

# Informatics 2A: Tutorial Sheet 6 Solutions

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1. The different phrases and corresponding heads:

- Jack’s brown chair. NP, chair.
- read the book that Sandy gave to me. VP, read.
- very intimidating member of the canine family. NP, member.
- to the store that my father owns. PP, to.
- in the park across the street. PP, in.
- will not fully complete the ride back. VP, complete.
- bottle green. AP, green.

2. (a) One possible equivalent CNF grammar is as follows:

$$\begin{array}{ll}
 S \rightarrow NP VP & NP \rightarrow Det N \\
 S \rightarrow Pro VPP & PP \rightarrow Pre NP \\
 VPP \rightarrow VP PP & VP \rightarrow ate \\
 VP \rightarrow V NP & V \rightarrow ate \\
 Pro \rightarrow I
 \end{array}$$

plus the original lexical rules for Det, N, Pre.

(b) Using the above CNF grammar, the CYK chart in matrix format would be:

	1	2	3	4	5	6	7
0	Pro						S
1		V,VP		VP			VPP
2			Det	NP			
3				N			
4					Pre		PP
5						Det	NP
6							N

(c) There is just one complete parse; its tree is represented by

$$(S (Pro I) (VPP (VP (V ate)(NP(Det the)(N salad))) (PP (Pre with)(NP(Det a)(N fork)))))$$

(d) If we record the steps used to transform our grammar into CNF, it’s clear how each step yields a mapping from ‘new’ parse trees to ‘old’ ones. For instance, if we replace the rule  $S \rightarrow Pro VP PP$  by the two rules  $S \rightarrow Pro VPP$ ,  $VPP \rightarrow VP PP$ , it’s clear that a tree of the form

$$(S (Pro subtree1) (VPP (VP subtree2)(PP subtree3)))$$

maps back to

$$(S (Pro subtree1) (VP subtree2)(PP subtree3))$$

(e) We could add a new rule

NP  $\rightarrow$  NP PP

This would add an NP entry to cell (2,7), hence a VP entry to (1,7). However, no new S entry would be added to (0,7), so there is still just one complete parse.

3. The main goal of this question is to be able to understand the distinctions made with phrase attachments. The following are possible phrases for each of the structures, among many which are possible:
  - (a) ate the salad with a fork from the store (the fork is from the store)
  - (b) ate the salad with the beans at the dining table
  - (c) ate the salad with the beans from the store
  - (d) ate the salad in the plate from the store (note that we have to interpret here that the salad is in the plate, and the salad was bought in the store, not the plate)
  - (e) ate the salad with a fork at the dining table (both PPs attach to the verb)