

$$II \quad G = (\{S, A, B\}, \{a, b\}, P, S)$$

$$P: S \rightarrow \varepsilon \mid aA \mid bB$$

$$A \rightarrow bA \mid bB$$

$$B \rightarrow aA \mid aB \mid a$$

$$x = ax + b \Leftrightarrow x = a^*b$$

$$\begin{cases} S = \varepsilon + aA + bB \\ A = bA + bB \Leftrightarrow \\ B = aA + aB + a \end{cases}$$

$$\Rightarrow \begin{cases} S = \varepsilon + aA + bB \\ A = b^*bB = b^+B \Leftrightarrow \\ B = aA + aB + a \end{cases}$$

$$\Rightarrow \begin{cases} S = \varepsilon + a b^+B + bB \\ A = b^+B \\ B = a b^+B + aB + a \end{cases} \Leftrightarrow$$

$$\Leftrightarrow \begin{cases} S = \varepsilon + a b^+a + bB \\ A = b^+B \\ B = (a b^+ + a)B + a \end{cases} \Leftrightarrow$$

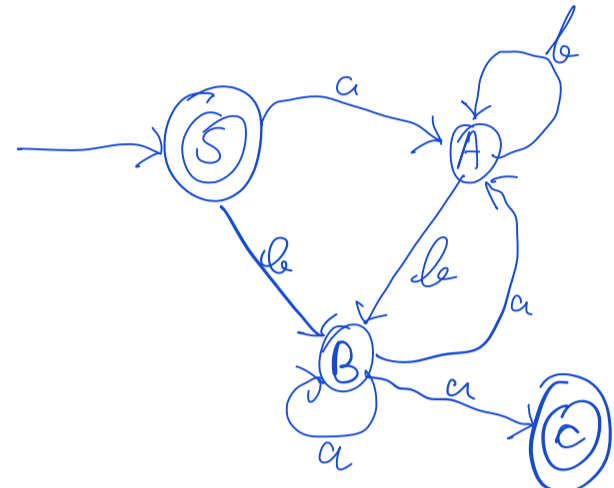
$$\Leftrightarrow \begin{cases} S = \varepsilon + a b^+a + bB \\ A = b^+B \\ B = (a b^+ + a)^*a \end{cases} \Leftrightarrow$$

$$S = \varepsilon + a b^+(a b^+ + a)^*a + b(a b^+ + a)^*a$$

$$S = \varepsilon + a b^+(a b^+)^*a + b(a b^+)^*a$$

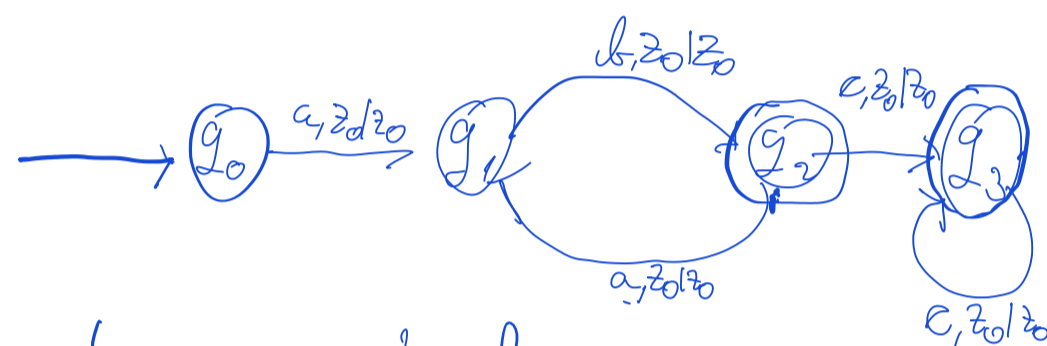
$$S = \varepsilon + (a b^+ + b)(a b^+)^*a$$

PG  $\Rightarrow$  FA



ab

$$III \quad L = \{(ab)^n c^m \mid n > 0, m \geq 0\}$$



$$M = \{Q, \Sigma, \Gamma, \delta, q_0, z_0, F\}, \text{ where}$$

$$Q = \{q_0, q_1, q_2, q_3\}$$

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

$$\Gamma = \{z_0\}$$

$$q_0 = q_0$$

$$z_0 = z_0$$

$$F = \{q_2, q_3\}$$

$$\delta(q_0, a, z_0) = (q_1, z_0)$$

$$\delta(q_1, b, z_0) = (q_2, z_0)$$

$$\delta(q_2, a, z_0) = (q_1, z_0)$$

$$\delta(q_3, c, z_0) = (q_3, z_0)$$

$$\delta(q_3, c, z_0) = (q_3, z_0)$$

$$\delta(q_3, c, z_0) = (q_3, z_0)$$

$$IV \quad G = (\{S, A, B, C\}, \{0, 1\}, P, S)$$

$$P: S \rightarrow AB \mid B \mid CC$$

$$A \rightarrow 0A \mid \varepsilon \mid SB$$

$$B \rightarrow 1A \mid \varepsilon \mid SC$$

$$C \rightarrow 0 \mid 1$$

I First

S	$\emptyset$	$\{0, 1, \varepsilon\}$	$\{0, 1, \varepsilon\}$
A	$\{0, \varepsilon\}$	$\{0, 1, \varepsilon\}$	$\{0, 1, \varepsilon\}$
B	$\{1, \varepsilon\}$	$\{0, 1, \varepsilon\}$	$\{0, 1, \varepsilon\}$
C	$\{0\}$	$\{0\}$	$\{0\}$

$$\text{First}(S) = \text{First}(A) \cup \text{First}(B) \cup \text{First}(C)$$

$$\text{First}(A) = \{0, \varepsilon\} \cup \text{First}(S)$$

$$\text{First}(B) = \{1, \varepsilon\} \cup \text{First}(S)$$

$$\text{First}(C) = \{0\}$$

$$\text{Follow}(C) = \{0, 1\} \quad \text{Follow}(C) = \{0, 1, \varepsilon\}$$

$$CO \quad CO$$

$$C1 \quad C1$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$ABC \quad ABC \checkmark$$

$$II \quad \text{Follow}(S) = \{\varepsilon\} \cup \text{First}(B) \cup \text{First}(C)$$

$$\text{Follow}(A) = \text{First}(B) \cup \text{Follow}(B)$$

$$\text{Follow}(B) = \text{First}(C) \cup \text{Follow}(C) \cup \text{Follow}(A)$$

$$\text{Follow}(C) = \text{First}(C) \cup \text{Follow}(C) \cup \text{Follow}(B) \cup \{0\}$$

S	$\{0, 1, \varepsilon\}$	$\{0, 1, \varepsilon\}$	$\{0, 1, \varepsilon\}$
A	$\{0, 1, \varepsilon\}$	$\{0, 1, \varepsilon\}$	$\{0, 1, \varepsilon\}$
B	$\{0, 1, \varepsilon\}$	$\{0, 1, \varepsilon\}$	$\{0, 1, \varepsilon\}$
C	$\{0\}$	$\{0, 1, \varepsilon\}$	$\{0, 1, \varepsilon\}$

⑤ for  $i := 1$  to  $n$  do  
 for  $j := 1$  to  $m$  do  
 if  $i < j$  then  $s := s + i$   
 else  $s := s + j$

index	op	arg1	arg2	res
1	:=	1		i
2	>	i	a	t <sub>1</sub>
3	goto	t <sub>1</sub>		(20)
4	:=	1		j
5	>	j	m	t <sub>2</sub>
6	goto	t <sub>2</sub>		(17)
7	<	i	j	t <sub>3</sub>
8	goto	t <sub>3</sub>		(12)
9	+	s	j	t <sub>4</sub>
10	:=	t <sub>4</sub>		s
11	goto			(14)
12	+	s	i	t <sub>5</sub>
13	:=	t <sub>5</sub>		s
14	+	j	1	t <sub>6</sub>
15	:=	t <sub>6</sub>		j
16	goto			(5)
17	+	i	1	t <sub>7</sub>
18	:=	t <sub>7</sub>		i
19	goto			(2)
20	:=	s		a