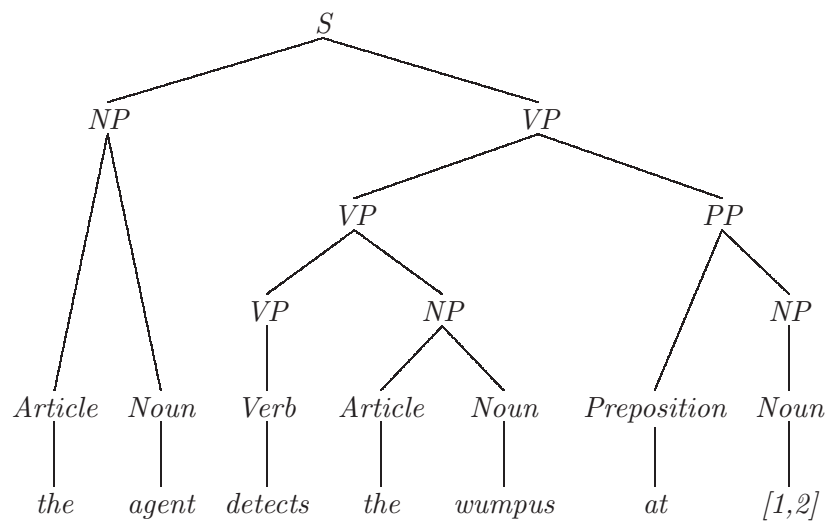


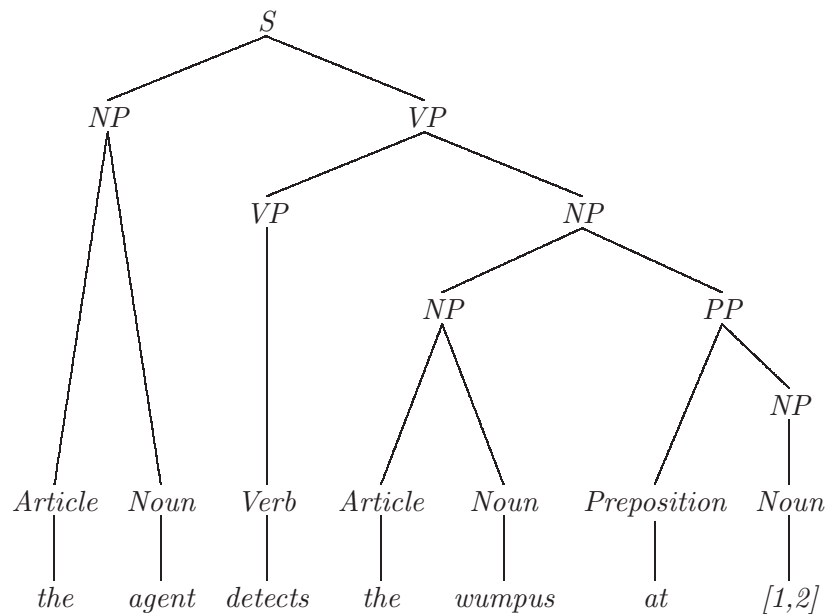
National University of Singapore
 School of Computing
 CS3243: Foundations of Artificial Intelligence
 Solutions for Tutorial 8

Readings: AIMA Chapter 22

1. Consider the sentence “the agent detects the wumpus at [1,2]”. Show two different parse trees of this sentence based on the above grammar, and give the interpretation (in English) of each parse tree.



Interpretation: the agent detects the wumpus, and the agent is at [1,2].

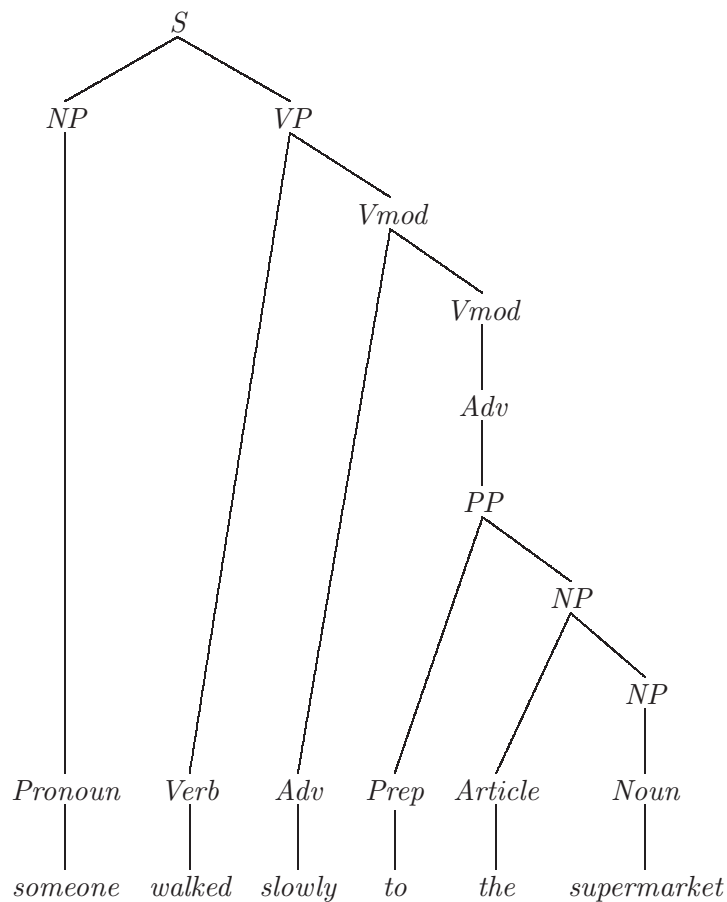


Interpretation: the agent detects the wumpus, and the wumpus is at [1,2].

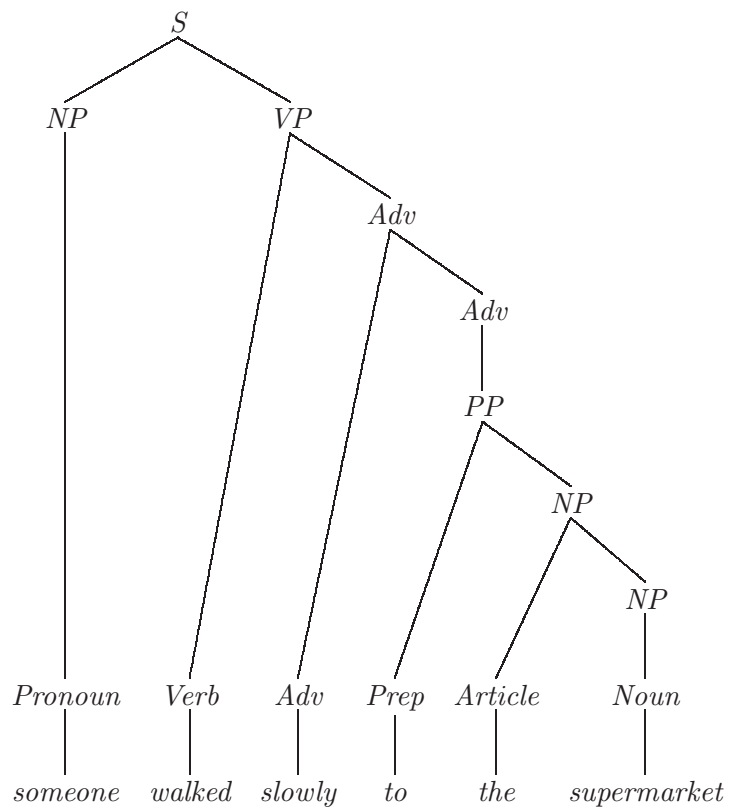
2. (Modified from Question 22.9 of the textbook) Consider the sentence “someone walked slowly to the supermarket”. Which of the following three grammars, combined with the lexicon, generates the given sentence? Show the corresponding parse tree(s).

Grammar A does not generate the given sentence because it contains the terminal symbol “slowly”, and the only rule to generate this terminal symbol is “Adv \Rightarrow slowly”, but the only rule that generates “Adv” is “VP \Rightarrow VP Adv Adv”, and the given sentence does not contain “slowly slowly”.

Grammar B generates the given sentence with the following parse tree:

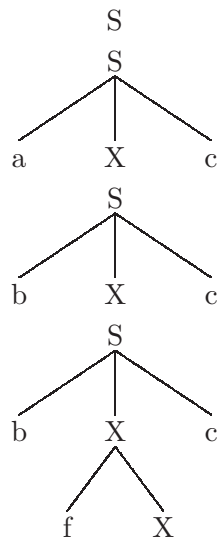


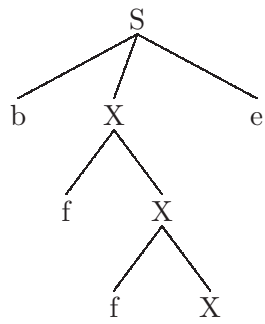
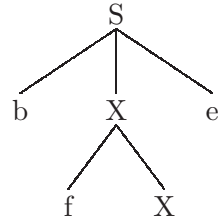
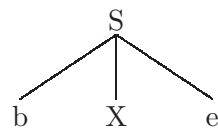
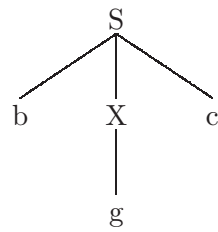
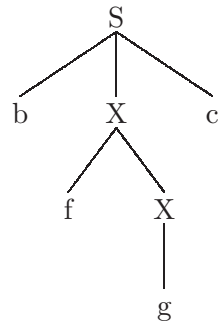
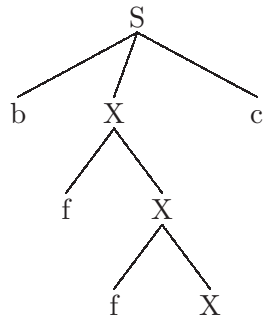
Grammar C generates the given sentence with the following parse tree:

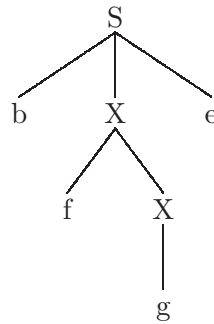


3. Consider the following context-free grammar that generates sequences of letters:

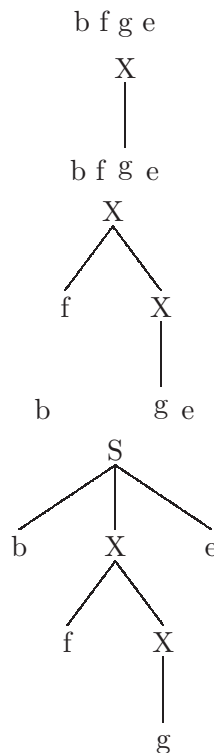
(a) Give a trace of the top-down parse on the input bfge







(b) Give a trace of the bottom-up parse on the same input bfge



(c) Which approach is better in this case?

Bottom-up parsing is better in this case, since there is no backtracking in bottom-up parsing for this input.

4. Give context-free grammars for

(a) The set of all strings of the form: n occurrences of as , followed by any number of bs , followed by any number of cs , followed by n occurrences of d

$$B \Rightarrow \epsilon | bB$$

$$C \Rightarrow \epsilon | cC$$

$$S \Rightarrow BC | aSd$$

(b) The set of palindromes (strings that read the same forward as backward) over alphabet $\{a, b\}$

$$S \Rightarrow \epsilon | a | b | aSa | bSB$$