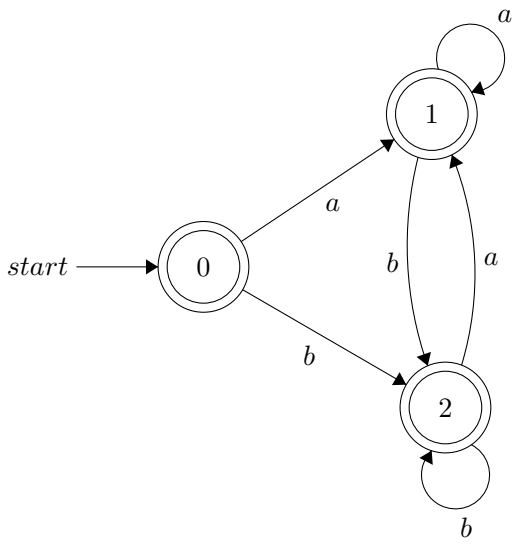
ε-closure$(\text{move}(s_0, b)) = \varepsilon$-closure$(\{5\}) = \{1, 2, 4, 5, 6, 7\} = S_2$

ε-closure$(\text{move}(S_1, a)) = \varepsilon$-closure$(\{3\}) = S_1$

ε-closure$(\text{move}(S_1, b)) = \varepsilon$-closure$(\{5\}) = S_2$

ε-closure$(\text{move}(S_2, a)) = \varepsilon$-closure$(\{3\}) = S_1$

ε-closure$(\text{move}(S_2, b)) = \varepsilon$-closure$(\{5\}) = S_2$

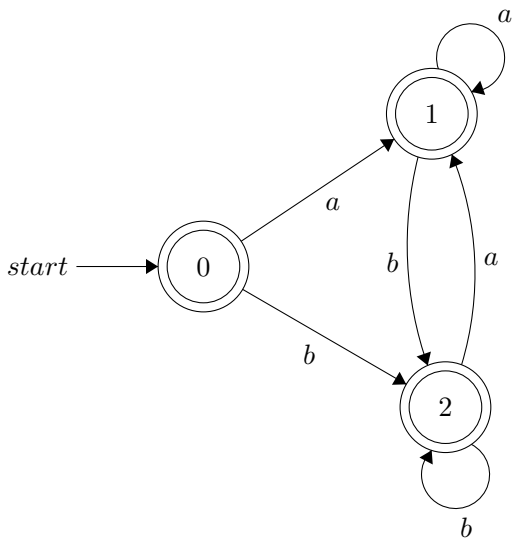


ababbab

$0 \to 1 \to 2 \to 1 \to 2 \to 2 \to 1 \to 2$

b) $(a^*|b^*)^*$

ε-closure$(\{0\}) = \{0, 1, 2, 3, 5, 6, 7, 9, 10, 11\} = S_0$
ε-closure(move$(S_0, a)) = \varepsilon$-closure$(\{4\}) = \{1, 2, 3, 4, 5, 6, 7, 9, 10, 11\} = S_1$
ε-closure(move$(S_0, b)) = \varepsilon$-closure$(\{8\}) = \{1, 2, 3, 5, 6, 7, 8, 9, 10, 11\} = S_2$
ε-closure(move$(S_1, a)) = \varepsilon$-closure$(\{4\}) = S_1$
ε-closure(move$(S_1, b)) = \varepsilon$-closure$(\{8\}) = S_2$
ε-closure(move$(S_2, a)) = \varepsilon$-closure$(\{4\}) = S_1$
ε-closure(move$(S_2, b)) = \varepsilon$-closure$(\{8\}) = S_2$



ababbab

$0 \to 1 \to 2 \to 1 \to 2 \to 2 \to 1 \to 2$

c) $((\varepsilon|a)b^*)^*$

ε-closure$(\{0\}) = \{0, 1, 2, 3, 4, 6, 7, 9, 10\} = S_0$

ε-closure(move$(S_0, a)) = \varepsilon$-closure$(\{5\}) = \{1, 2, 3, 4, 5, 6, 7, 9, 10\} = S_1$

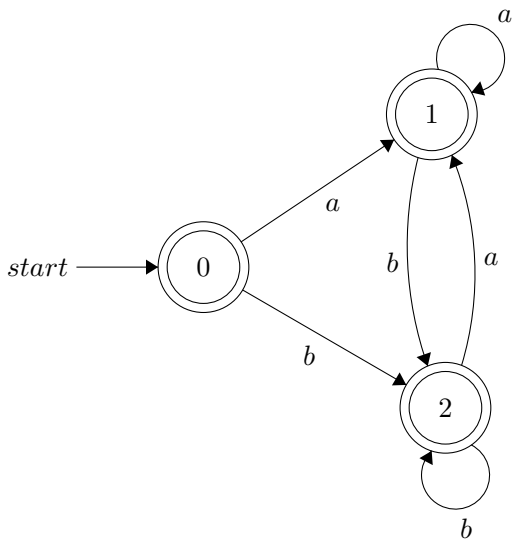
ε-closure(move$(S_0, b)) = \varepsilon$-closure$(\{8\}) = \{1, 2, 3, 4, 6, 7, 8, 9, 10\} = S_2$

ε-closure(move$(S_1, a)) = \varepsilon$-closure$(\{5\}) = S_1$

ε-closure(move$(S_1, b)) = \varepsilon$-closure$(\{8\}) = S_2$

ε-closure(move$(S_2, a)) = \varepsilon$-closure$(\{5\}) = S_1$

ε-closure(move$(S_2, b)) = \varepsilon$-closure$(\{8\}) = S_2$



ababbab

$0 \to 1 \to 2 \to 1 \to 2 \to 2 \to 1 \to 2$

d) $(a|b)^*abb(a|b)^*$

ε-closure$(\{0\}) = \{0, 1, 2, 4, 7\} = S_0$

ε-closure$(\text{move}(S_0, a)) = \varepsilon$-closure$(\{3, 8\}) = \{1, 2, 3, 4, 6, 7, 8\} = S_1$

ε-closure$(\text{move}(S_0, b)) = \varepsilon$-closure$(\{5\}) = \{1, 2, 4, 5, 6, 7\} = S_2$

ε-closure$(\text{move}(S_1, a)) = \varepsilon$-closure$(\{3, 8\}) = S_1$

ε-closure$(\text{move}(S_1, b)) = \varepsilon$-closure$(\{5, 9\}) = \{1, 2, 4, 5, 6, 7, 9\} = S_3$

ε-closure$(\text{move}(S_2, a)) = \varepsilon$-closure$(\{3, 8\}) = S_1$

ε-closure$(\text{move}(S_2, b)) = \varepsilon$-closure$(\{5\}) = S_2$

ε-closure$(\text{move}(S_3, a)) = \varepsilon$-closure$(\{3, 8\}) = S_1$

ε-closure$(\text{move}(S_3, b)) = \varepsilon$-closure$(\{5, 10\}) = \{1, 2, 4, 5, 6, 7, 9, 10, 11, 12, 14, 17\} = S_4$

ε-closure$(\text{move}(S_4, a)) = \varepsilon$-closure$(\{3, 8, 13\}) = \{1, 2, 3, 4, 6, 7, 8, 9, 11, 12, 13, 14, 16, 17\} = S_5$

ε-closure$(\text{move}(S_4, b)) = \varepsilon$-closure$(\{5, 15\}) = \{1, 2, 4, 5, 6, 7, 11, 12, 14, 15, 16, 17\} = S_6$

ε-closure$(\text{move}(S_5, a)) = \varepsilon$-closure$(\{3, 8, 13\}) = S_5$

ε-closure$(\text{move}(S_5, b)) = \varepsilon$-closure$(\{5, 9, 15\}) = \{1, 2, 4, 5, 6, 7, 9, 11, 12, 14, 15, 16, 17\} = S_7$

ε-closure$(\text{move}(S_6, a)) = \varepsilon$-closure$(\{3, 8, 13\}) = S_5$

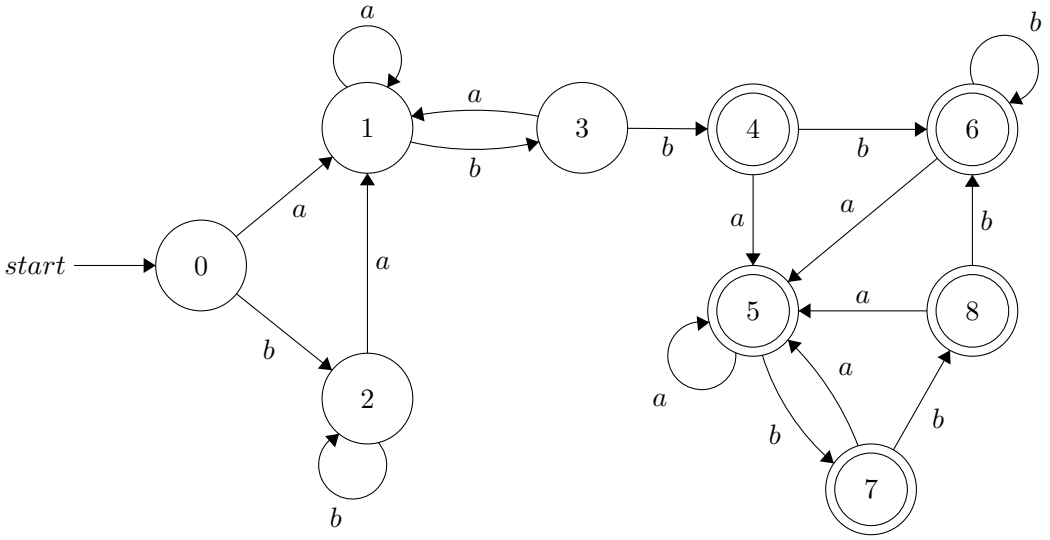
ε-closure$(\text{move}(S_6, b)) = \varepsilon$-closure$(\{5, 15\}) = S_6$

ε-closure$(\text{move}(S_7, a)) = \varepsilon$-closure$(\{3, 8, 13\}) = S_5$

ε-closure$(\text{move}(S_7, b)) = \varepsilon$-closure$(\{5, 10, 15\}) = \{1, 2, 4, 5, 6, 7, 10, 11, 12, 14, 15, 16, 17\} = S_8$

ε-closure$(\text{move}(S_8, a)) = \varepsilon$-closure$(\{3, 8, 13\}) = S_5$

ε-closure$(\text{move}(S_8, b)) = \varepsilon$-closure$(\{5, 15\}) = S_6$



ababbab

$0 \to 1 \to 3 \to 1 \to 3 \to 4 \to 5 \to 7$