

Theoretical homework #2, TTTV 2017

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Group: G

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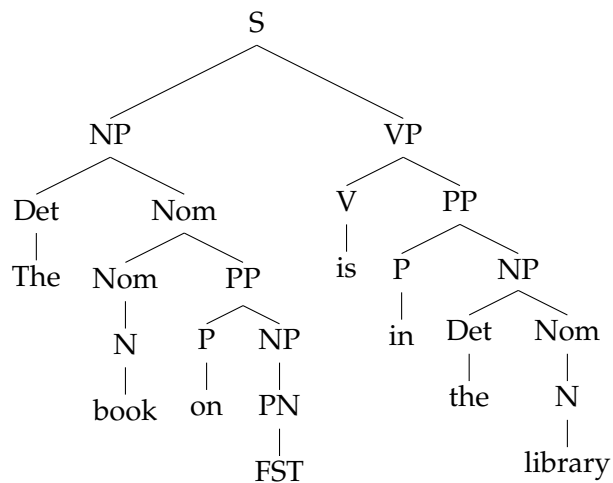
Exercise 1

(a) (1) 1

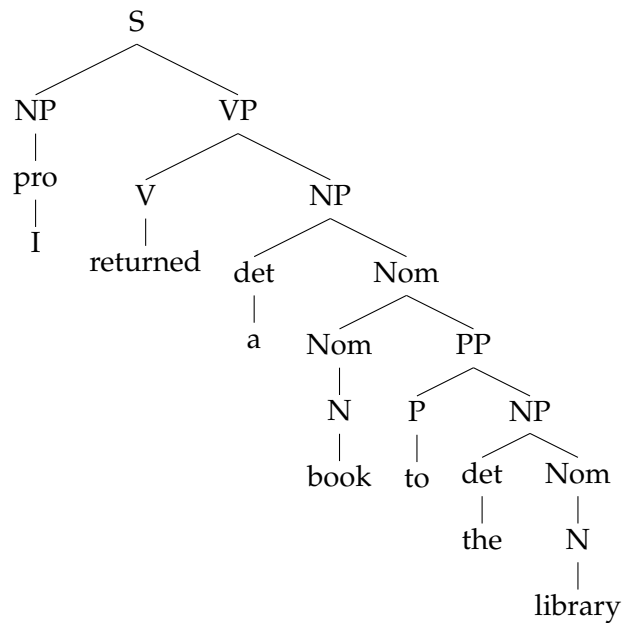
(2) 2

(3) 2

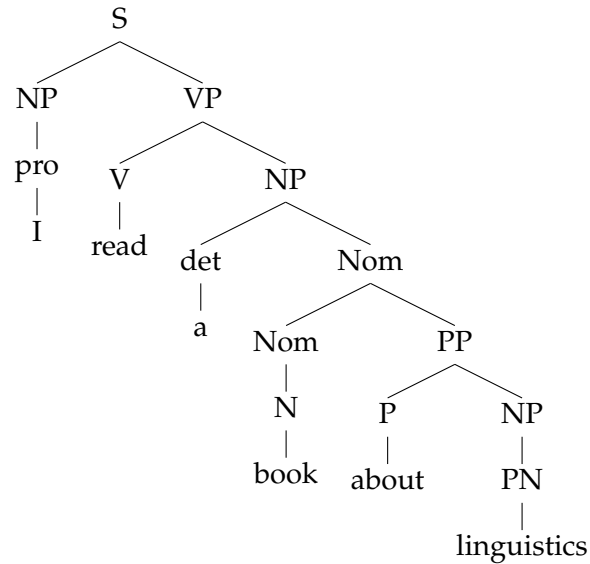
(b) (1)



(2)



(3)



(c) The rule $\text{nom} \rightarrow \text{nom PP}$ makes this possible. This rule is a direct recursion because nom appears on both the left hand side and the right hand side of the rule. This can be used ad infinitum to make a sentence longer. Example:

(a) I returned a book about linguistics.

(b) I returned a book about linguistics to you.

(c) I returned a book about linguistics to you in the library.

(d) I returned a book about linguistics to you in the library on tuesday.

(e) I returned a book about linguistics to you in the library on tuesday ... (when it was silent)

(d) Assuming 'do' and 'like' are verbs too:

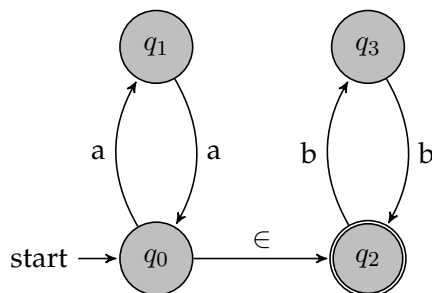
$\text{VP} \rightarrow \text{V NP V}$

This accepts the proposed 'do you like?'

Exercise 2

(a) (i) $/ (aa)^* (bb)^* /$

(ii) L:



(iii) $\text{S} \rightarrow \text{A B}$
 $\text{A} \rightarrow \text{a A} \mid \text{eps}$

$B \rightarrow b B \mid \epsilon$

- (b) The pumping lemma describes that somewhere in a language, something can be repeated *ad infinitum*. In a regular expression, this is represented as a Kleene star (*). This definitely describes L.

Exercise 3

- (a) It is not a regular language; it involves memory (of what n is). In $a^n b^2 a^n$, there have to be two b 's, and if something like $xy^n z$ would be tried within the first or second series of a 's, the series would not be of equal length.
- (b) L is a context-free grammar, because it can be generated with:

$S \rightarrow a S a \mid b b$