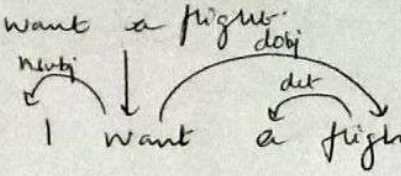
NLP – EC5763P – Lab Sheet 4

190573735

Part A – Dependency Grammer

1. Basic level Question

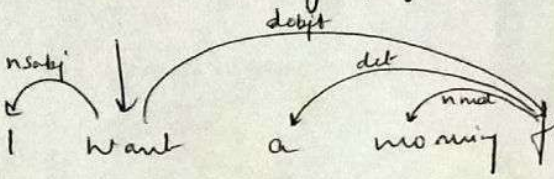
1. I want a flight.



Longest path → want → flight → a

length → 3

2. I want a morning flight.

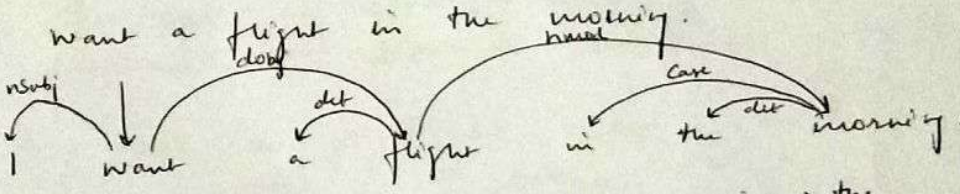


Longest path → want → ~~morning~~ flight → morning

want → flight → a

length → 3

3. I want a flight in the morning.

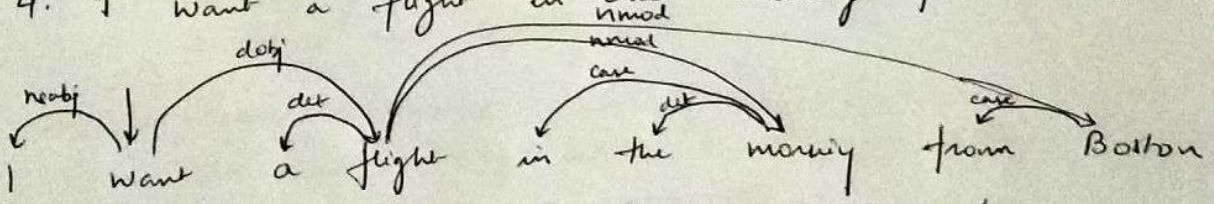


Longest path → want → flight → morning → the

→ want → flight → morning → in

length → 4.

4. I want a flight in the morning from Boston



Longest path → want → flight → morning → the

want → flight → morning → in

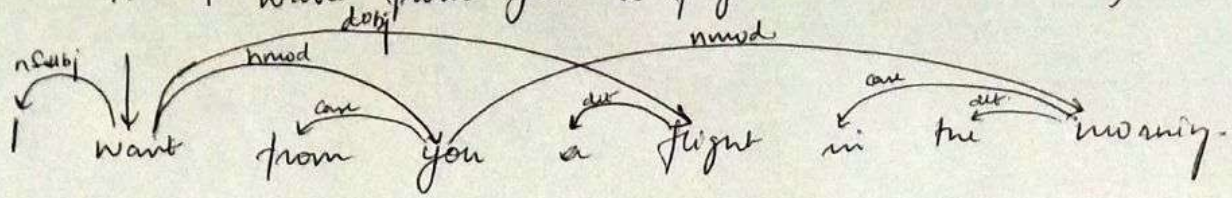
want → flight → Boston → from.

length → 4.

Sentence 4 is the most involved in respect to grammer structure. Because we see here Nmod (Nomial Modifier) being used 2 times along with it, it has the highest number of longest path (4) which counts to 3. and it is projective at the same time.

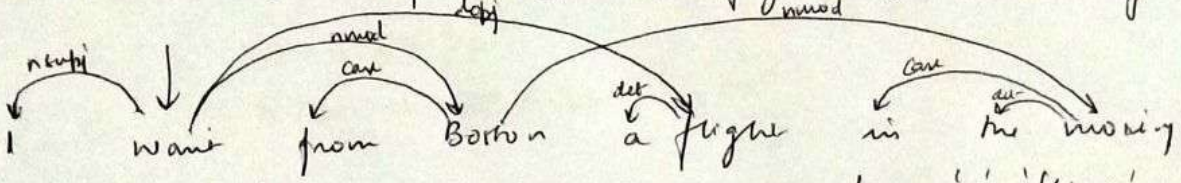
Q2 Medium Level Question. (4pt) Non projective Are

1. I want from you a flight in the morning



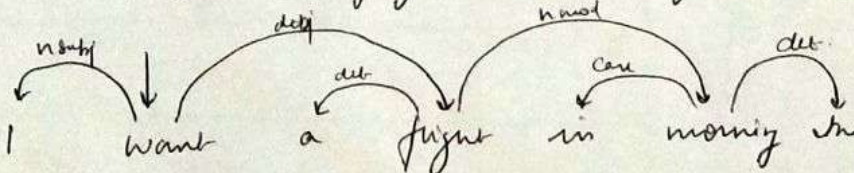
Here there is no path for "a", "flight" if
want → you → morning → in is considered
thus, you → morning are is non-projective.

2. I want from Boston a flight in the morning.



Here again there is no path for 'a' 'flight'
if want → Boston → morning path is
considered, thus Boston → morning are is non projective

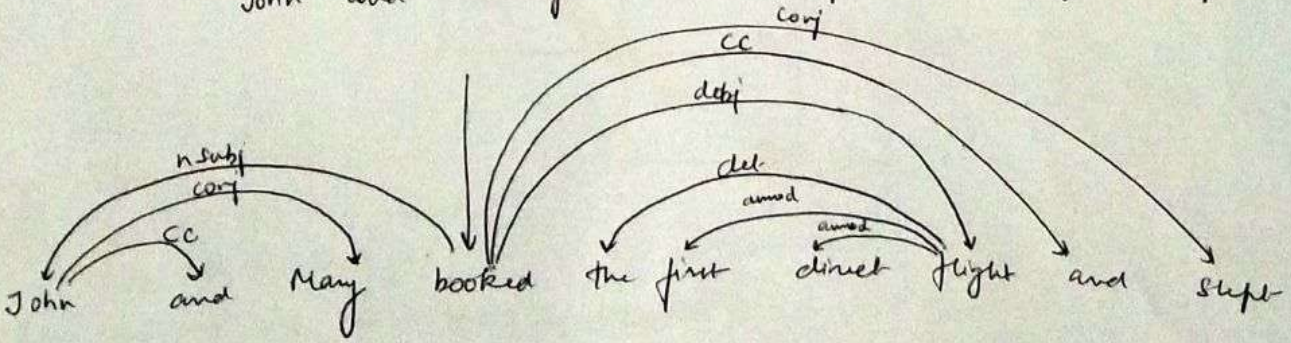
3. I want a flight in morning the.



No non projective are, sentence is grammatically
incorrect but logically correct.

Q3 ~~Medium level~~ Advanced Level Question. (8pt)

John and Mary booked the first-clinet flight and slept



ECS763P - Lab Sheet 4
Part B - CKY Parsing with CFG

Q1. Basic level Question.

Production Rules

S → VP NP
S → VP NP PP

VP → Verb
PP → Prep NP
PP → PP PP
NP → Det Noun
NP → NP PP
NP → Det AP Noun

AP → Adj AP
AP → Adj

CNF Rules.

S → VP NP
S → X1 PP
X1 → VP NP
VP → Verb
PP → Prep NP
PP → PP PP
NP → Det Noun
NP → NP PP
NP → X2 Noun
X2 → Det AP
AP → Adj AP
AP → Adj

Q2. Take the big yellow banana.

0	1	2	3	4	5
Take	the	Big	yellow	banana.	
Verb VP → Verb x_{01}	— x_{02}	— x_{03}	— x_{04}	S → VP NP x_{05}	
	DET x_{12}	X_2 x_{13}	X_2 x_{14}	NP x_{15}	
		AP → Adj Adj x_{23}	AP x_{24}	— x_{25}	
			AP → Adj Adj x_{34}	— x_{35}	
				Noun x_{45}	

Steps taken to fill the parse chart in diagonal

Step 1 / Part 1

① $x_{02} \rightarrow x_{01}\, x_{12}$ → No
② $x_{13} \rightarrow x_{12}\, x_{23}$ → Yes
$X_2 \rightarrow$ DET AP
③ $x_{24} \rightarrow x_{23}\, x_{34}$ → Yes
AP → Adj AP
④ $x_{35} \rightarrow x_{34}\, x_{45}$ → No

In Step 1 we fill
x_{02} x_{13} x_{24} x_{35}

Step 2.

Step 2 / Part 2

⑤ $x_{03} \rightarrow x_{01}\, x_{13}$ → No
$x_{03} \rightarrow x_{02}\, x_{23}$ → No.
⑥ $x_{14} \rightarrow x_{12}\, x_{24}$ → ~~Yes~~ (X_2 → DET AP)
$x_{14} \rightarrow x_{13}\, x_{34}$ → NO
⑦ $x_{25} \rightarrow x_{23}\, x_{35}$ → No
$x_{25} \rightarrow x_{24}\, x_{45}$ → No

In Step 2 we fill x_{03} x_{14} x_{25}

Step 3 / Part 3

(8) $x_{04} \rightarrow x_{01}\ x_{14} \rightarrow$ No
$x_{04} \rightarrow x_{02}\ x_{24} \rightarrow$ No
$x_{04} \rightarrow x_{03}\ x_{34} \rightarrow$ No.

(9) $x_{15} \rightarrow x_{12}\ x_{25} \rightarrow$ No
$x_{13}\ x_{35} \rightarrow$ No
$x_{14}\ x_{35} \rightarrow$ Yes
(NP $\rightarrow X_2$ Noun)

In Step 3 we would fill x_{04}, x_{15}

(10) $x_{05} \rightarrow x_{01}\ x_{15} \rightarrow$ Yes $S \rightarrow VP\ NP$
$x_{05} \rightarrow x_{02}\ x_{25} \rightarrow$ No
$x_{05} \rightarrow x_{03}\ x_{25} \rightarrow$ No
$x_{05} \rightarrow x_{04}\ x_{25} \rightarrow$ No

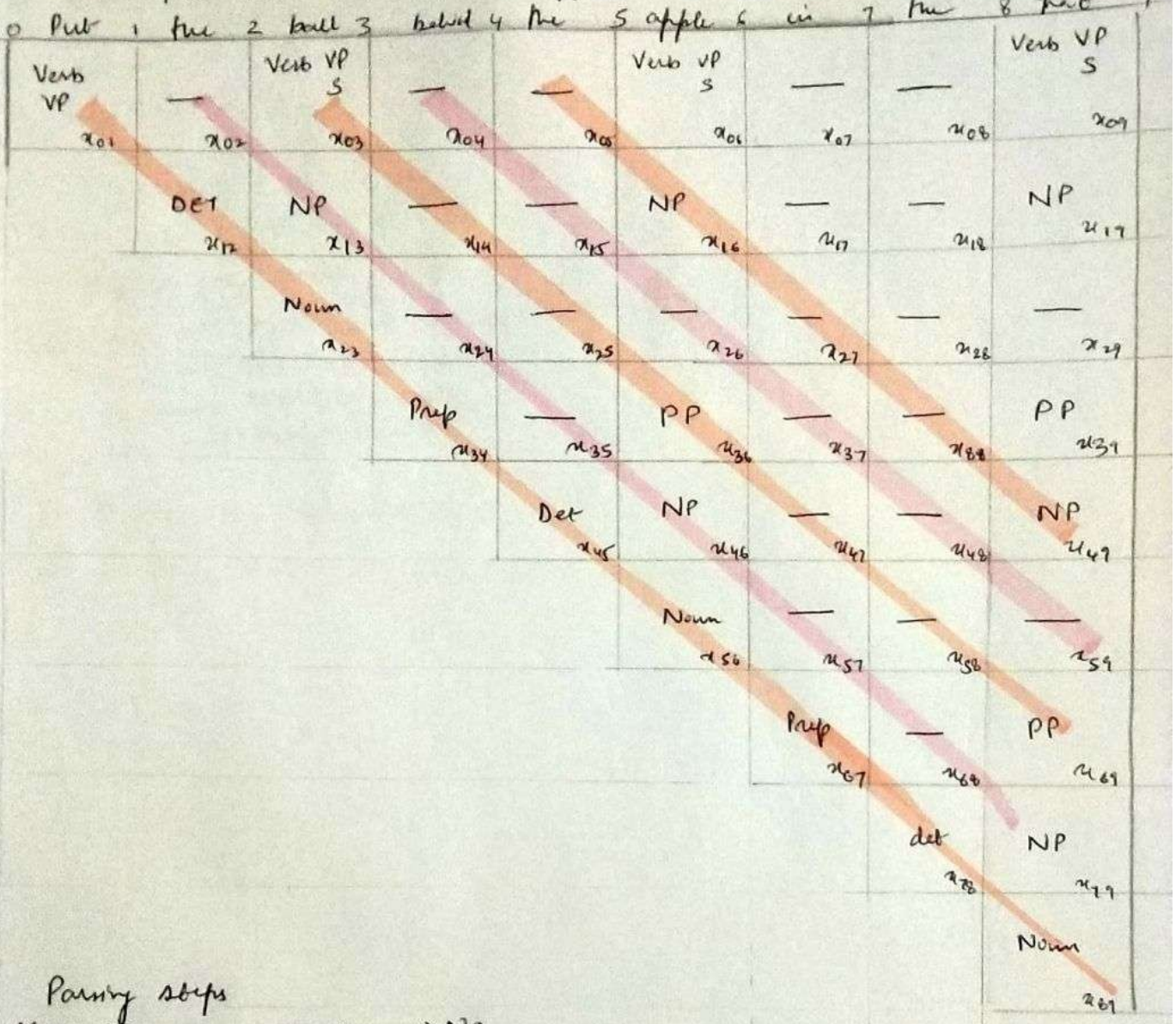
In Step 4 we would fill x_{05}

Thus in four parses we arrive at S, only once.

Q3 Advance Level Question.

Put the ball behind the apple in the hat.

0 Put 1 the 2 ball 3 behind 4 the 5 apple 6 in 7 the 8 hat 9



Parsing steps

Step 1 (1) $x_{02} \rightarrow x_{01}\, x_{12} \rightarrow$ No

(2) $x_{13} \rightarrow x_{12}\, x_{23} \rightarrow$ No

(3) $x_{24} \rightarrow x_{23}\, x_{34} \rightarrow$ No

(4) $x_{35} \rightarrow x_{34}\, x_{45} \rightarrow$ No

(5) $x_{46} \rightarrow x_{45}\, x_{56} \rightarrow$ Yes NP → DET Noun

(6) $x_{57} \rightarrow x_{56}\, x_{67} \rightarrow$ No

(7) $x_{68} \rightarrow x_{67}\, x_{78} \rightarrow$ No

(8) $x_{79} \rightarrow x_{78}\, x_{89} \rightarrow$ Yes NP → DET Noun.

Step 2 (9) $x_{03} \rightarrow x_{01}\, x_{13} \rightarrow$ Yes S → VP NP

$x_{03} \rightarrow x_{02}\, x_{23} \rightarrow$ No

(10) $x_{14} \rightarrow x_{12}\, x_{24} \rightarrow$ No

$x_{14} \rightarrow x_{13}\, x_{34} \rightarrow$ No

(11) $x_{25} \rightarrow x_{23}\ x_{35} \rightarrow$ No
$x_{25} \rightarrow x_{24}\ x_{45} \rightarrow$ No

(12) $x_{36} \rightarrow x_{34}\ x_{46} \rightarrow$ Yes PP → Prep NP
$x_{36} \rightarrow x_{35}\ x_{56} \rightarrow$ No

(13) $x_{47} \rightarrow x_{45}\ x_{57} \rightarrow$ No
$x_{47} \rightarrow x_{46}\ x_{67} \rightarrow$ No

(14) $x_{58} \rightarrow x_{56}\ x_{68} \rightarrow$ NO
$x_{58} \rightarrow x_{57}\ x_{78} \rightarrow$ No

(15) $x_{69} \rightarrow x_{67}\ x_{79} \rightarrow$ Yes PP → Prep NP
$x_{69} \rightarrow x_{68}\ x_{89} \rightarrow$ No

Step 3

(16) $x_{04} \rightarrow x_{01}\ x_{14} \rightarrow$ No
$x_{04} \rightarrow x_{02}\ x_{24} \rightarrow$ No
$x_{04} \rightarrow x_{03}\ x_{34} \rightarrow$ No

(17) $x_{15} \rightarrow x_{12}\ x_{25} \rightarrow$ No
$x_{15} \rightarrow x_{13}\ x_{35} \rightarrow$ No
$x_{15} \rightarrow x_{14}\ x_{45} \rightarrow$ No.

(18) $x_{26} \rightarrow x_{23}\ x_{36} \rightarrow$ No
$x_{26} \rightarrow x_{24}\ x_{46} \rightarrow$ No
$x_{26} \rightarrow x_{25}\ x_{56} \rightarrow$ No

(19) $x_{37} \rightarrow x_{34}\ x_{47} \rightarrow$ No
$x_{37} \rightarrow x_{35}\ x_{57} \rightarrow$ No
$x_{37} \rightarrow x_{36}\ x_{67} \rightarrow$ No.

(20) $x_{48} \rightarrow x_{45}\ x_{58} \rightarrow$ No
$x_{48} \rightarrow x_{46}\ x_{68} \rightarrow$ No
$x_{48} \rightarrow x_{47}\ x_{78} \rightarrow$ No.

(21) $x_{59} \rightarrow x_{56}\ x_{69} \rightarrow$ No
$x_{59} \rightarrow x_{57}\ x_{79} \rightarrow$ No
$x_{59} \rightarrow x_{58}\ x_{89} \rightarrow$ NO

Step 4.

(22) $x_{05} \rightarrow$ No

(23) $x_{16} \rightarrow$ Yes
$\rightarrow x_{13}\ x_{36}$
$\rightarrow$ NP → NP PP

(24) $x_{27} \rightarrow$ No

(25) $x_{38} \rightarrow$ No

(26) $x_{49} \rightarrow$ Yes NP → NP PP
$\rightarrow x_{46}\ x_{69}$

Step 5

(27) $x_{06} \rightarrow x_{01} x_{16}$ $S \rightarrow VP\ NP$

(28) $x_{17} \rightarrow No$

(29) $x_{28} \rightarrow No$

(30) $x_{39} \rightarrow x_{34} x_{49} \rightarrow Yes \Rightarrow PP \rightarrow Prep\ NP$

$x_{39} \rightarrow x_{36} x_{69} \rightarrow Yes \Rightarrow PP \rightarrow PP\ PP$

~~(31) x.~~

Step 6

(31) $x_{07} \rightarrow No$

(32) $x_{18} \rightarrow No$

(33) $x_{29} \rightarrow No$

Step 7

(34) $x_{08} \rightarrow No$

$x_{19} \rightarrow Yes$

$x_{19} \rightarrow x_{13} x_{39}$ $NP \rightarrow NP\ PP$

$x_{19} \rightarrow x_{16} x_{69}$ $NP \rightarrow NP\ PP$

Step 8

(35) $x_{09} \rightarrow Yes.$

$S \rightarrow VP\ NP.$

Thus in 8 parses we arrive at **S** 4 times.