Computation Theory

Language Grammar

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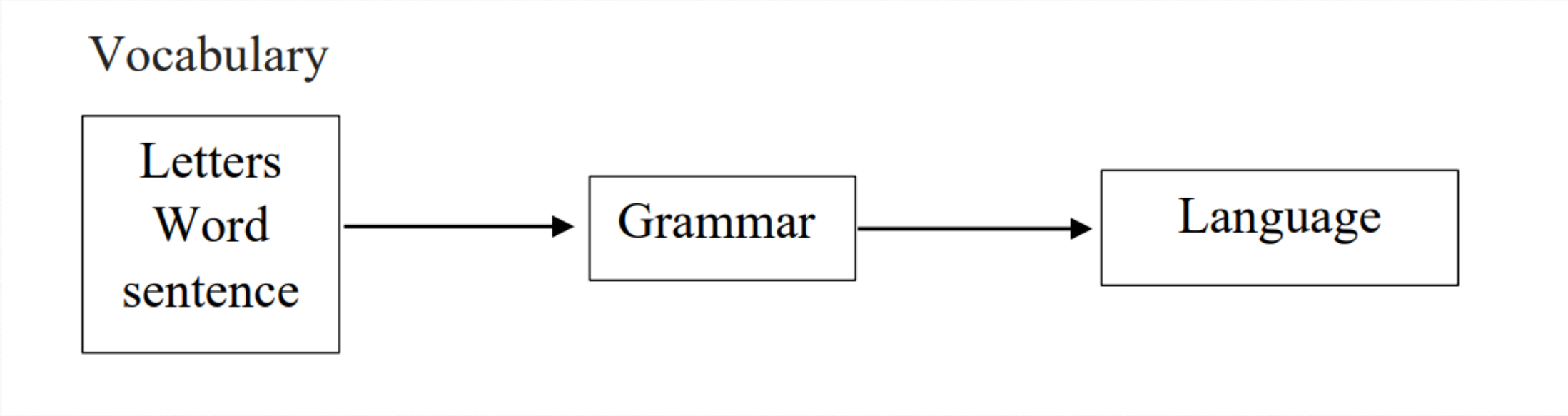
Language Grammar are the foundations and principles; through which we can link the vocabulary



Example:

Let the following grammar:

Sentence = Noun Phrase (NP) + Verb Phrase (VP) + Noun Phrase (NP)

NP = Article (Art) + Noun (N)

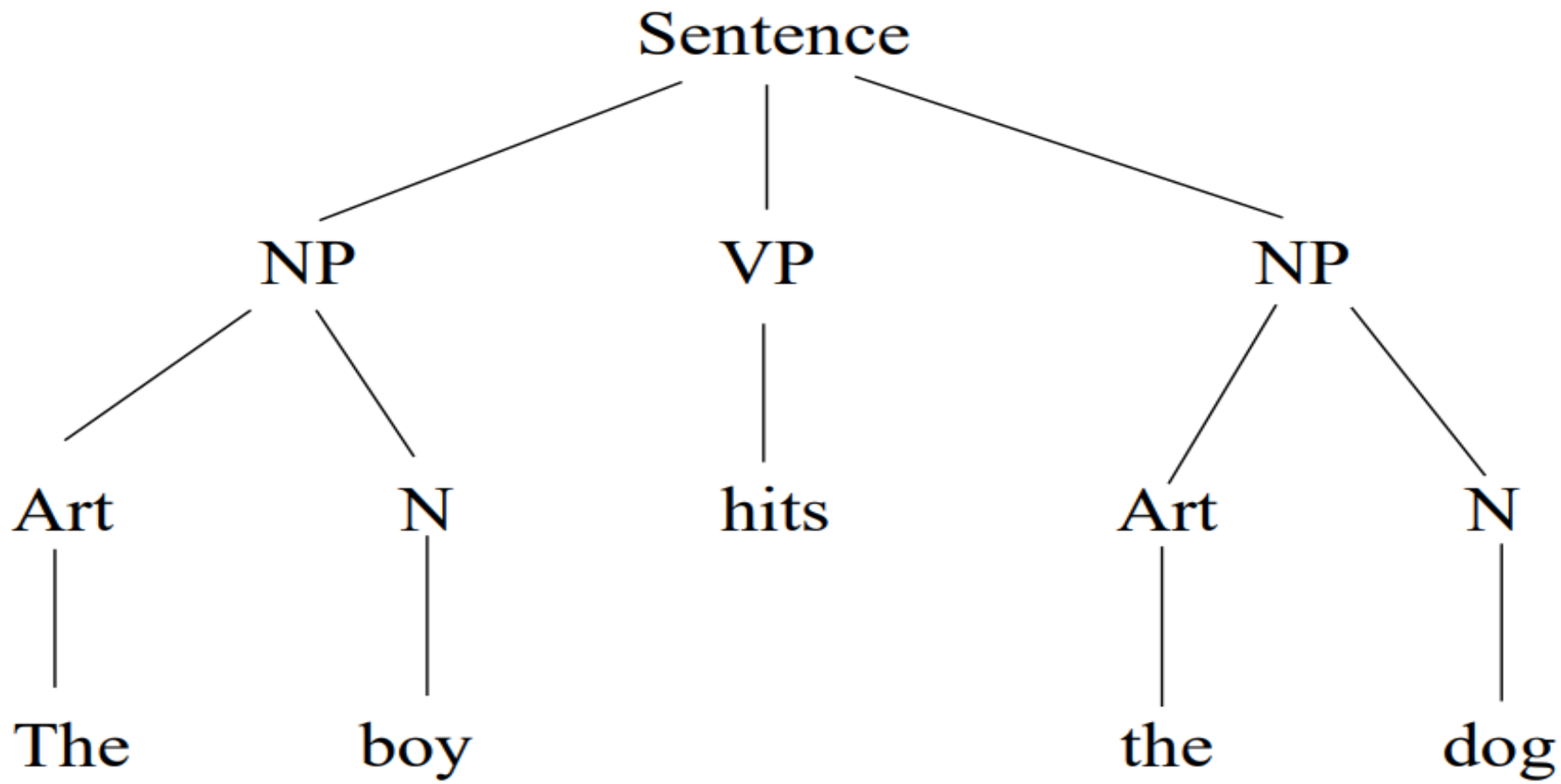
Art = a or an or the

Noun = Man, Car, House, Dog, …

VP = eat, play, write, read, …

“The boy hits the dog”

NP VP NP



Phrase Tree

في المثال اعلاه الجملة مكونة من مفردات وقواعد تنتمي الى نفس اللغة، لذلك فأن هذه الجملة صحيحة ووفق قواعد هذه اللغة هي مقبولة (Accept)

Example: “The dog eats the house”

NP VP NP

الجملة اعلاه وفق القواعد صحيحة لكن من ناحية المعنى ليس لها معنى. من هذا نستنتج ان الجملة يجب ان تتكون من جزئين مترابطين هما القواعد (syntax) و المعنى(semantic)

Terminal Symbol (T): The words that cannot be replaced by anything are called terminals.

Non-terminal Symbol (N): The words that must be replaced by other things we call non-terminals.

Grammars

A grammar is a set of rules which are used to construct a language (combine words to generate sentences).

Grammars are containing four things:

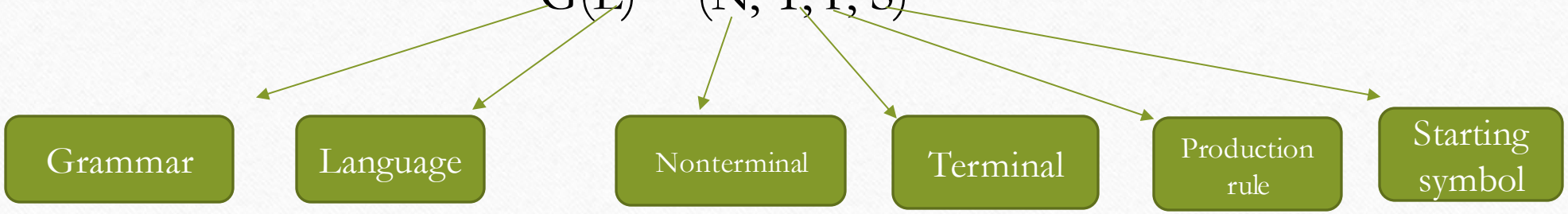
1- A finite set of Nonterminal Symbols (N).

2- A finite set of Terminal Symbols (T).

3- A finite set of production rules (P) of the form $u \rightarrow v$; $(u, v) \in (N \cup T)^*$

4- Starting symbol (S).

$$G(L) = (N, T, P, S)$$



Example: Let G(L) = ({S, A, B}, {a, b}, P, S) where P denoted as:

$S \rightarrow aA \mid bB \mid a \mid b$ rule 1

$A \rightarrow aA \mid a$ rule 2

$B \rightarrow bB \mid b$ rule 3

1- Is the string "aa" Accept or not?

$S \rightarrow aA$ using rule 1 ($S \rightarrow aA$)

$\rightarrow aa$ using rule 2 ($A \rightarrow a$)

The string is Accept

2- Is the string “bbb” Accept or not?

$S \rightarrow bB$ using rule 1 ($S \rightarrow bB$)

$\rightarrow bbB$ using rule 3 ($B \rightarrow bB$)

$\rightarrow bbb$ using rule 3 ($B \rightarrow b$)

The string is Accept

3- Is the string “aaba” Accept or not?

$S \rightarrow aA$ using rule 1 ($S \rightarrow aA$)

$\rightarrow aaA$ using rule 2 ($A \rightarrow aA$)

The string is not Accept

Example: Let G(L) = ({S, B, C}, {a, b, c}, P, S) where P denoted as:

$S \rightarrow aSBC \mid aBC$	rule 1
$CB \rightarrow BC$	rule 2
$aB \rightarrow ab$	rule 3
$bB \rightarrow bb$	rule 4
$bC \rightarrow bc$	rule 5
$cC \rightarrow cc$	rule 6

1- Is the string “abc” Accept or not?

$S \rightarrow aBC$ using rule 1 ($S \rightarrow aBC$)

$\rightarrow abC$ using rule 3 ($aB \rightarrow ab$)

$\rightarrow abc$ using rule 5 ($bC \rightarrow bc$)

The string is Accept

2- Is the string "$a^2b^2c^2$" Accept or not?

$S \rightarrow aSBC$	using rule 1 ($S \rightarrow aSBC$)
$\rightarrow aaBCBC$	using rule 1 ($S \rightarrow aBC$)
$\rightarrow aaBBCC$	using rule 2 ($CB \rightarrow BC$)
$\rightarrow aabBCC$	using rule 3 ($aB \rightarrow ab$)
$\rightarrow aabbCC$	using rule 4 ($bB \rightarrow bb$)
$\rightarrow aabbcC$	using rule 5 ($bC \rightarrow bc$)
$\rightarrow aabbcc$	using rule 6 ($cC \rightarrow cc$)

The string is Accept

Homework: Let G(L) = ({S, B, C}, {a, b, c}, P, S) where P denoted as:

$S \rightarrow aSBC \mid aBC$

$CB \rightarrow BC$

$aB \rightarrow ab$

$bB \rightarrow bb$

$bC \rightarrow bc$

$cC \rightarrow cc$

1- Is the string "$a^3b^3c^3$" Accept or not?

2- Is the string "a^3b^2" Accept or not?

Thanks for listening