Type 2 or CFG

$G = (V, T, P, S)$ is a type 2 grammar or context free grammar if all the productions are of the form

→ $A \rightarrow \alpha$ where $\alpha \in (V \cup T)^*$ and

→ A is a non-terminal.

→ ϵ can appear in the RHS of any production.

(already discussed in the begining)

$S \rightarrow aB \mid bA \mid \epsilon$

$A \rightarrow aA \mid b$

$B \rightarrow bB \mid a \mid \epsilon$

Type 3 or regular Grammar

$G = (V, T, P, S)$ is type 3 or regular iff it is left linear or right linear.

- A grammar is said to be <u>right linear</u> if productions are of the form

$A \rightarrow wB$ and/or $A \rightarrow w$

(variables appear on Right side of the production on RHS)

$A, B \in V$

$w \in T^*$.

A grammar G is said to be **left linear** if all the productions are of the form (8)

$A \rightarrow Bw \mid A \rightarrow w$

$A, B \in V$ & $w \in T^*$

$S \rightarrow aaB \mid bbA \mid \epsilon$
$A \rightarrow aA \mid b$
$B \rightarrow bB \mid a \mid \epsilon$

Right linea

$S \rightarrow Baa \mid Abb \mid \epsilon$
$A \rightarrow Aa \mid b$
$B \rightarrow Bb \mid a \mid \epsilon$

Left linea.

$S \rightarrow aA$
$A \rightarrow aB \mid b$
$B \rightarrow Ab \mid a$

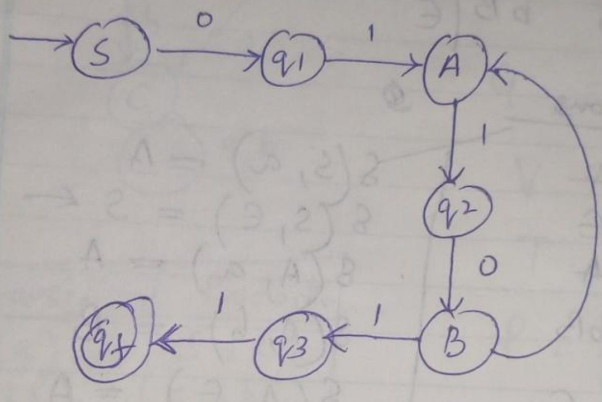
$\Uparrow$

linear grammar

productions are left and right linear.

$S \to 01A$
$A \to 10B$
$B \to 0A / 11$

Construct a DFA to accept the language (9)



~~$G = (V, T, P, S)$~~ $M = (Q, \Sigma, \delta, q_0, F)$

$V = \{S, A, B, q1, q2, q3, qf\}$

$T = \{0, 1\}$

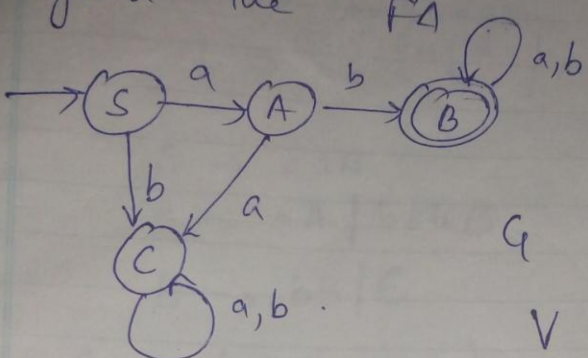
$q_0 = S$

$f = qf$

δ = table.

IS	Transiti
S	$\delta(S, 01) \to A$
A	$\delta(A, 10) \to B$
B	$\delta(B, 0) \to A$
	$\delta(B, 11) \to qf$

Construct a Regular Grammar from the FA (10)



$G = (V, T, P, S)$

$V = \{S, A, B, C\}$

$T = \{a, b\}$

$P = \{$

$S \rightarrow aA \mid bC$

$A \rightarrow aC \mid bB$

$B \rightarrow aB \mid bB \mid \epsilon$

$C \rightarrow aC \mid bC$

$\}$

S is the start symbol

Transitions	Production
$\delta(S, a) = A$	$S \rightarrow aA$
$\delta(S, b) = C$	$S \rightarrow bC$
$\delta(A, a) = C$	$A \rightarrow aC$
$\delta(A, b) = B$	$A \rightarrow bB$
$\delta(B, a) = B$	$B \rightarrow aB$
$\delta(B, b) = B$	$B \rightarrow bB$
$\delta(C, a) = C$	$C \rightarrow aC$
$\delta(C, b) = C$	$C \rightarrow bC$

Conversion of FA to RG

1) start symbol of RG will be the start ~~symbol~~ state of FA

2) for Any product $A \rightarrow wB$

$\delta(A, w) = B$

3) for any prod of form $A \rightarrow w$

$\delta(A, w) = q_f$

4) for any pro $A \rightarrow \epsilon$, make A the final state

Obtain a right linear grammar to the language (11)

$L = \{a^n b^m \mid n \geq 2\ m \geq 3\}$

aabbb or more.

$S \to aaA$

$A \to aA \mid bbbB$

$B \to bB \mid \epsilon$

$G = (V, T, P, S)$

$V = \{S, A, B\}$

$T = \{a, b\}$

$P = \{ S \to aaA$

$A \to aA \mid bbbB$

$B \to bB \mid \epsilon$

$\}$

S is the start symbol.

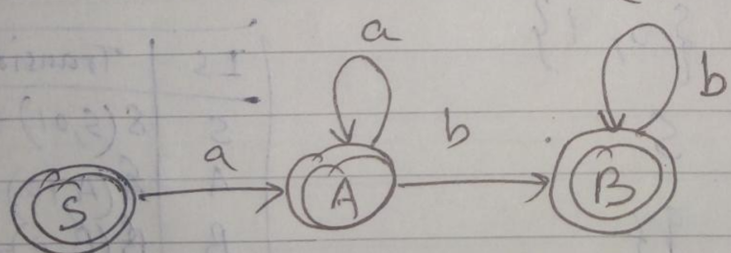
Construct a DFA to accept (12)

$S \rightarrow aA \mid \epsilon$

$A \rightarrow aA \mid bB \mid \epsilon$

$B \rightarrow bB \mid \epsilon$

Production	Transitions
$S \rightarrow aA$	$\delta(S, a) = A$
$S \rightarrow \epsilon$	$\delta(S, \epsilon) = S$ ← final state
$A \rightarrow aA$	$\delta(A, a) = A$
$A \rightarrow bB$	$\delta(A, b) = B$
$A \rightarrow \epsilon$	$\delta(A, \epsilon) = A$ ← final state
$B \rightarrow bB$	$\delta(B, b) = B$
$B \rightarrow \epsilon$	$\delta(B, \epsilon) = B$ ← final



$Q = \{S, A, B\}$

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

$q_0 = S$

$q_f = \{S, A, B\}$