1. $S ::= aAS \mid a$

   $A ::= SbA \mid SS \mid ba$

a)

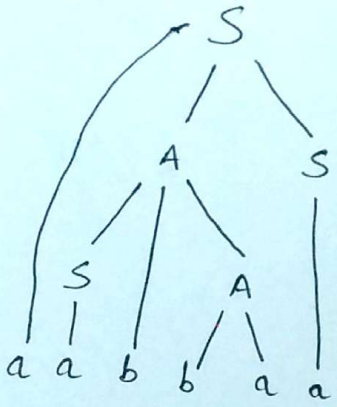
TERMINALS := a, b

NON-TERMINALS := A, S

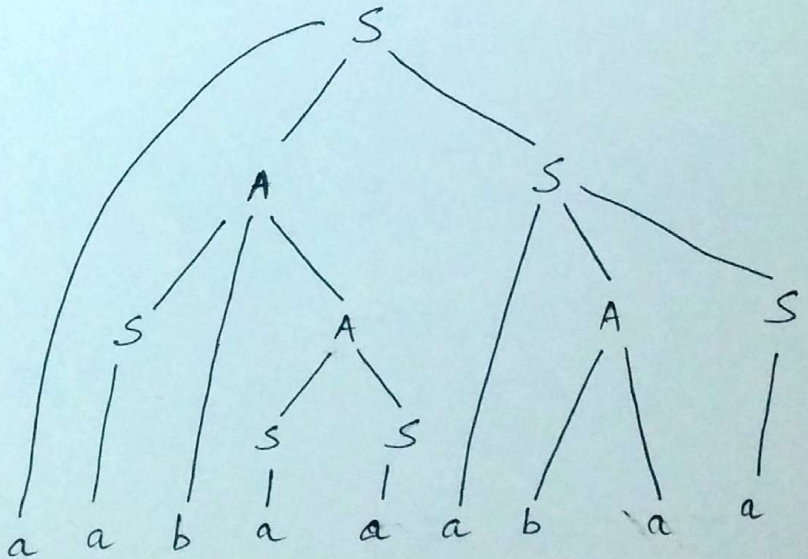
START-SYMBOL := S

b)

1.



2.



c) 1. $S \Rightarrow aAS \Rightarrow aSbAS \Rightarrow aabAS$

$\Rightarrow aabbaS \Rightarrow aabbaa$

2. $S \Rightarrow aAS \Rightarrow aSbAS \Rightarrow aabAS$

$\Rightarrow aabSSS \Rightarrow aabaSS \Rightarrow aabaaS$

$\Rightarrow aabaaaAS \Rightarrow aabaaabaS \Rightarrow aabaaabaa$

2.

a) $S := S(S)S \mid S[S]S \mid \varepsilon$

b) $S := aXbX \mid bXaX$

$X := S \mid \varepsilon$

c)

$S := WcY$

$W := aXa \mid bXb$

$X := W \mid \varepsilon$

$Y := aZbb$

$Z := Y \mid \varepsilon$

3. $N = \{ S, NP, VP, PP, D, V, N, P \}$

where S = Sentence
NP = Noun phrase
VP = Verb phrase
PP = Prepositional phrase
D = Determiner
V = Verb
N = Noun
P = preposition

start = ~~sentence~~

Rules :-

$S \rightarrow NP\ VP \mid S\ ;\ S$

$VP \rightarrow V\ NP \mid VP\ PP \mid V$

$NP \rightarrow N\ NP \mid NP\ PP \mid D\ N$

$PP \rightarrow P\ NP$

$N \rightarrow$ time | arrow | fruit | flies | banana

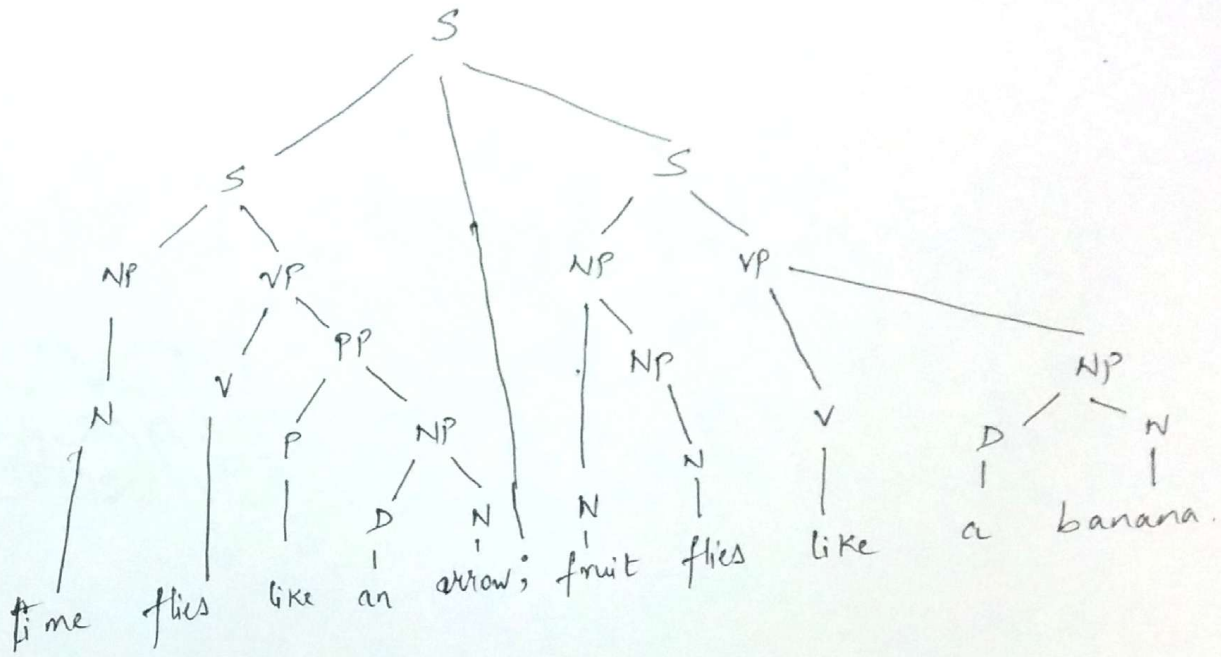
$V \rightarrow$ flies | like

D → a | an

P → like

PARSE - TREE

(1)



(2)