Tutorial 3: Parsing

Part I: Constituent parsing

Q1. Context-free grammar

Consider this constituent tree:

Q1a - Write down the context-free grammar that results in this tree.

Sol:

CFG=(N, T, P, S)

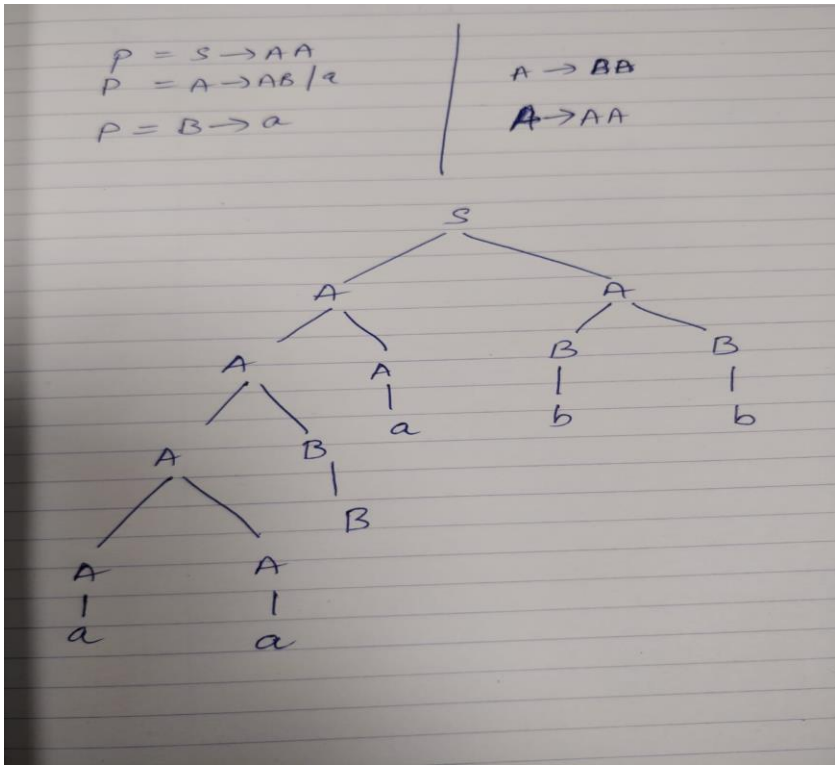
N = {S, A, B}, T = {a, b}, Starting symbol = S,

P = S → AA

P=A→AB | a

P=B→ b

Q1b - Adding the rules A -> *BB* and A -> AA makes the sentence structurally ambiguous. Draw the tree for the other interpretation.



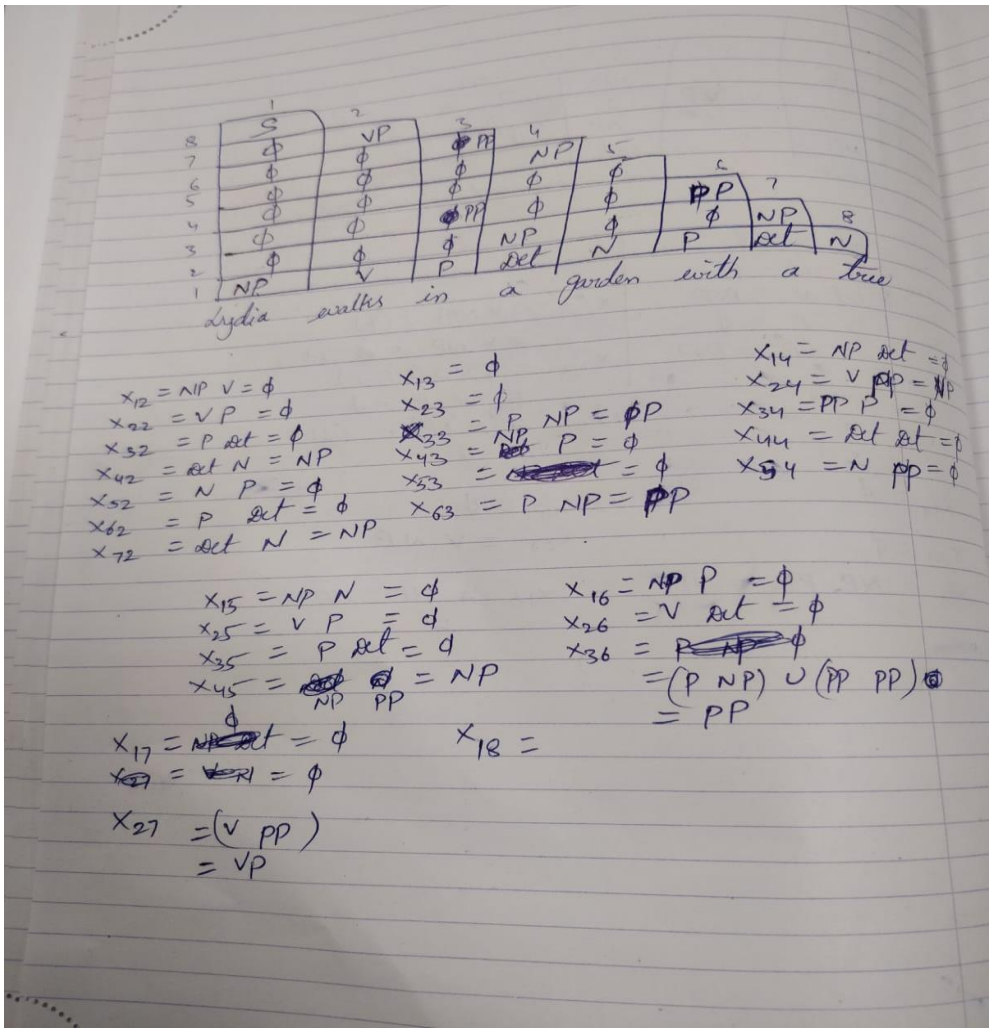
Q2. CKY

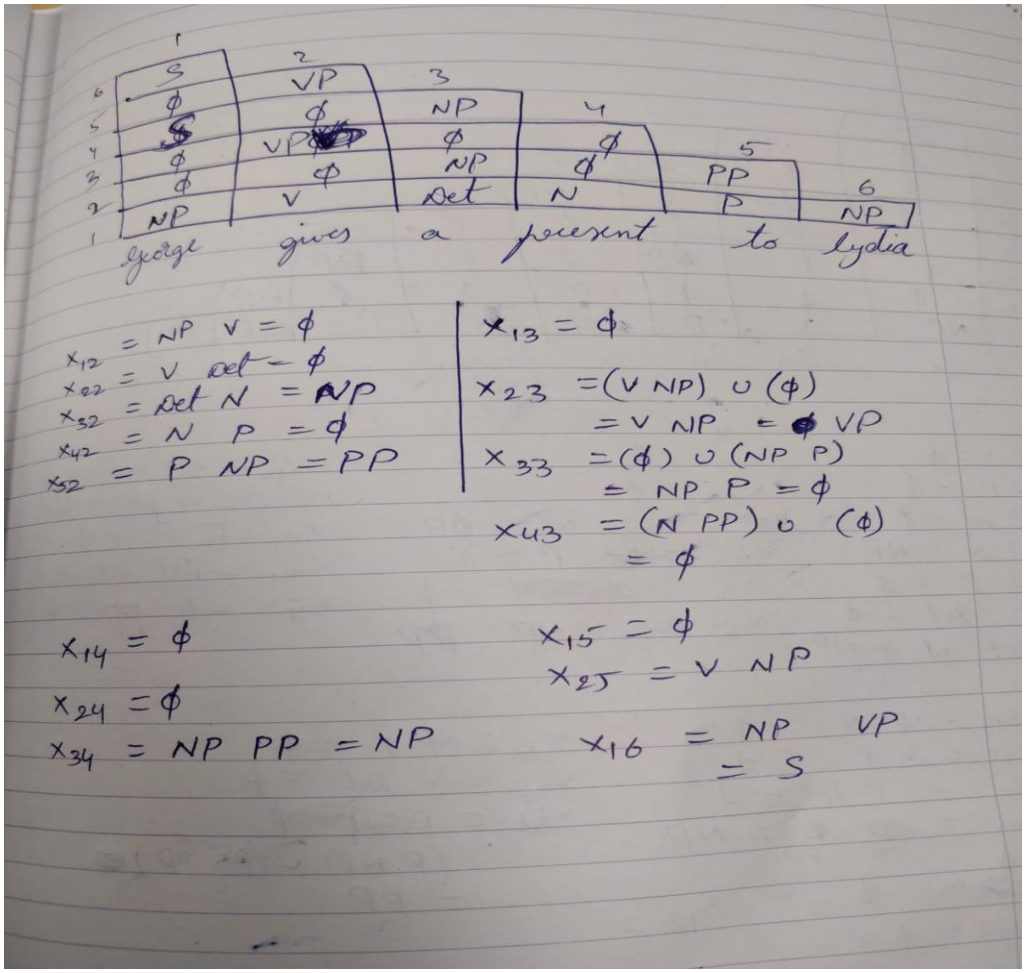
Here is a simple context-free grammar for a fragment of English:

```
S -> NP VP
NP -> Det N
NP -> NP PP
PP -> P NP
VP -> V NP
VP -> V PP
VP -> VP PP
Det -> "a"
N -> "present" | "garden" | "tree"
NP -> "Lydia" | "George"
V -> "gives" | "walks"
P -> "to" | "in" | "with"
```

Q2a - Complete the CKY tables for the following two sentences.

1. George gives a present to Lydia
2. Lydia walks in a garden with a tree





Q2b - Sentence 2 is ambiguous. For each interpretation, give the constituent tree and an intuitive rephrasing that makes the difference clear (like they do in this blg post). [**Note:** Sentence 1 is actually ambiguous too. You only need to give two interpretations for sentence 2 though]

1. Lydia walks in a garden. The garden has a tree.
2. Lydia walks in a garden. Lydia is carrying a tree.

Part II: Dependency parsing

Q3. CONNL-U

Consider these two dependency parses for the same sentence.

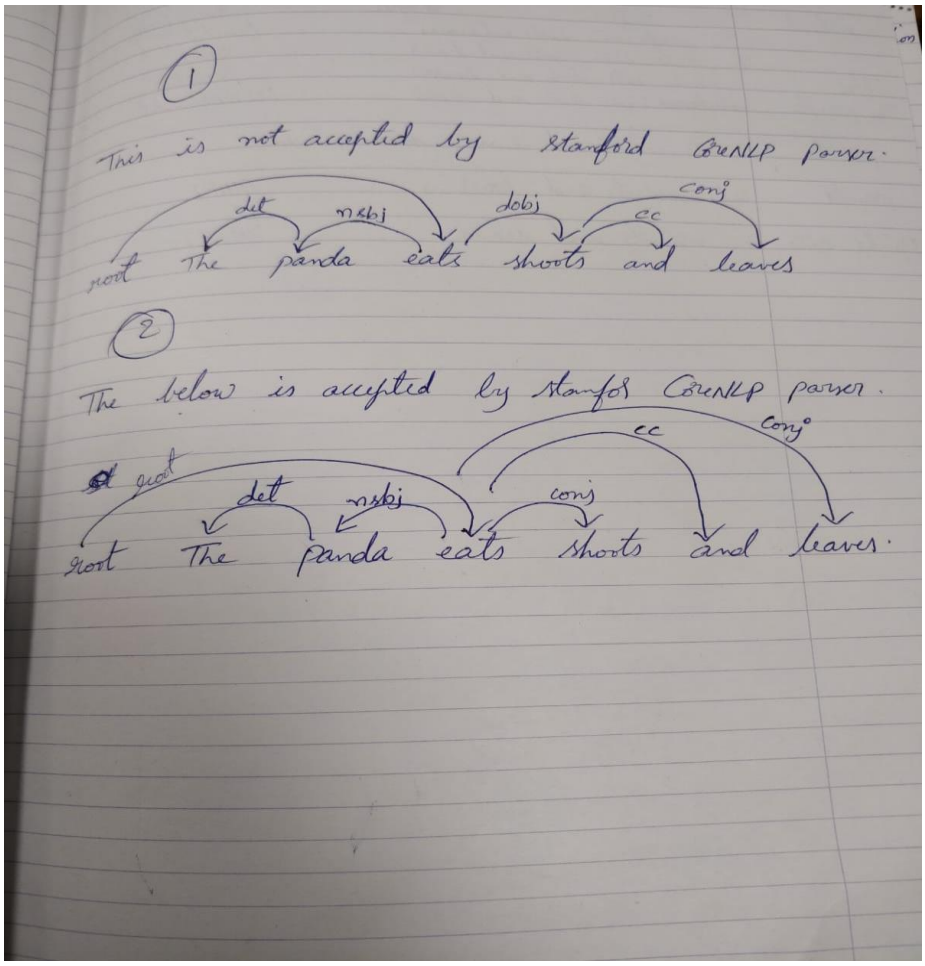
```
1    The      the      DET      _    _    2    det
2    panda    panda    NOUN     _    _    3    nsbj
3    eats     eat      VERB     _    _    0    root
4    shoots   shoot    NOUN     _    _    3    dobj
5    and      and      CONJ     _    _    4    cc
6    leaves   leaf     NOUN     _    _    4    conj

1    The      the      DET      _    _    2    det
```

```
2    panda    panda    NOUN    _    _    3    nsbj
3    eats     eat      VERB    _    _    0    root
4    shoots   shoot    VERB    _    _    3    conj
5    and      and      CONJ    _    _    3    cc
6    leaves   leave    VERB    _    _    3    conj
```

Universal dependencies references:

- CONLL-U format
- Dependency tags
- PoS tags

Q3a - Which of the two parses does the Stanford CoreNLP parser get (use the *Basic Dependencies)*? Draw the other tree. [**Note:** Actually the CoreNLP parser doesnt exactly match either -- but just choose one to draw or draw both if you like]



Q3b - Like Q2b, rephrase the sentence twice to highlight the difference in meaning implied by the two parses. For each one, explain why the dependency parse implies that interpretation. *Hint: If you're not sure what the difference is, look at the lemmas and PoS tags to get a clue (but be sure to refer to the parse in your explanation).*

1. *The panda eats. Panda eats shoots. Panda eats leaves.*
   Here eats is the root. Its tells about what panda eats. Shoots is noun.

2. *The panda eats. The panda shoots. The Panda leaves.*
   Here panda is root and subject for all the verbs eats,shoots and leaves. Here shoots is considered as verb.

Q4. Transition-based parsing

Q4a - Choose one of the two trees from Q3a and fill out the transition table for it. E.g., Lecture 7 slides, p.29; JMv3 p.285.

Note: There are slight differences between the slides and JM (Word list = Buffer, Action = Transition, Relation Added = Graph). Also, the slides do not explicitly do the *REDUCE* action. You can do it either way.

Table for the graph that's not accepted by Stanford coreNLP parser in Q3.

Steps	Stack	Buffer	Graph	Transition
1		The Panda eats shoots and leaves		Initial config
2		The Panda eats shoots and leaves		SHIFT
3	The	Panda eats shoots and leaves		SHIFT
4	The Panda	eats shoots and leaves		LEFT-ARC-det
5	Panda	eats shoots and leaves	+<Panda,The,det>	
6	Panda	eats shoots and leaves		SHIFT
7	Panda eats	Shoots and leaves		LEFT-ARC-nsubj
8	eats	Shoots and leaves	+<eats,panda,nsubj>	
9	Eats	Shoots and leaves		SHIFT
10	Eats shoots	And leaves		SHIFT
11	Eats shoots and	leaves		RIGHT-ARC-cc
12	Eats shoots	leaves	+<shoots,and,cc>	
13	Eats shoots	leaves		SHIFT

14	Eats shoots leaves			Right-ARC-conj
15	Eats shoots		+<shoots,leaves,conj>	
16	Eats shoots			RIGHT-ARC-dobj
17	Eats		+<eats,shoots,dobj>	
18	Eats			

Q4b - What's the first step in the table that would be different if you chose the other parse tree? Give just that one line of the alternative transition table.

Step 10.	Eats shoots	And leaves		RIGHT-ARC-dobj