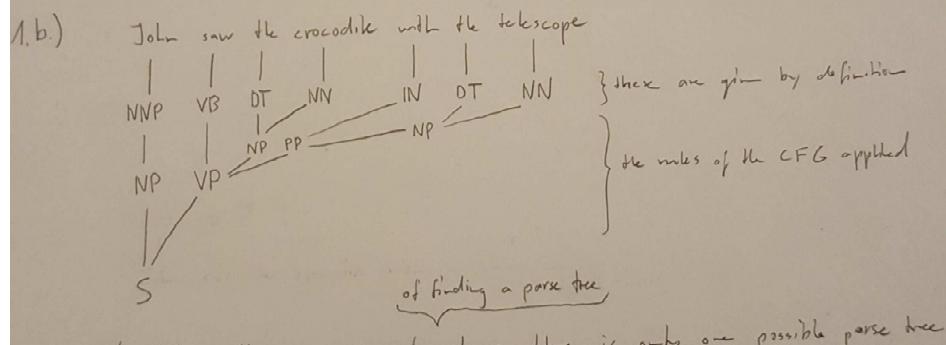
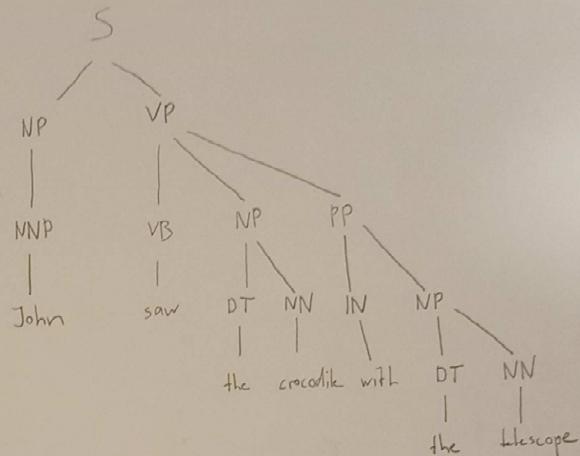
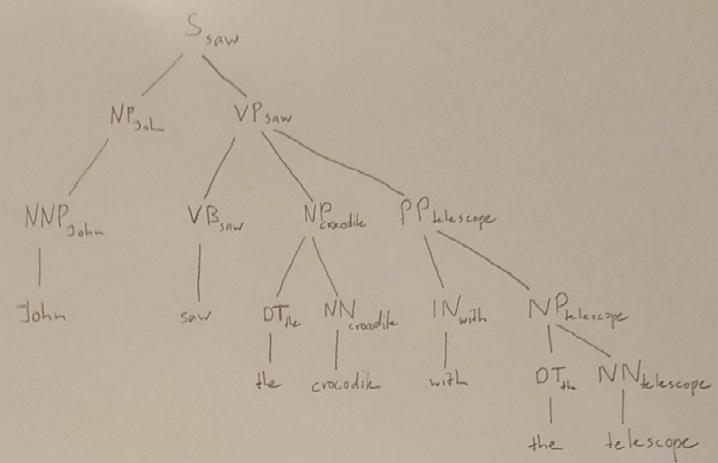


1.a) NLP ex.4 Aviv Fleisher, Lukas Zbinden

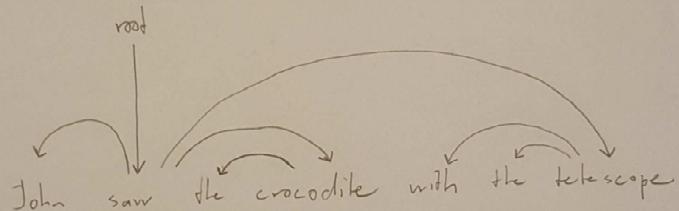


As this bottom-up approach shows, there is only one possible parse tree under the given CFG, no other unfolding of the rules yields the desired sequence of POS labels.

1.c.)



1.d.)



2

(a)

balloons    likes    ballons    float pop    and eggs

$\underbrace{[0]}_{\Sigma} \quad \underbrace{[1|2|3|4|5|6|7]}_{B} \quad \underbrace{[]}_{A}$

1. shift

[0, 1]    [2, 3, 4, 5, 6, 7]

2. shift

[0, 1, 2]    [3, 4, 5, 6, 7]

3. left-arc move

[0, 2]    [3, 4, 5, 6, 7]

[(2, move), 1)]

4. shift

[0, 2, 3]    [4, 5, 6, 7]

5. shift

[0, 2, 3, 4]    [5, 6, 7]

6. shift

[0, 2, 3, 4, 5]    [6, 7]

[(2, move), 1], (5, move), 4)]

7. left-arc move

[0, 2, 3, 5]    [6, 7]

[(2, move), 1], (5, move), 4], (3, acl), 5)]

8. Right-arc move

[0, 2, 3]    [6, 7]

9. shift

[0, 2, 3, 6]    [7]

10. shift

[0, 2, 3, 6, 7]    []

[(2, move), 1], (5, move), 4], (3, acl), 5], (7, cc), 6)]

11. left-arc cc

[0, 2, 3, 7]    []

A = [(2, move), 1], (5, move), 4], (3, acl), 5], (7, cc), 6], (7, cc), 7)]

12. Right-arc comp

[0, 2, 3]    []

A' = A ∪ [(2, obj), 3)]

13. Right-arc obj

[0, 2]    []

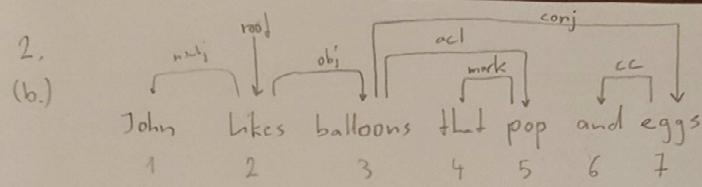
A' = A' ∪ [(0, root), 2)]

14. Right-arc root

[0]    []

→ c<sub>t</sub> = ([0], [], A')

→ the sequence has length 14 (2n positions where n = 7 (words))



[0] [1, 2, 3, 4, 5, 6, 7] []

1. shift  
[0, 1] [2, 3, 4, 5, 6, 7]

2. Left-arc nsubj  
[0]

$$A = [(2, \text{nsubj}, 1)]$$

3. Right-arc root  
[0, 2] [3, 4, 5, 6, 7]

$$A = A \cup [(0, \text{root}, 2)]$$

4. Right-arc obj  
[0, 2, 3] [4, 5, 6, 7]

$$A = A \cup [(2, \text{obj}, 3)]$$

5. Shift  
[0, 2, 3, 4] [5, 6, 7]

6. Left-arc mark  
[0, 2, 3] [5, 6, 7]

$$A = A \cup [(5, \text{mark}, 4)]$$

7. Right-arc acl  
[0, 2, 3, 5] [6, 7]

$$A = A \cup [(3, \text{acl}, 5)]$$

8. Reduce  
[0, 2, 3] [6, 7]

9. Shift  
[0, 2, 3, 6] [7]

$$A = A \cup [(7, \text{cc}, 6)]$$

10. Left-arc cc  
[0, 2, 3] [7]

$$A = A \cup [(3, \text{conj}, 7)]$$

11. Right-arc conj  
[0, 2, 3, 7] []

$$\rightarrow C_t = ([0, 2, 3, 7], [], A)$$

$\rightarrow$  the sequence has length 11.