

Theory of Computation

Regular Expression

Lecture 8_9

Gaurav Raj

Operators

+

.

+

*

} Binary

} Unary

$$\Sigma = \{0, 1\}$$

Symbol : 0, 1, ε



$$\Sigma = \{\epsilon, a, b\}$$

Symbol : ε, a, b

ε → empty string

λ → empty string

Operators

+ }
• } Binary

+ }
* } Unary

$$R = \{a\}^* \xleftarrow{\text{R.E}} \text{NFA}$$

$$L(R) = \left\{ \epsilon, a, \underbrace{aa}, \underbrace{aaa}, \dots \right\}$$

$\sum^0 \quad \downarrow \text{length=0} \quad \sum^1 \quad \sum^2$

$$\sum^* = \left\{ \sum^0 \cup \sum^1 \cup \sum^2 \cup \dots \right\}$$

Operators

OR $\leftarrow +$
 \cdot

} Binary

$+$
 $*$

} Unary

$$\Sigma^* = \sum_{\in}^0 \cup \sum_{ab}^1 \cup \sum_{abab}^2 \cup \dots$$

$$R_1 = \underline{(a+b)}^* \quad (\underline{a} \text{ or } \underline{b})^*$$

$$L(R_1) = \{ \underline{\epsilon}, \underline{a}, \underline{b}, \underline{aa}, \underline{bb}, \underline{ba}, \underline{ab}, \dots \}$$

Universal lang over Symbol
a, b.

$$R_2 = \underline{(a.b)}^*$$

$$L(R_2) = \{ \cancel{a}, ab, a\cancel{a}b, \dots \}$$

$$L(R_2) = \{ \epsilon, ab, abab, ababab, \dots \}$$

one symbol "a is followed by b"

Operators

+

•

+

*

} Binary

} Unary

$$R = \{a, b\}^+$$

$$L(R) = \left\{ \cancel{\lambda}, \frac{a, b}{\sum^1}, \frac{aa, ab, ba, bb}{\sum^2} \right\}$$

$$\Sigma^+ \rightarrow \Sigma^1 \cup \Sigma^2 \cup \dots$$

$$\Sigma^* \rightarrow \Sigma^0 \cup \Sigma^1 \cup \Sigma^2 \cup \dots$$

Operators

+
•
}

+
*
}

Unary

$$L = \left\{ w \in \{a, b\}^* \mid L(w) = 2 \right\}$$

$\sum = \{a, b\}$

R.E

DFA

$$\begin{aligned} L &= \{aa, ab, ba, bb\} \\ &= (a+b)(a+b) \\ &= (a+b)^2 \end{aligned}$$



Operators

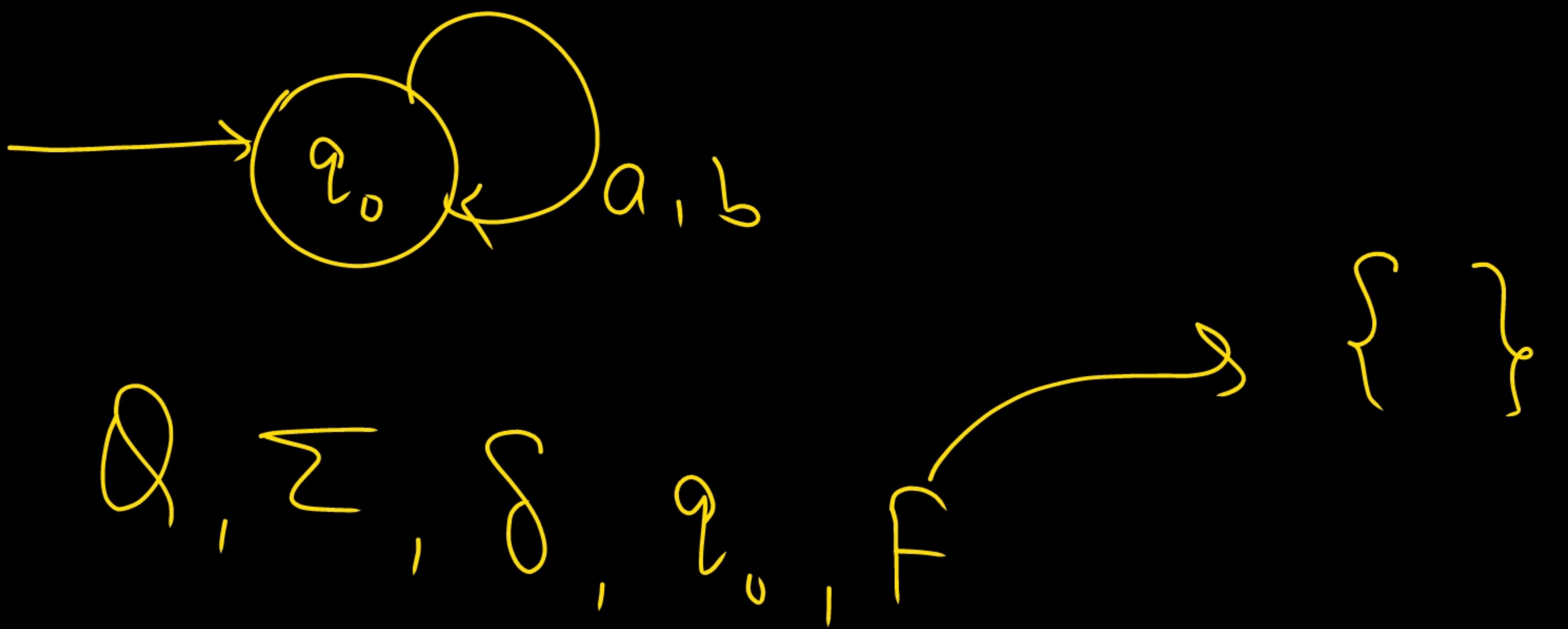
+ }
• } Binary

+ }
* } Unary

$$L = \{ \omega \in \{a, b\}^* \mid L(\omega) < 0 \}$$



$$L = \phi = \{ \}$$

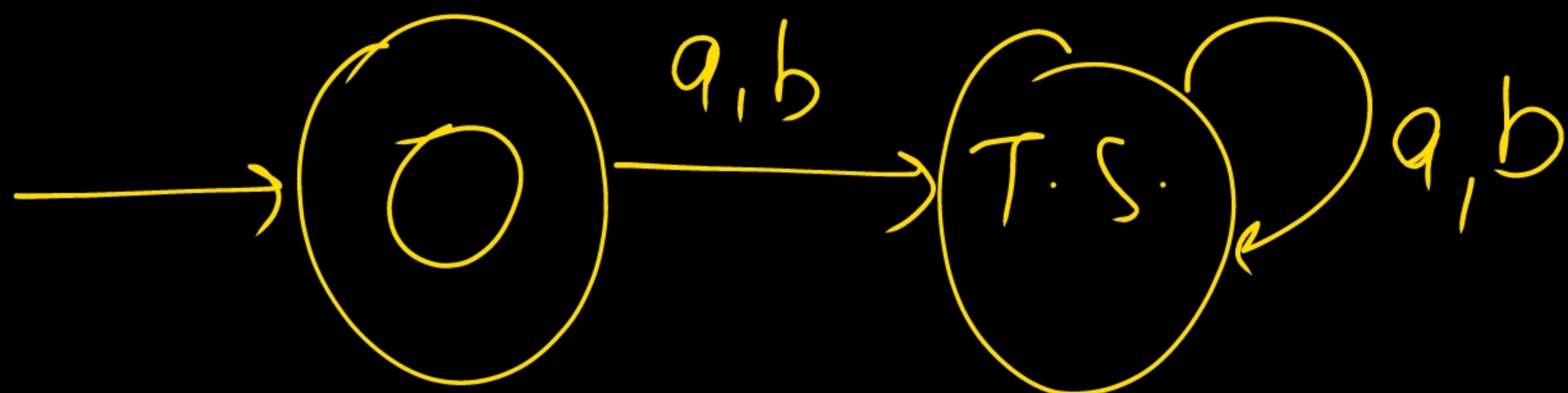


Operators

+ }
• } Binary
+ }
* } Unary

$$L = \left\{ \omega \in \{a, b\}^* \mid L(\omega) = o \right\}$$

$$R.E = \{\epsilon\}$$



Operators

+

•

+

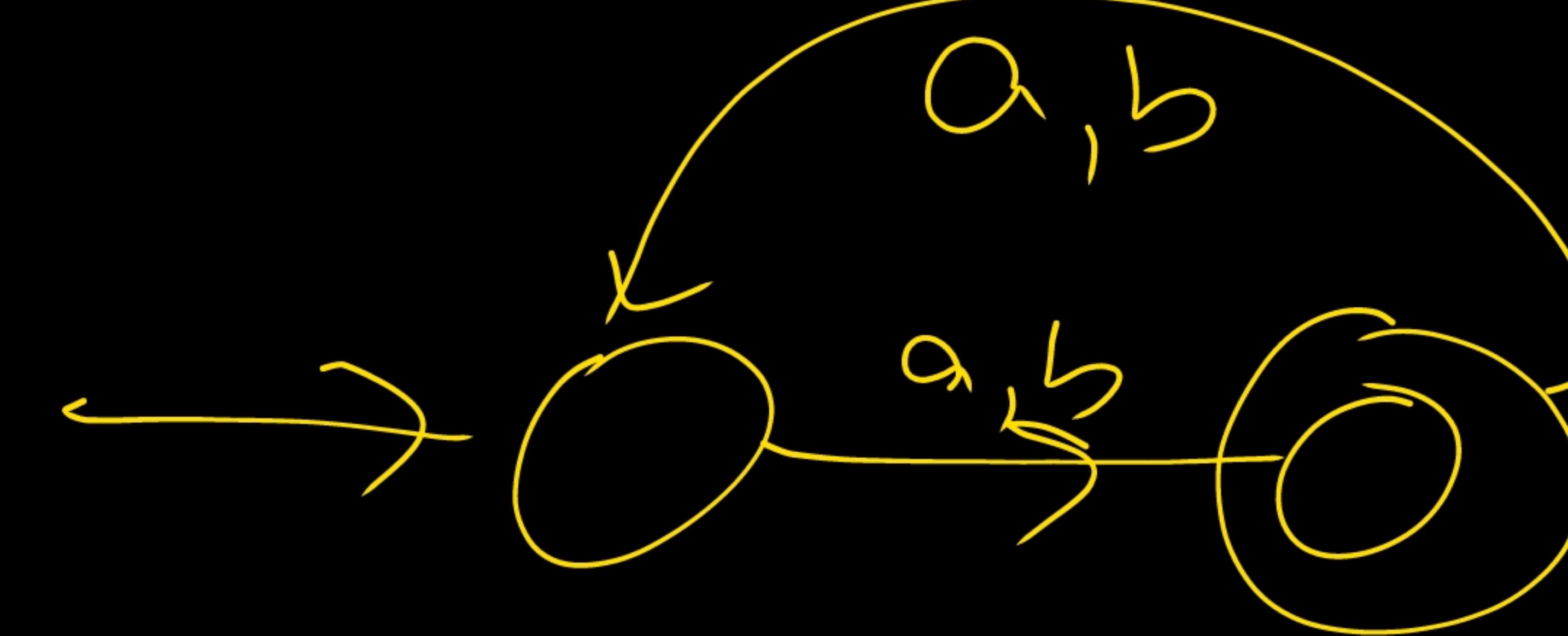
*

} Binary

} Unary

$$L = \left\{ \omega \in \{a, b\}^* \mid L(\omega) = \text{odd } \sum_{n+1} \right\}$$

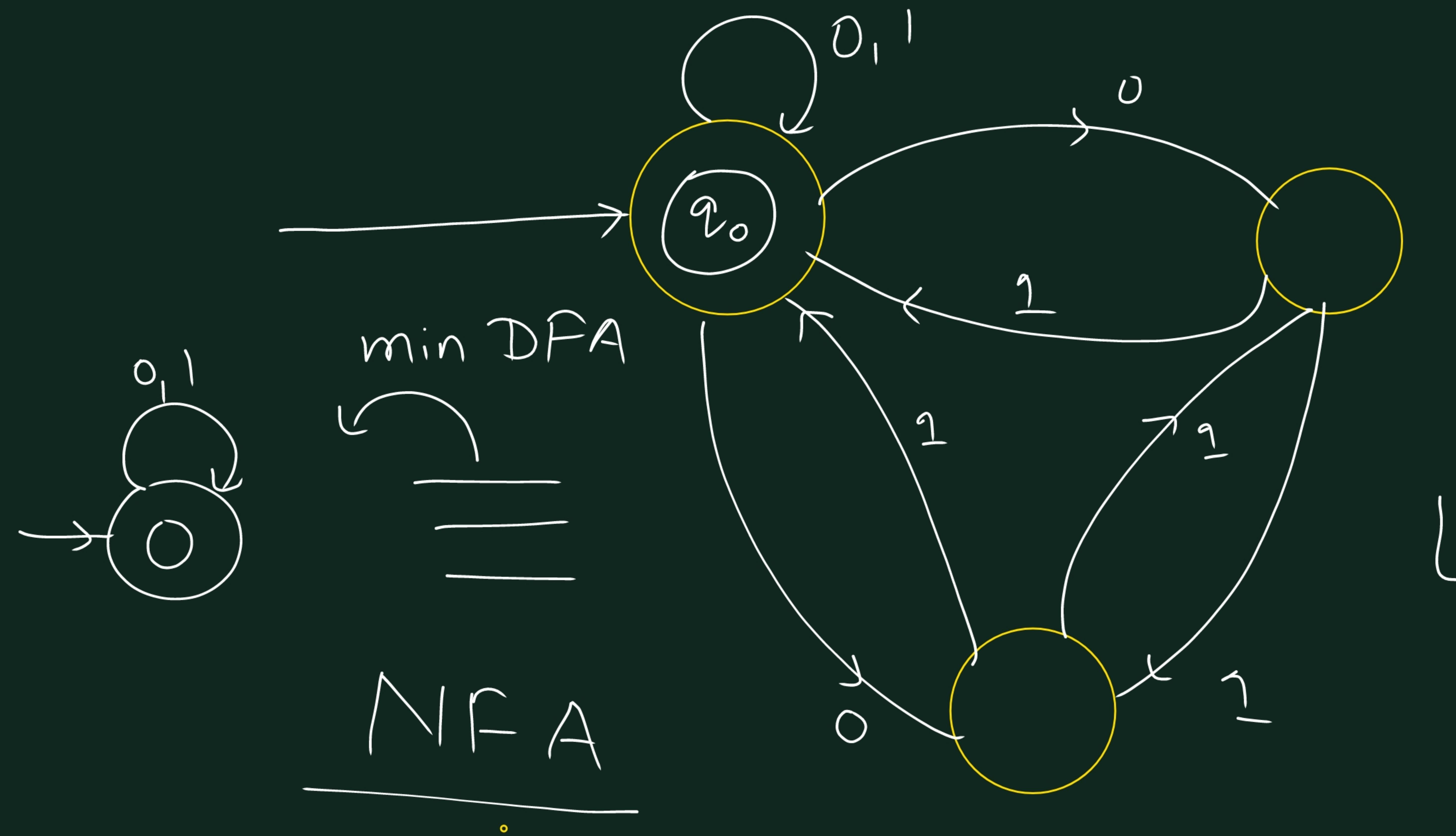
$$L(Q) = \{a, b, aaa, aab, \dots\}$$



$$L = \left\{ a.b, aaa, aab, \dots \right\}$$

= ~~Σ*~~

$$\begin{array}{c}
 \boxed{\epsilon} \\
 \downarrow \\
 \boxed{\sum^* \sum^* \sum^*} \\
 \boxed{\sum^* \sum^*} \\
 \boxed{\sum^* \sum^*}
 \end{array}
 \quad \left. \begin{array}{l}
 \sum^* \sum^* \\
 (\epsilon, a, b, aa, \dots)
 \end{array} \right\} \text{Same} \quad : \min \text{ length} = 2.$$



Thank You !