NLP Numericals-3

Q1.Convert the following CFG grammar into CNF form

S->A|cB|c

A->Bc|b

B->cAA|Є

CNF $V \rightarrow V_1 V_2$

$V \rightarrow T$

Step1 - Remove Null Production

$S \rightarrow A \mid cB \mid c$

$A \rightarrow Bc \mid b \mid c$

$B \rightarrow cAA$

Step22 Remove Unit Production

$S \rightarrow Bc \mid b \mid c \mid cB$

$A \rightarrow Bc \mid b \mid c$

$B \rightarrow cAA$

Step3 Adding $X \rightarrow AA$ $Y \rightarrow c$

$S \rightarrow BY \mid b \mid c \mid YB$

$A \rightarrow BY \mid b \mid c$

$B \rightarrow YX$

$X \rightarrow AA$

$Y \rightarrow c$

Q2 Construct a parse tree for the following sentence using CFG rules:”The man read this book”

Rules:

S->NP VP

S->VP

NP->Det Nom

Nom->Noun

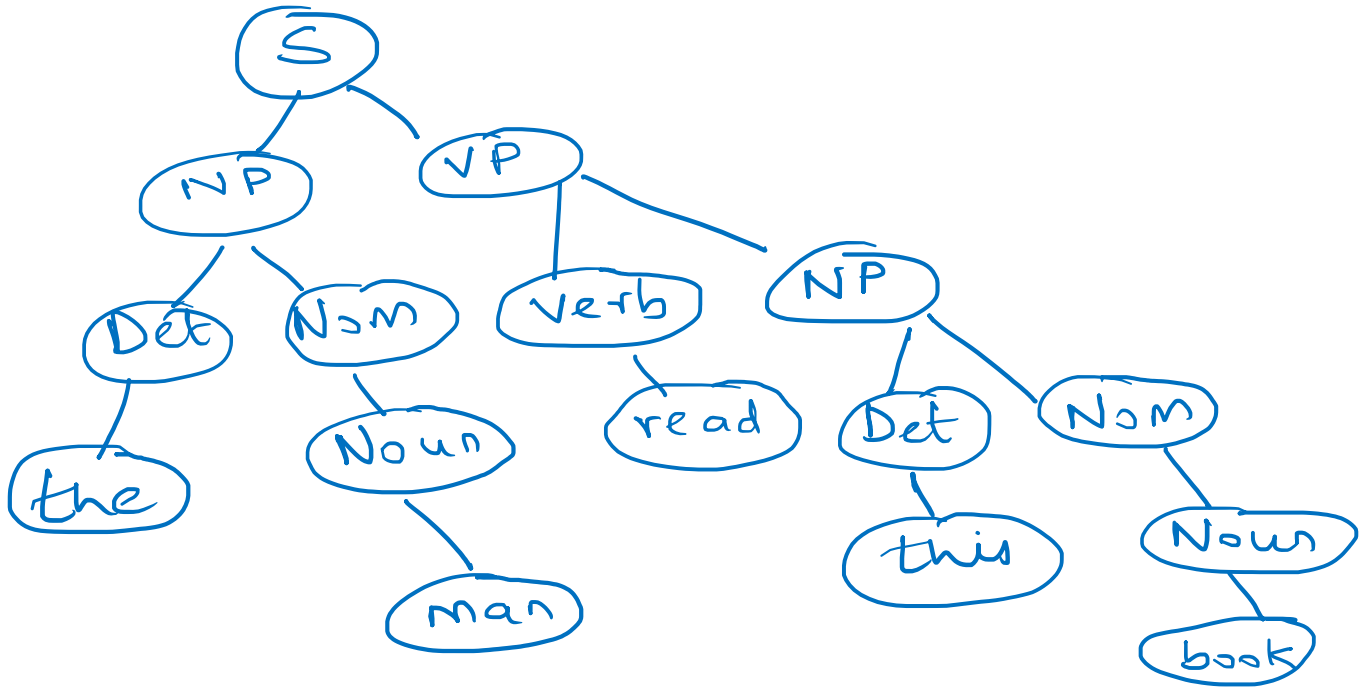
VP->verb NP

Verb->read

Det->the , this

Noun->book, man

Verb->book, read



Q3.Using the CKY algorithm find the possible parse tree for the following statement:" **A pilot likes flying planes**" using the following rules

S->NP VP

VP->VBG NNS

VP->VBZ VP

NP->DT NN

NP->JJ NNS

DT->a

NN->pilot

VBZ->likes

VBG->flying

JJ->flying

NNS->planes

A	pilot	likes	flying	planes
DT x_{01}	NP x_{02}	— x_{03}	— x_{04}	S x_{05}
	NN x_{12}	— x_{13}	— x_{14}	— x_{15}
		VBZ x_{23}	— x_{24}	VP x_{25}
			VBG JJ x_{34}	VP NP x_{35}
				NNS x_{45}

$x_{02} \rightarrow x_{01}\, x_{12}$

$x_{13} = x_{12}\, x_{23}$

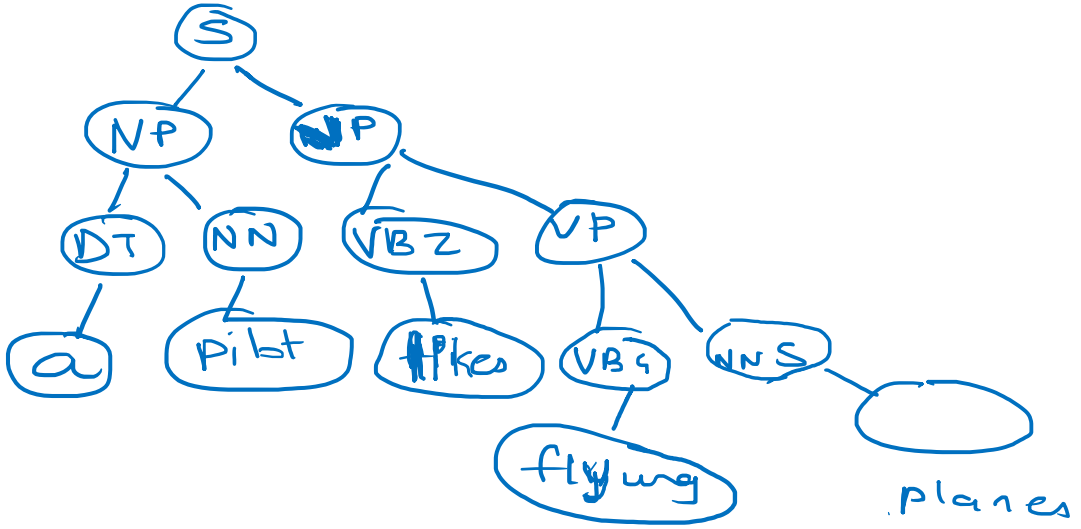
$x_{03} = x_{02}\, x_{23}$

$x_{24} = x_{23}\, x_{34}$

$x_{35} = x_{34}\, x_{45}$

$x_{25} = x_{23}\, x_{35}$

$x_{05} = x_{02}\, x_{25}$



Q4.Find the probability of string **aaab** using the given PCFG

S->AB 0.5

S->BC 0.5

A->BA 0.3

A->a 0.7

B->CC 0.4

B->b 0.6

C->AB 0.2

C->a 0.8

(1) $S \to AB \quad (0.5)$

$S \to aB \quad (0.7)$

$S \to aCC \quad (0.4)$

$S \to aaC \quad (0.8)$

$S \to aaAB \quad (0.2)$

$S \to aaaB \quad (0.7)$

$S \to aaab \quad (0.6)$

$P_1 = 0.5 \times 0.7 \times 0.4 \times 0.8 \times 0.2 \times 0.7 \times 0.6$

$P_1 = 0.009408$

(2) $S \to BC \quad (0.5)$

$S \to CCC \quad (0.4)$

$S \to aCC \quad (0.8)$

$S \to aaC \quad (0.8)$

$S \to aaAB \quad (0.2)$

$S \to aaaB \quad (0.7)$

$S \to aaab \quad (0.6)$

$P2 = 0.5 \times 0.4 \times 0.8 \times 0.8 \times 0.2 \times 0.7 \times 0.6$

$P2 = 0.010752$

(3)

$S \to AB$ (0.5)

$S \to BAB$ (0.3)

$S \to cCAB$ (0.4)

$S \to aCAB$ (0.8)

$S \to aaAB$ (0.8)

$S \to aaaB$ (0.7)

$S \to aaab$ (0.6)

$P_3 = 0.5 \times 0.3 \times 0.4 \times 0.8 \times 0.8 \times 0.7 \times 0.6$

$P_3 = 0.01612$

$P(aaab) = P1 + P2 + P3$

$= 0.009408 + 0.010075 + 0.01612$

$= 0.0363$

Q5.Find the probability of the sentence: **astronomers saw stars with ears** using the given PCFG

S->NP VP 1.0

VP->V NP 0.7

VP->VP PP 0.3

PP->P NP 1.0

P->with 1.0

V->saw 1.0

NP->NP PP 0.4

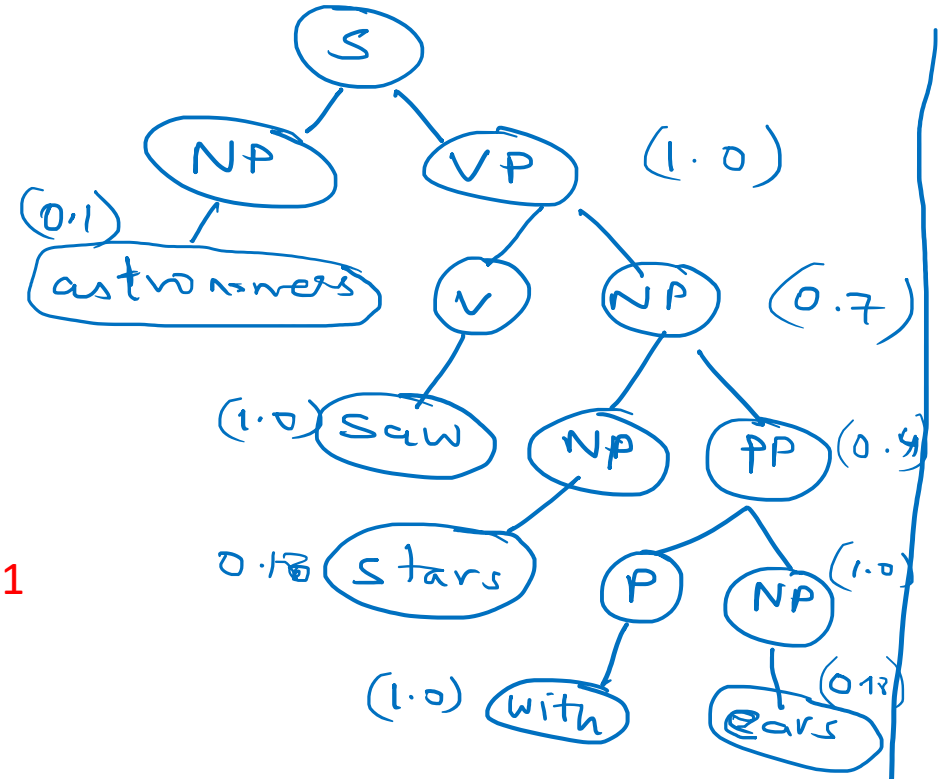
NP->astronomers 0.1

NP->ears 0.18

NP->saw 0.04

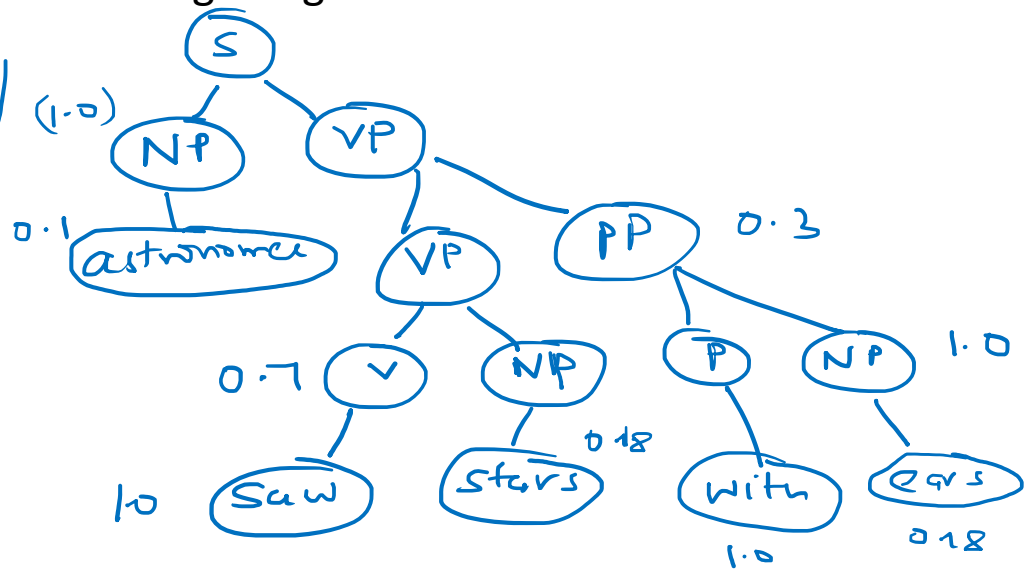
NP->stars 0.18

NP->telescope 0.1



$P_1 = 1 \times 0.1 \times 0.7 \times 1 \times 0.4 \times 0.18 \times 1 \times 1 \times 0.18$

$P_1 = 0.0009072$



$P_2 = 1 \times 0.1 \times 0.3 \times 0.7 \times 1.0 \times 1.0 \times 0.18 \times 1.0 \times 0.18$

$= 0.00068$

$P(s) = P1 + P2$

$= 0.00158$