

## Informatics 2A: Tutorial Sheet 6 (Week 8)

### Phrase Structures and CYK

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1. Classify each of the following phrases as NP (noun phrase), VP (verb phrase), PP (prepositional phrase) or AP (adjectival phrase) and indicate the head word in the phrase:

- Jack's brown chair
- read the book that Sandy gave to me
- very intimidating member of the canine family
- to the store that my father owns
- in the park across the street
- will not fully complete the ride back
- bottle green as in "The pillow is bottle green"

2. Consider the following context free grammar with start symbol S:

$$\begin{array}{ll} S \rightarrow NP VP & PP \rightarrow Pre NP \\ S \rightarrow I VP PP & V \rightarrow ate \\ NP \rightarrow Det N & Det \rightarrow the \mid a \\ VP \rightarrow ate NP & N \rightarrow fork \mid salad \\ VP \rightarrow V & Pre \rightarrow with \end{array}$$

- (a) Convert this grammar to Chomsky Normal Form (see Lecture 12).
- (b) Use the CYK algorithm from Lecture 18 to parse the sentence

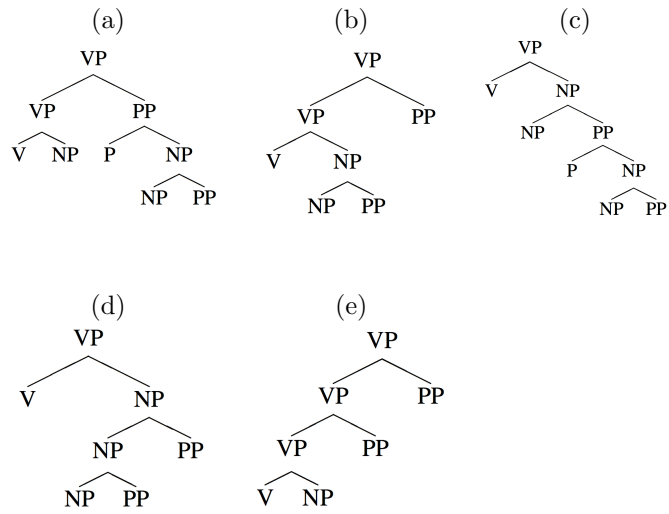
*I ate the salad with a fork*

representing the CYK chart in matrix form.

- (c) How many complete analyses of S do you get? Draw their parse trees.
- (d) How, in general, would you go about translating a parse tree for the CNF grammar into one for the original grammar? Do this for the parse trees obtained from the above sentence.
- (e) Now add a further production rule to your CNF grammar to allow for the alternative prepositional phrase attachment, i.e. 'the salad with a fork'. Revise your CYK chart or graph to include any new entries this introduces.

How many complete analyses are there now for the above sentence?

3. The following are possible structures that can be used for verb phrases with prepositional phrases:



Suggest a verb phrase for each of the above structures. For example, which structure would go with “ate the salad with a fork from the store”?