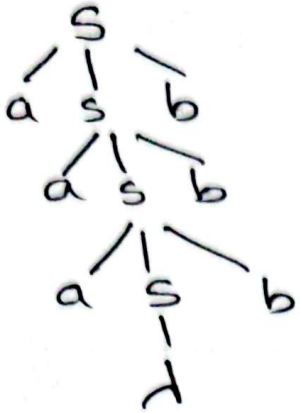
18 Aug 2025

CFG - Context Free Grammar

Q) $a^n b^n, n \geq 0$

$S \rightarrow aSb \mid \lambda$ → Termination condition

aaabbb

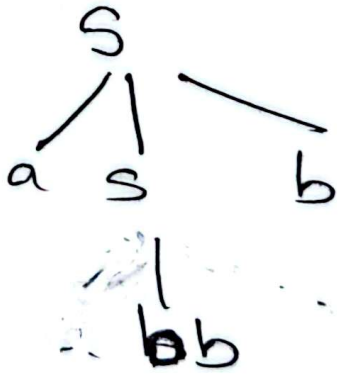


abbb

Q) $a^n b^{n+2}, n \geq 0$

$S \rightarrow aSb \mid bb$

abbb



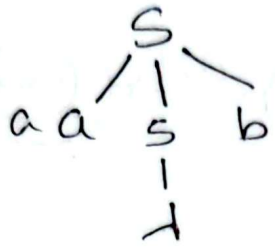
Q) $a^n b^n$, $n \geq 1$

$S \rightarrow a\,S\,b \mid ab$

ab in Tic if +2, +3, etc...

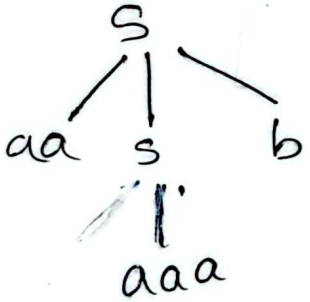
Q) $a^{2n} b^n$, $n \geq 0$

$S \rightarrow aa\,S\,b \mid \lambda$



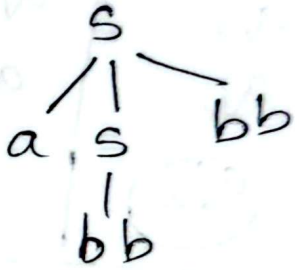
Q) $a^{2n+3} b^n$, $n \geq 0$

$S \rightarrow aaSb \mid aaa$



Q) $a^n b^{2n+2}$, $n \geq 0$

$S \rightarrow a\,S\,bb \mid bb$



NFA to DFA

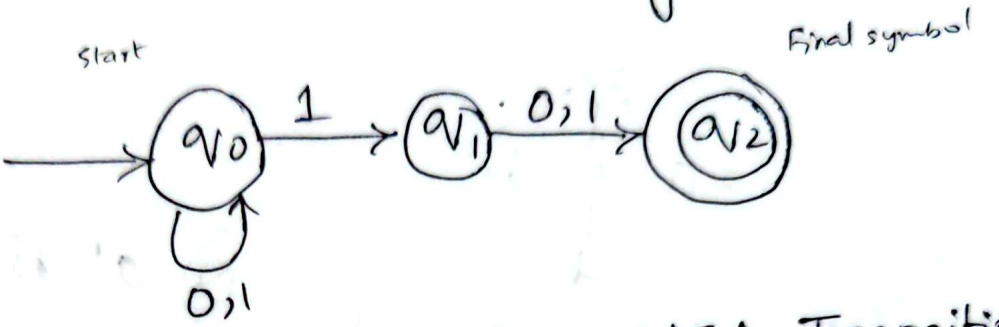
NFA - Non-Deterministic Finite Automata

DFA - Deterministic Finite Automata

NFA to equivalent DFA

What is NFA and DFA with diagram:

NFA



Stage	0	1
→ q_0	q_0	q_0, q_1
q_1	q_2	q_2
(q_2)	—	—

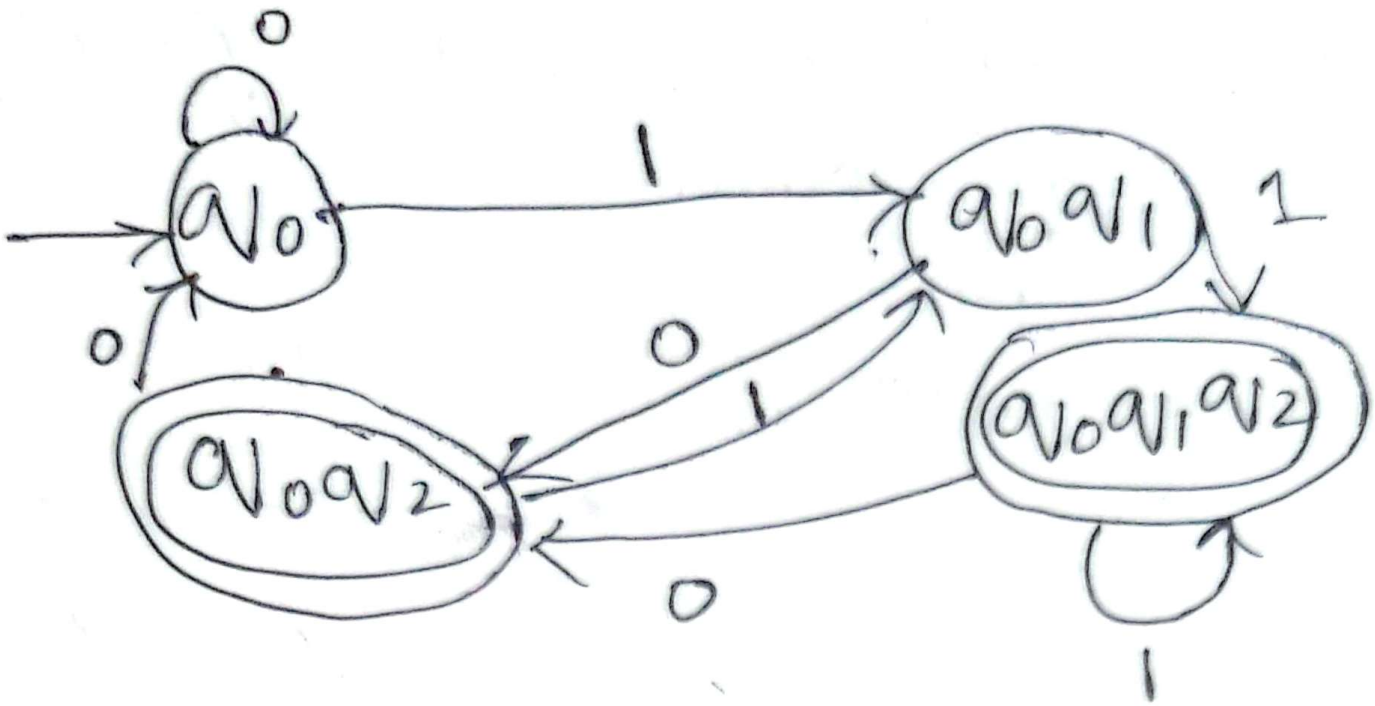
NFA Transition ~~Diagram~~ Table

DFA Transition Table

stage	0	1
→ q_0	q_0	$q_0 q_1$
$q_0 q_1$	$q_0 q_2$	$q_0 q_1 q_2$
($q_0 q_2$)	q_0	$q_0 q_1$
($q_0 q_1 q_2$)	$q_0 q_2$	$q_0 q_1 q_2$

Finish state

DFA



19 Aug 2025

Grammar – Ambiguous & Non-Ambiguous

↓ more than one path and correct path

↓ only one path

Q) If the grammar is ambiguous or non-ambiguous. Prove.

$S \to ASBa \mid ab$

$A \to aA \mid b$

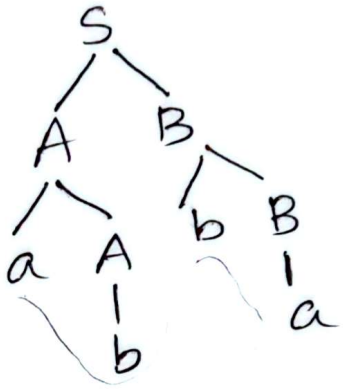
A → variable
S → starting symbol
a, b → termination variable

Q) $S \to AB$

$A \to aA \mid b$

$B \to bB \mid a$

w: abba



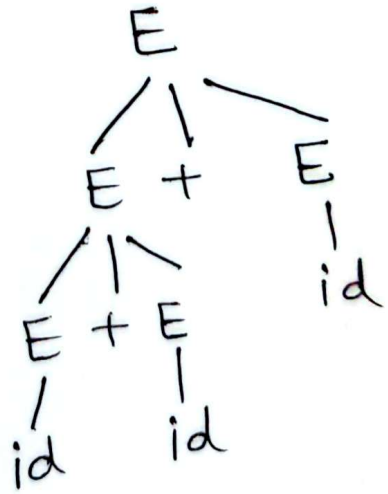
unambiguous

Q) $E \to E+E \mid id$

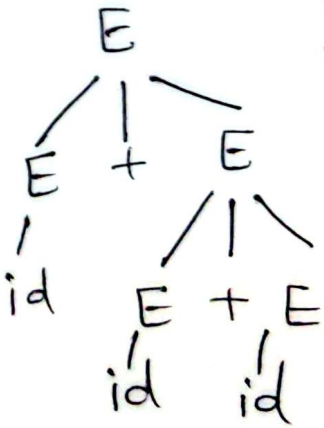
w: id + id + id

+ → Terminal

For left



For Right



Ambiguous

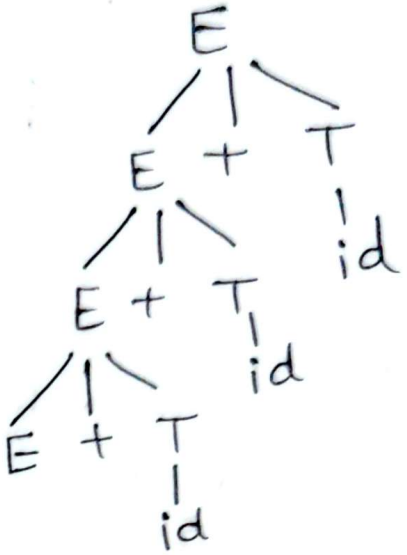
Ambiguous ~~CFG~~ Un~~non~~ ambiguous ~~a~~ convert

Q) $E \to E+E/id$

w: id + id + id

$E \to E+T/T$

$T \to id$



Q) $S \to SA \mid Bs \mid ab$

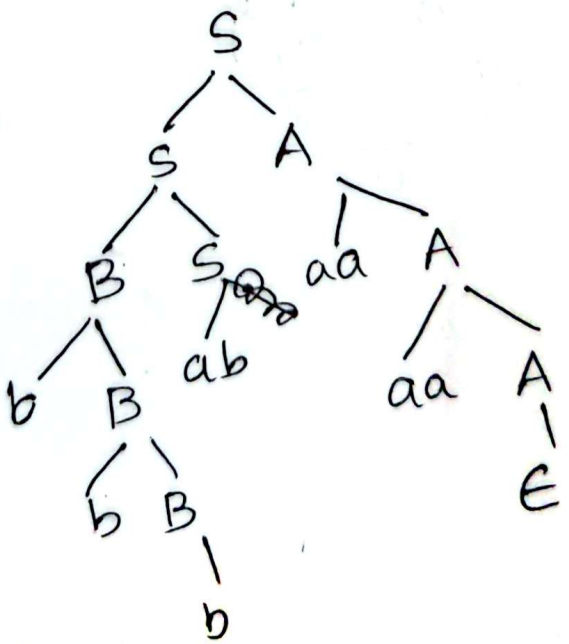
$A \to aaA \mid \epsilon$

$B \to bB \mid b$

word: bbbabaaaaa

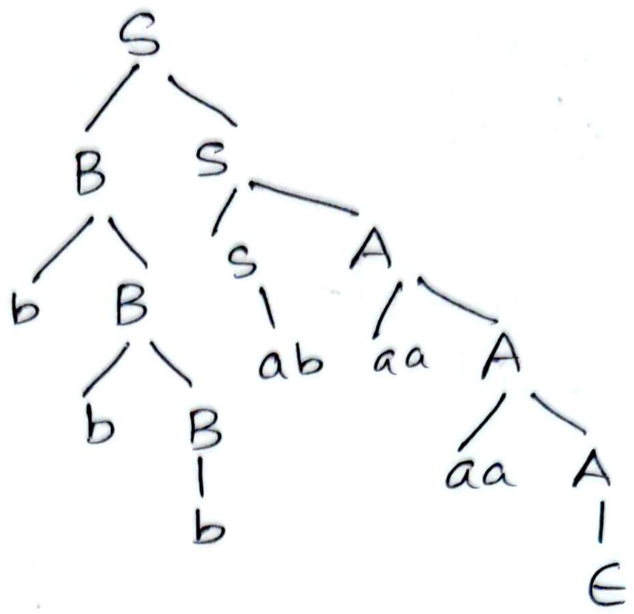
Check it is ambiguous or not?

one-way



Right

Second way



DFA

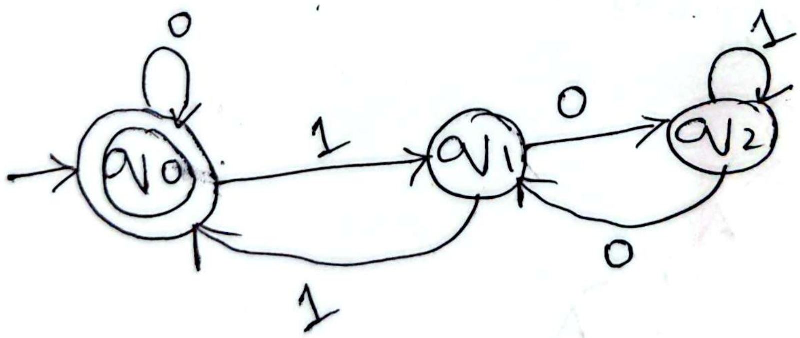
binary no. divisible by 3

number		Remainder	
000	→	0	→ q_0
001	→	1	→ q_1
010	→	2	→ q_2
011	→	0	→ q_0
100	→	1	→ q_1
101	→	2	→ q_2
110	→	0	→ q_0
111	:	:	

DFA diagn
ei সকল no. gulo accept করবে

যেগুলো 0 — accepted

1) start with zero



একটা

1100 = 12

3|12|4
12
0

1101 =
↓
Not divisible

DFA hexadecimal 15th input
divisible by 5, 10, ..

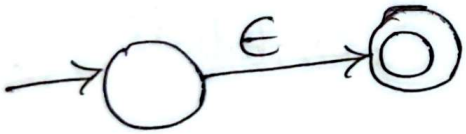
NFA Diagram

Regular Expression → NFA

$r = \phi$

$r = a$

$r = \epsilon$



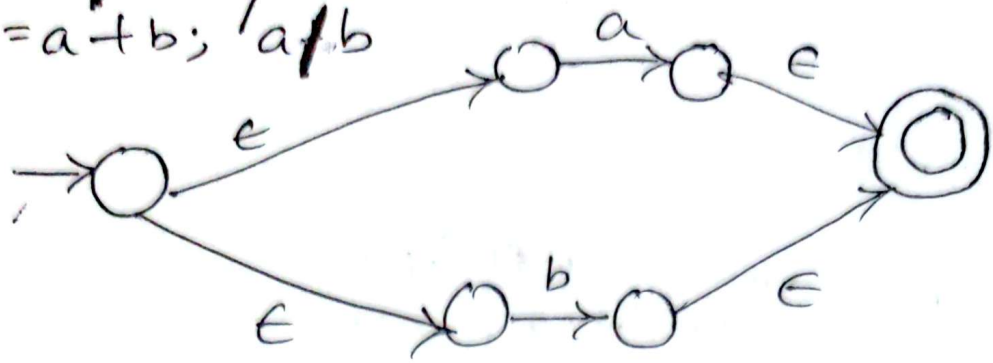
$r = ab$

$r = 101$

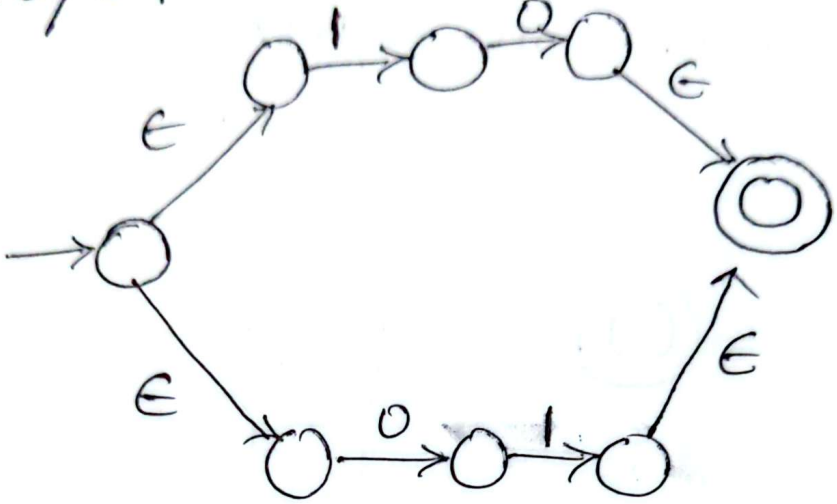
a or b

Q) $r = a/b \quad / a+b$

$r = a+b; \quad a/b$



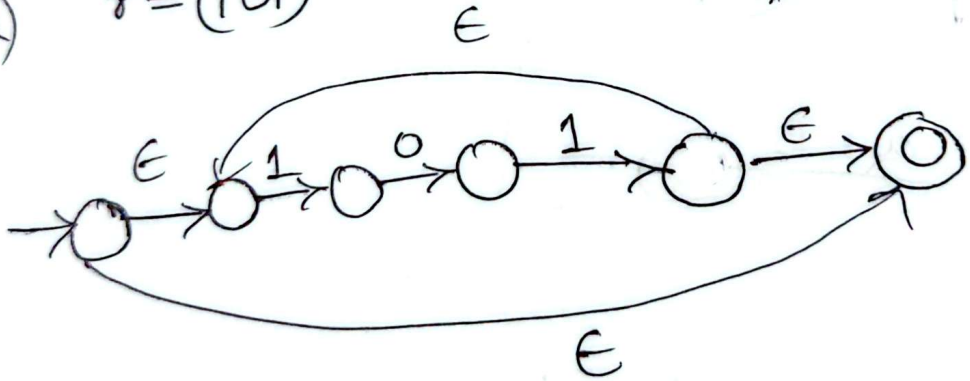
Q) $r = 10/01$

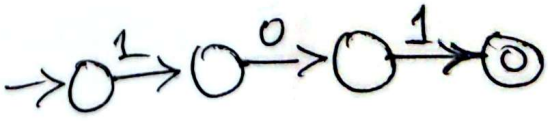


Q) $r = (10|1)^*$

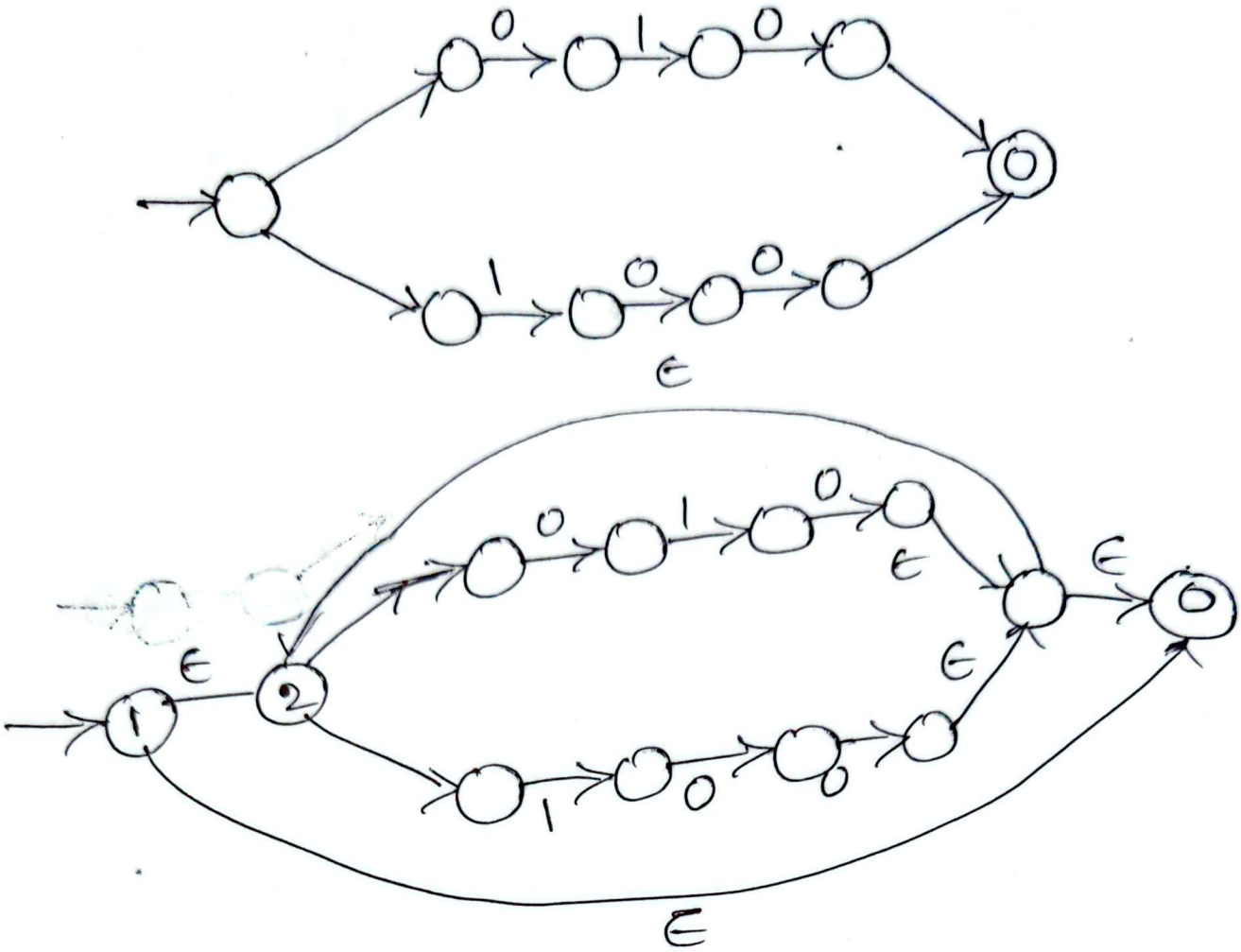
* → statistics

if * then a steps complete





Q) $r = (010 / 100)^*$



Q) $r = 1(0+1)^* 10$