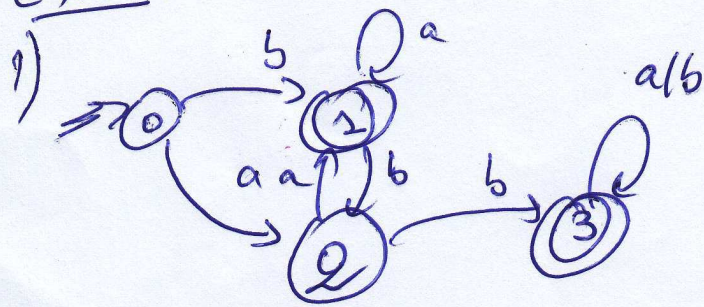


EX01:



$$X_0 = \Sigma$$

$$X_1 = X_0 b + X_1 a + X_2 a = b + X_1 a + X_2 a$$

$$X_2 = X_0 a + X_1 b = a + X_1 b = a + (b + X_1 a) (a + b) a$$

$$X_1 = b + X_1 a + (a + X_1 b) a$$

$$= b + X_1 a + a + X_1 b a$$

$$= b + a + X_1 (a + b a)$$

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

$$X_3 = X_2 b + X_3 a + X_3 b$$

$$= (b + a) (a + b a)^* b + X_3 (a + b)$$

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

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

$$L = X_1 + X_3$$

3



2)

$$0 \rightarrow b_1/b/a_2' \quad (0: a+)$$

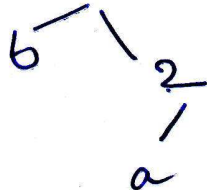
$$1 \rightarrow a_1/a/b_2$$

$$2 \rightarrow a_1/b_3/b/a$$

$$3 \rightarrow a_3/b_3/a/b$$

(11)

3)



(out)

Exo 2:

$$S \rightarrow a s b B \mid d A a \mid d B$$

$$A \rightarrow S A \mid \epsilon$$

$$B \rightarrow b B \mid \epsilon$$

C: inaccem Re.

$$\Rightarrow S \rightarrow a s b B \mid a s b \mid d A a \mid d B$$

$$A \rightarrow S A \mid S$$

$$B \rightarrow b B \mid b$$

$$\Downarrow$$

$$S \rightarrow A' S B' B \mid A' S B' \mid D A A' \mid D A'$$

$$D B \mid d$$

$$A \rightarrow S A \mid S$$

$$B \rightarrow D B \mid b$$

$$A' \rightarrow a$$

$$B' \rightarrow b$$

$$D \rightarrow d$$

(2)

$$S \rightarrow A'X_1 / A'X_3 / DX_4 / DA' / DB / d$$

(at the).

$$X_1 \rightarrow SX_2$$

$$X_2 \rightarrow B'B$$

$$X_3 \rightarrow SB'$$

$$X_4 \rightarrow AA'$$

$$A \rightarrow SA / A'X_1 / A'X_3 / DX_4 / DA' / DB / d$$

$$B \rightarrow DB / b$$

$$A' \rightarrow a$$

$$B' \rightarrow b$$

$$D \rightarrow d$$

21

$$2) S \rightarrow SAa / Sb / aA / b$$

$$A \rightarrow aA / b / \epsilon$$

$$\Downarrow$$

$$S \rightarrow SAa / Sa / Sb / aA / a / b$$

$$A \rightarrow aA / a / b$$

$$\Downarrow$$

$$S \rightarrow aAS' / aS' / bS'$$

$$S' \rightarrow AaS' / aS' / bS' / \epsilon$$

$$A \rightarrow aA / a / b$$

$$\Downarrow$$

$$S \rightarrow aAS' / aA / aS' / a / bS' / b$$

$$S' \rightarrow AaS' / Aa / aS' / a / bS' / b$$

$$A \rightarrow aA / a / b$$

→ Graded

2

$$S' \rightarrow (aA|a|b) aS' / (aA|a|b) a / aS' / a|bS'/b$$

$$\Downarrow$$

$$S' \rightarrow aAaS' / a aS' / b aS' / aAa / aa / ba / aS' / a|bS'/b$$

$$\Downarrow$$

$$S' \rightarrow aAA'S' / aA'S' / bA'S' / aAA' / aA' / bA' / aS' / a$$

$$A' \rightarrow a$$

$$S \rightarrow aAS' / aA|aS' / a|bS'/b \quad (a \text{ true})$$

$$A \rightarrow aA|a|b$$

Exo 3:  $L = b^* (ab)^+ c^* + c (ba)^+$

$$q_0 = L$$

$$q_0 \parallel a = b^* (ab)^+ c^* \parallel a = b (ab)^+ c^* = q_1$$

$$q_0 \parallel b = b^* (ab)^+ c^* = q_2$$

$$q_0 \parallel c = (ba)^+ = q_3 \in Q_F$$

$$q_1 \parallel b = (ab)^+ c^* = q_4 \in Q_F$$

$$q_1 \parallel c = \emptyset$$

$$q_2 \parallel a = b (ab)^+ c^* = q_1$$

$$q_2 \parallel b = q_2$$

$$q_2 \parallel c = \emptyset$$

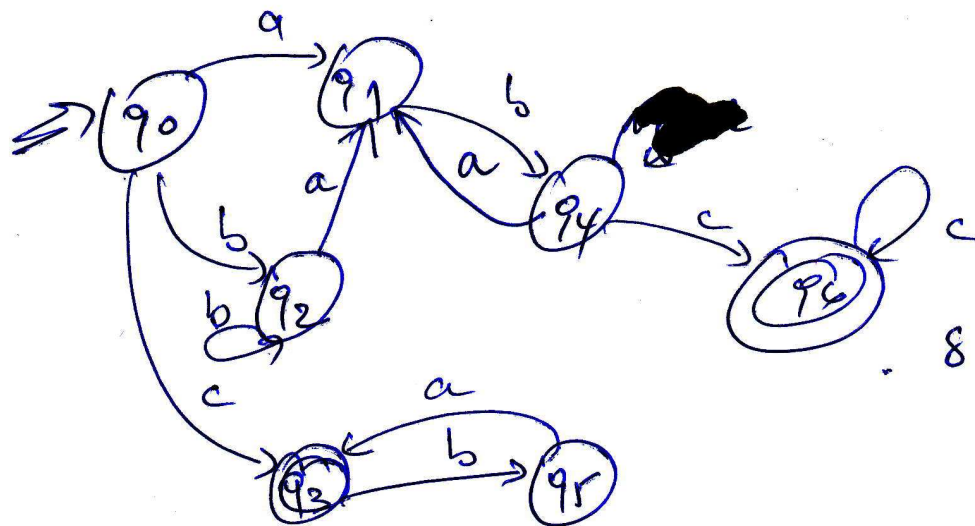
$$q_3 \parallel b = a (ba)^+ = q_5$$

$$q_4 \parallel a = b (ab)^+ c^* = q_4$$

$$q_4 \parallel c = c^* = q_6 \in Q_F$$

$$q_5 \parallel a = (b a)^* = q_3$$

$$q_6 \parallel c = q_6$$



④

$\delta(q_0, b a b c) \vdash (q_2, a b c)$   
 $\vdash (q_1, b c)$   
 $\vdash (q_4, c)$   
 $\vdash (q_6, c)$   
 $\in Q_F$

Ex 4.1

$$1) L = \{ a^u b^m ; \frac{u}{2} \leq 2m ; m \geq 1 \}$$

$$\delta(q_0, a, \#) = (q_1, a \#) ; \delta(q_0, b, \#) =$$

$$\delta(q_1, a, a) = (q_2, a) \quad (q_4 \#)$$

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

$$\delta(q_1, b, a) = (q_3, \epsilon)$$

$$\delta(q_3, b, a) = (q_3, \epsilon)$$

$$\delta(q_3, b, \#) = (q_4, \#)$$

$$\delta(q_4, b, \#) = (q_4, \#)$$

$$\delta(q_4, \epsilon, \#) = (q_F, \#)$$

③

$$\delta(q_0, c b a b a)$$

$$\vdash (q_3, b a b a) \quad \text{O.I.}$$

$$\vdash (q_1, a b a)$$

$$\vdash (q_3, b a)$$

$$\vdash (q_1, a)$$

$$\vdash (q_3, \epsilon)$$

$$\in Q_F$$

⑤