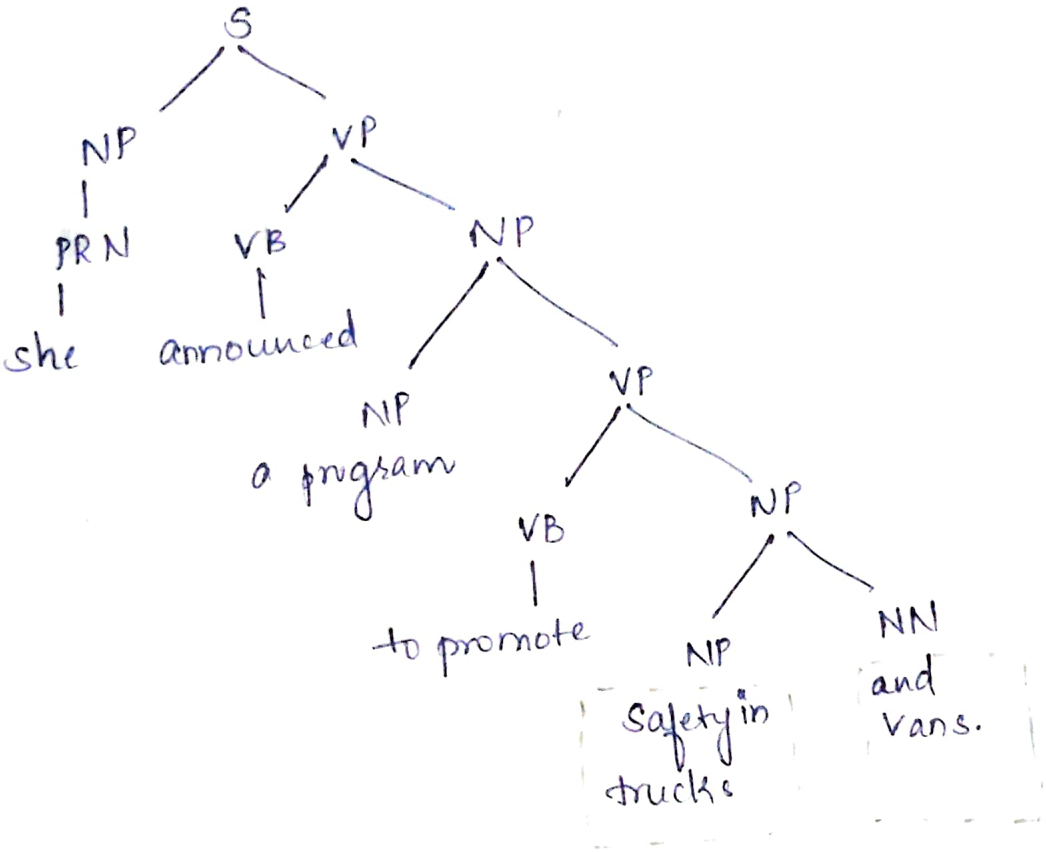
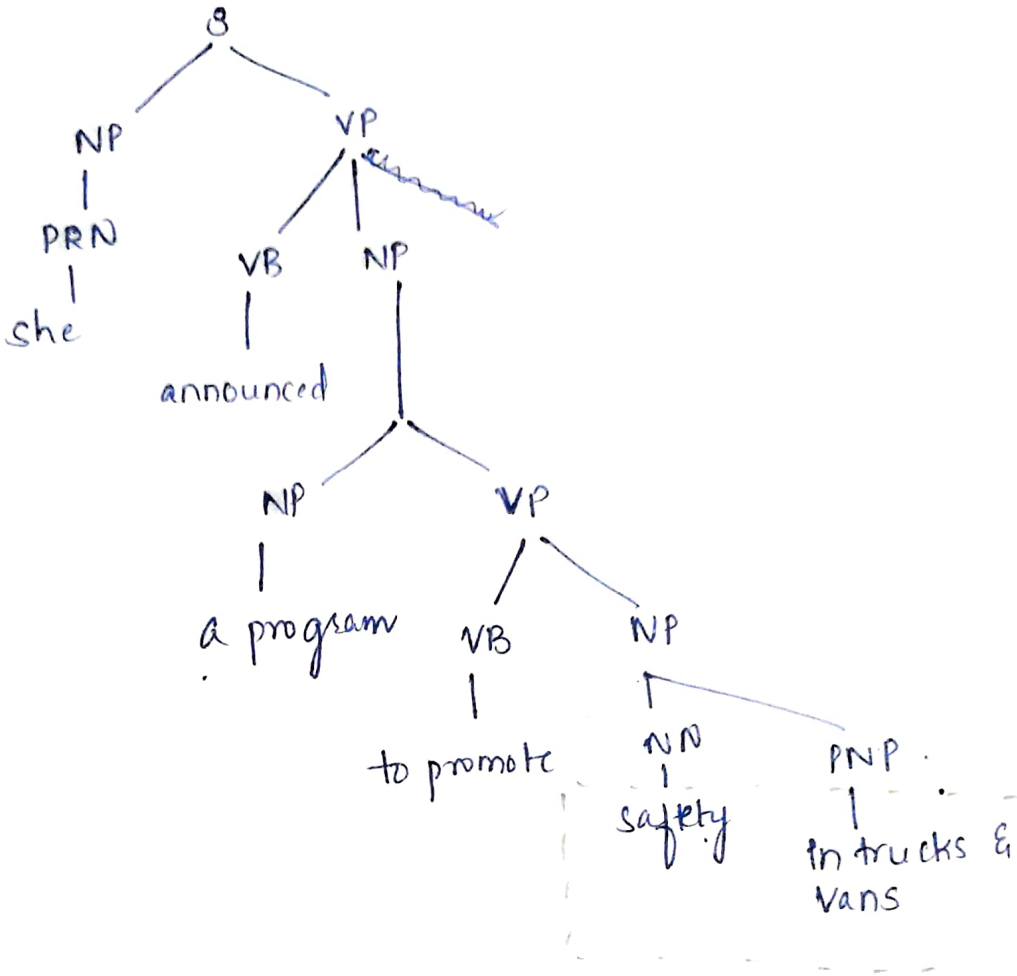
1.1. The program promotes safety in trucks & also promotes vans.

(1)

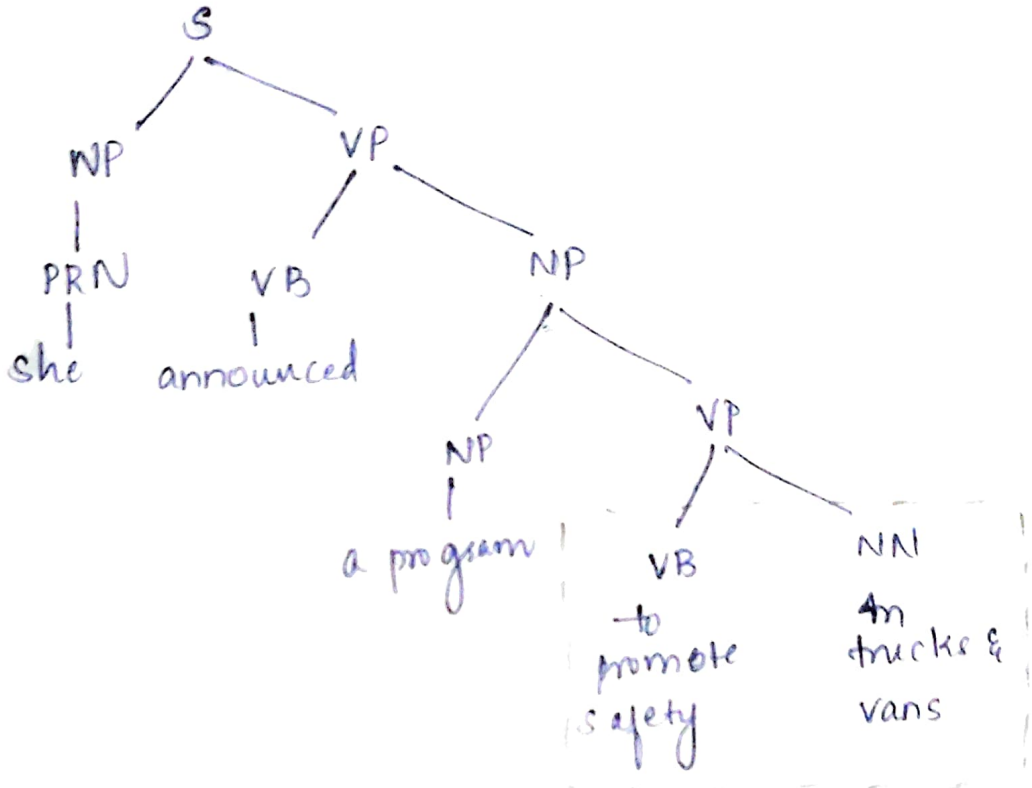


1.1 (2) The program promotes safety in trucks & vans.



(5) The program promotes safety, and the program is in trucks and vans.

1.1

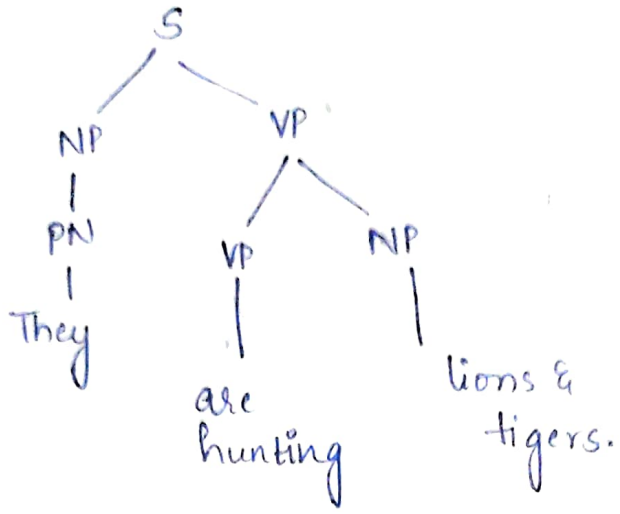


(a) Precision & Recall.

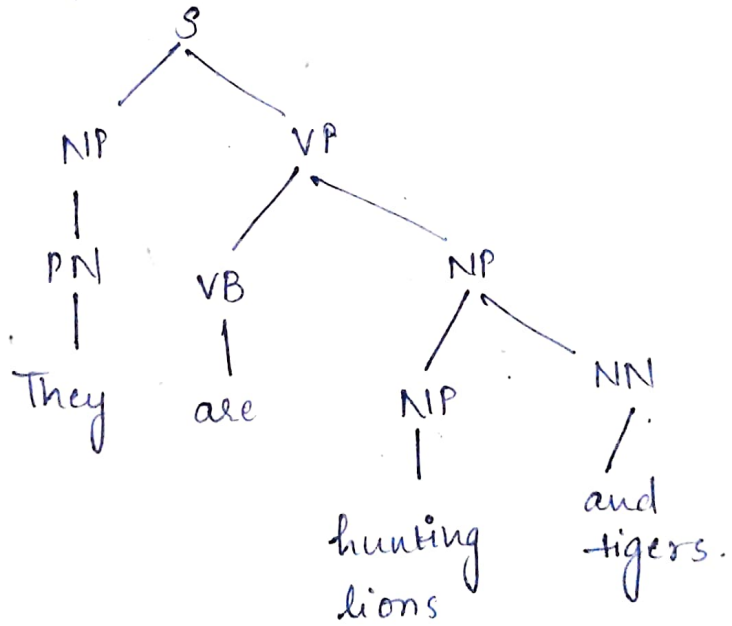
They ~~lions~~ are hunting lions & tigers.

1.2

① Someone is hunting lions & tigers.



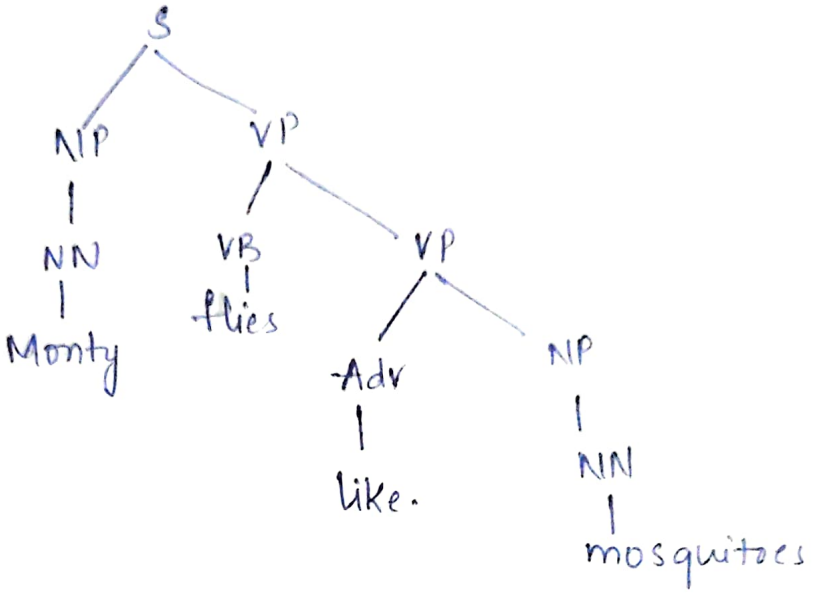
② They are hunting either lions or tigers or both possibly.



(2) Decision 4

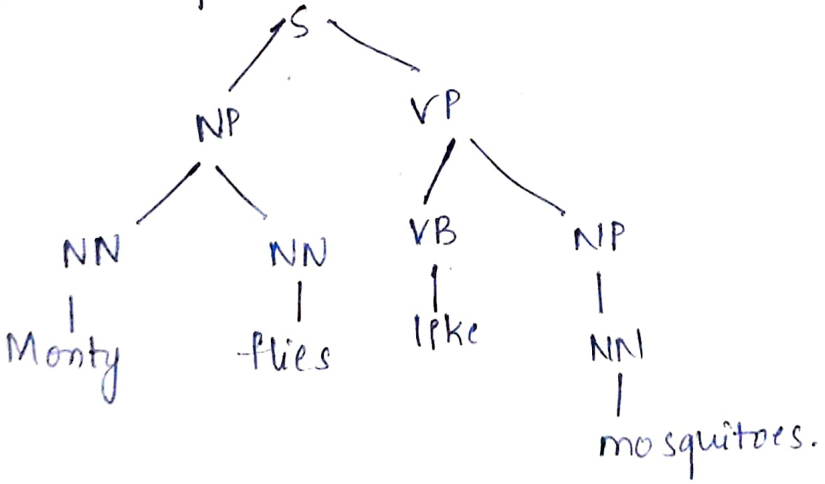
1.2 Monty flies like mosquitoes.

(1) Monty flies in a manner similar to mosquitoes.



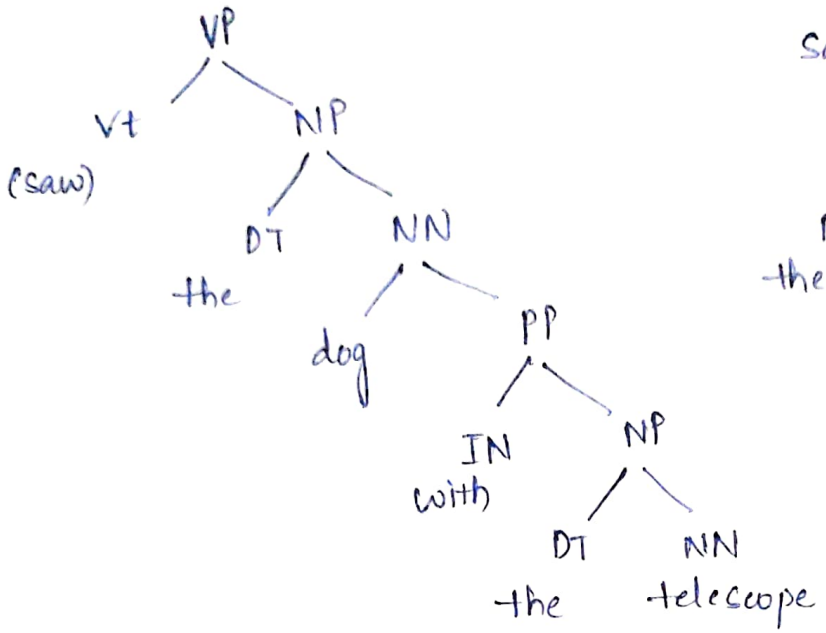
(2) Monty flies (Insects) similar to mosquitoes.

~~Monty~~ flies from a placed called Monty.

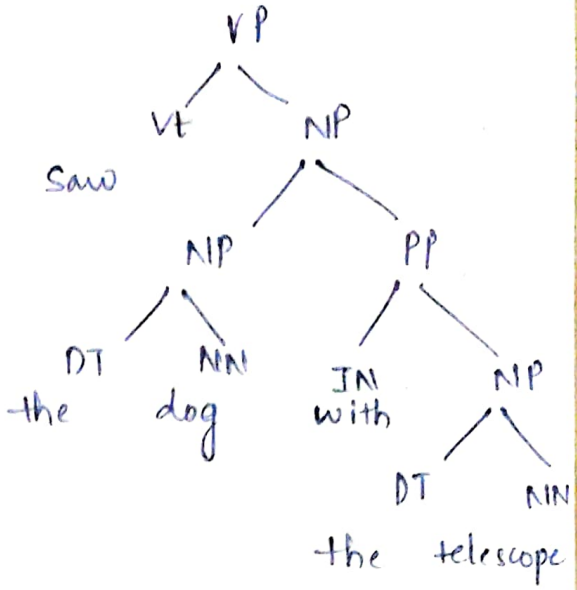


(2) Precision & Recall.

Gold standard tree



Predicted tree



Precision = $\frac{\text{no. of correctly predicted constituents}}{\text{Total no. of predicted constituents.}}$

Recall = $\frac{\text{no. of correctly predicted constituents}}{\text{total no. of correct constituents in gold standard.}}$

Gold standard

VP → Vt NP ✓
Vt → saw ✓
NP → DT NN ✓
DT → the ✓
NN → dog ✓
NN → PP
PP → IN NP ✓
IN → with ✓
NP → DT NN ✓
DT → the ✓
NN → telescope ✓

Predicted

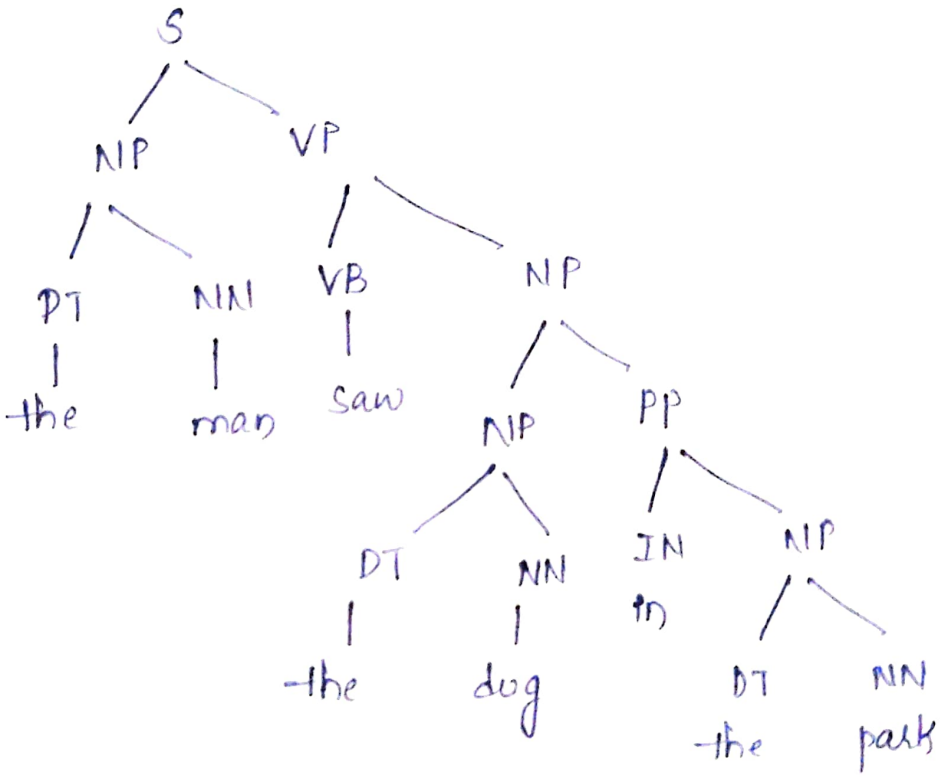
VP → Vt NP ✓
Vt → saw ✓
NP → NP PP
NP → DT NN ✓
DT → the ✓
NN → dog ✓
PP → IN NP ✓
IN → with ✓
NP → DT NN ✓
DT → the ✓
NN → telescope ✓

So, precision = $\frac{10}{11} = \frac{\text{no. of correctly predicted}}{\text{total no. of predicted}} = 0.909 = 90.9\%$

Since there are 10 rules, correctly predicted constituents

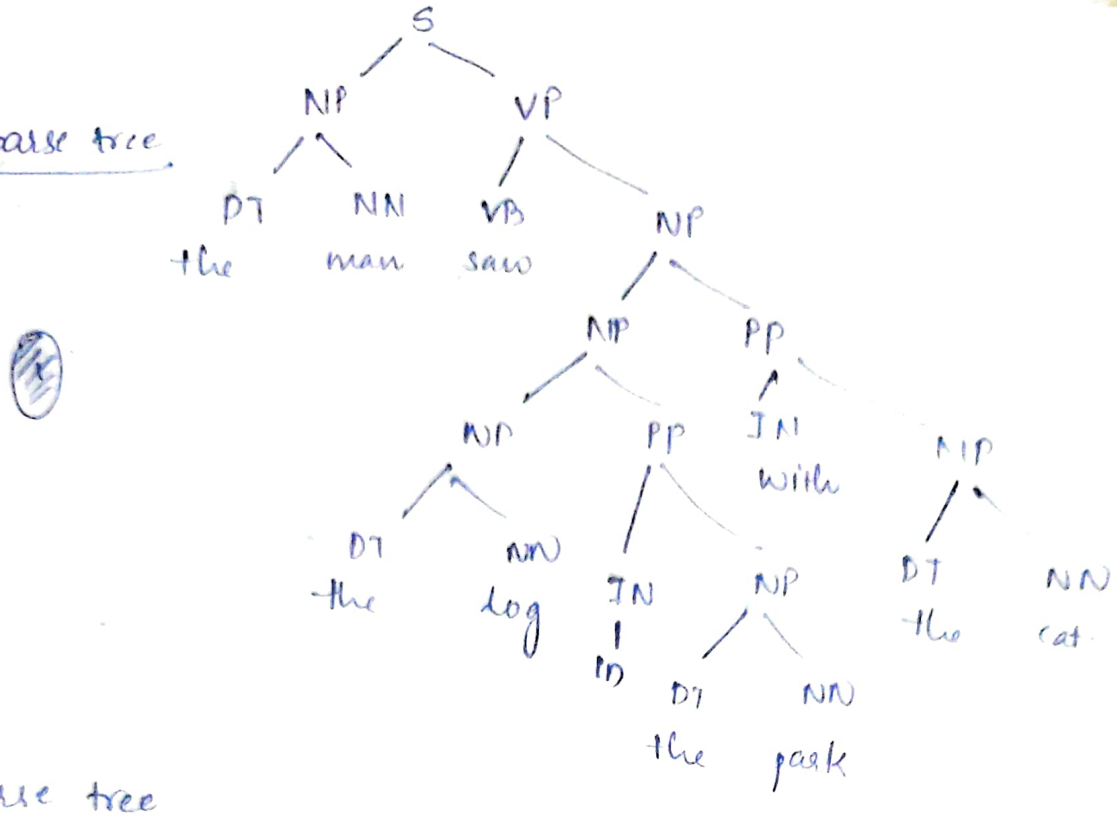
& recall = $\frac{\text{no. of correctly predicted}}{\text{total no. of Standard tree}} = \frac{10}{11} = 0.909 = 90.9\%$

3.1 Only one parse tree is possible.

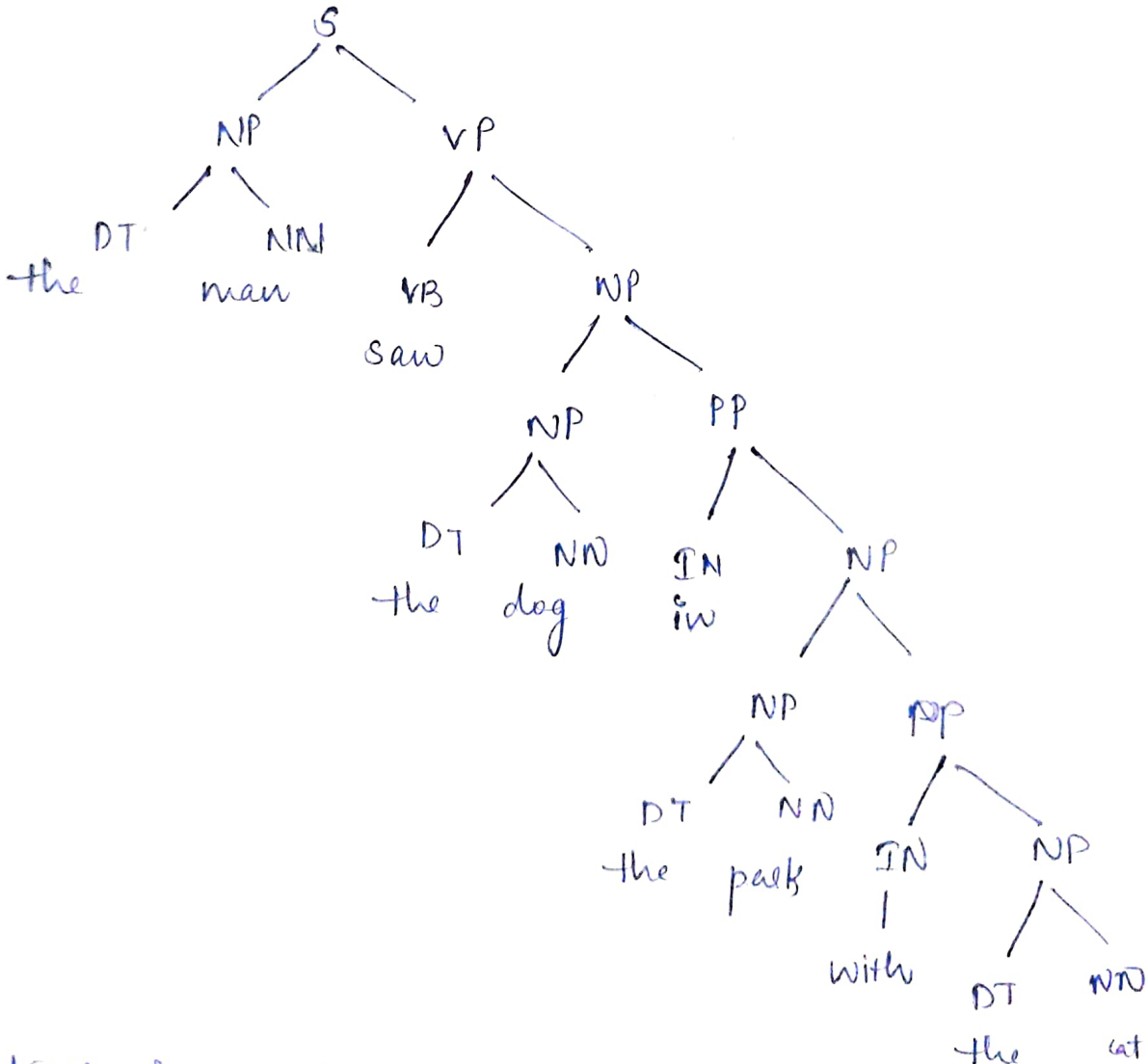


3.2

1st parse tree.



2nd parse tree



Two parse trees in total.

3.3

In first sentence, we had one preposition after the verb & In second sentence, we had two prepositions after the verb.

so, If we have k prepositions after the verb, then it means there are k+1 nouns (one before ~~verb~~ preposition & one after the preposition)

for each new preposition can be attached to any of the previous nouns. so, it can create k! combinations, but not all of them are valid, as they dont form proper constituency trees.

No of valid combinations corresponds to the no of valid binary trees that can be built with k+1 leaves, which is given by the kth Catalan number C_k.

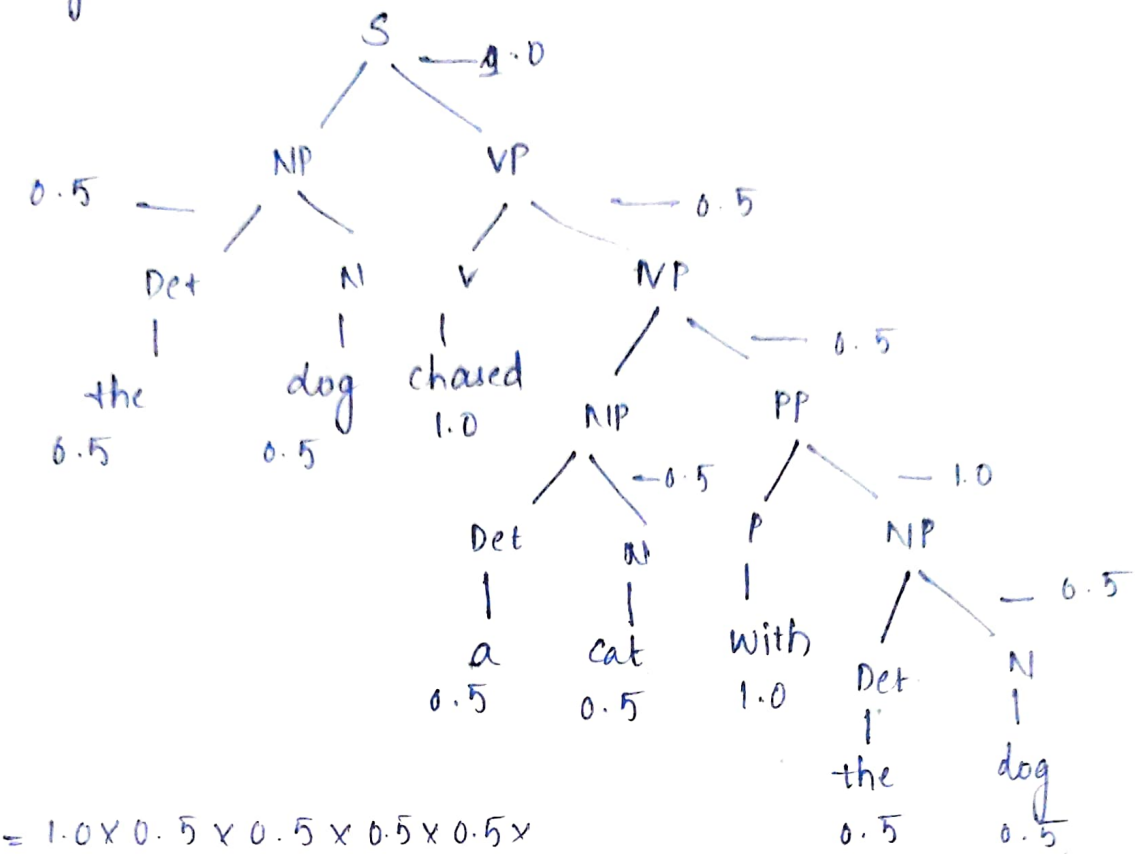
$$C_k = \frac{(2k)!}{(k+1)!\,k!}$$

So, first sentence when $k=1$, $C_k = \frac{2!}{2!\,1!} = 1$

In second sentence when $k=2$, $C_k = \frac{4!}{3!\,2!} = 2$.

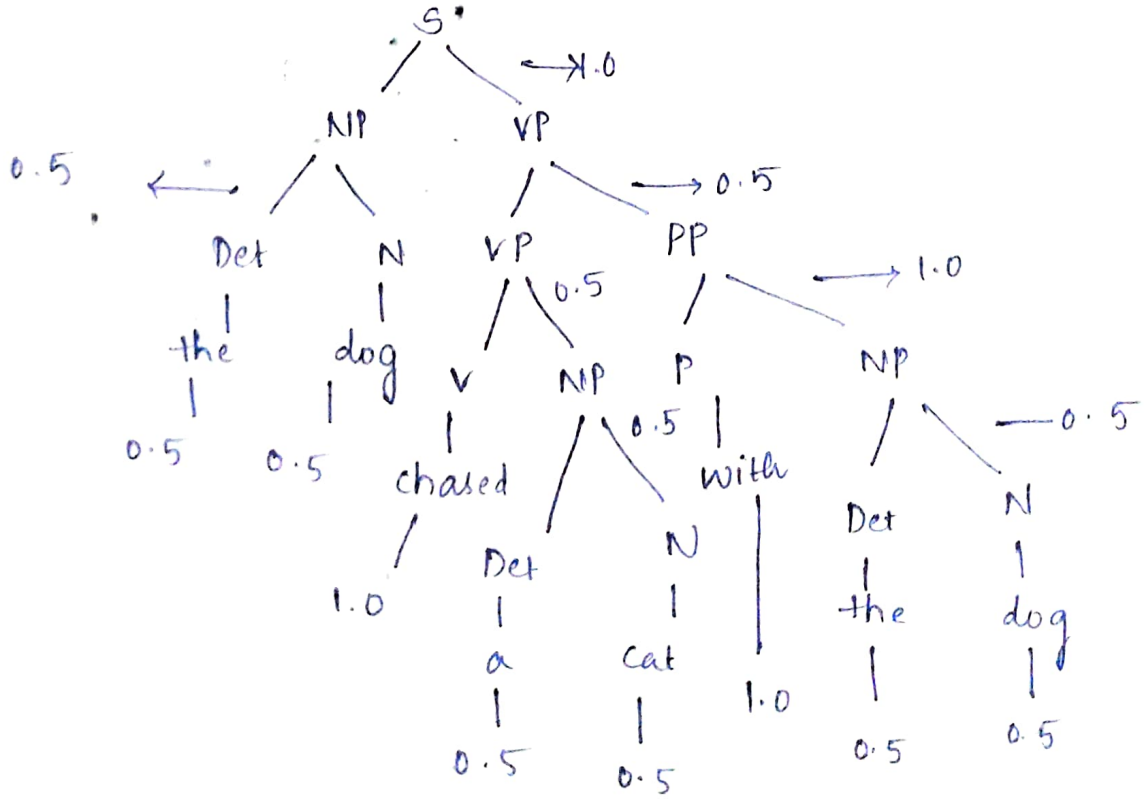
⑤ The dog chased a cat with the dog.

5.1 & 5.2



Probability (4) = $1.0 \times 0.5 \times 0.5 \times 0.5 \times 0.5 \times 1.0 \times 0.5 \times 0.5 \times 0.5 \times 0.5 \times 1.0 \times 0.5 \times 0.5 \times 0.5$

$= 0.000488 = 4.89 \times 10^{-4}$.

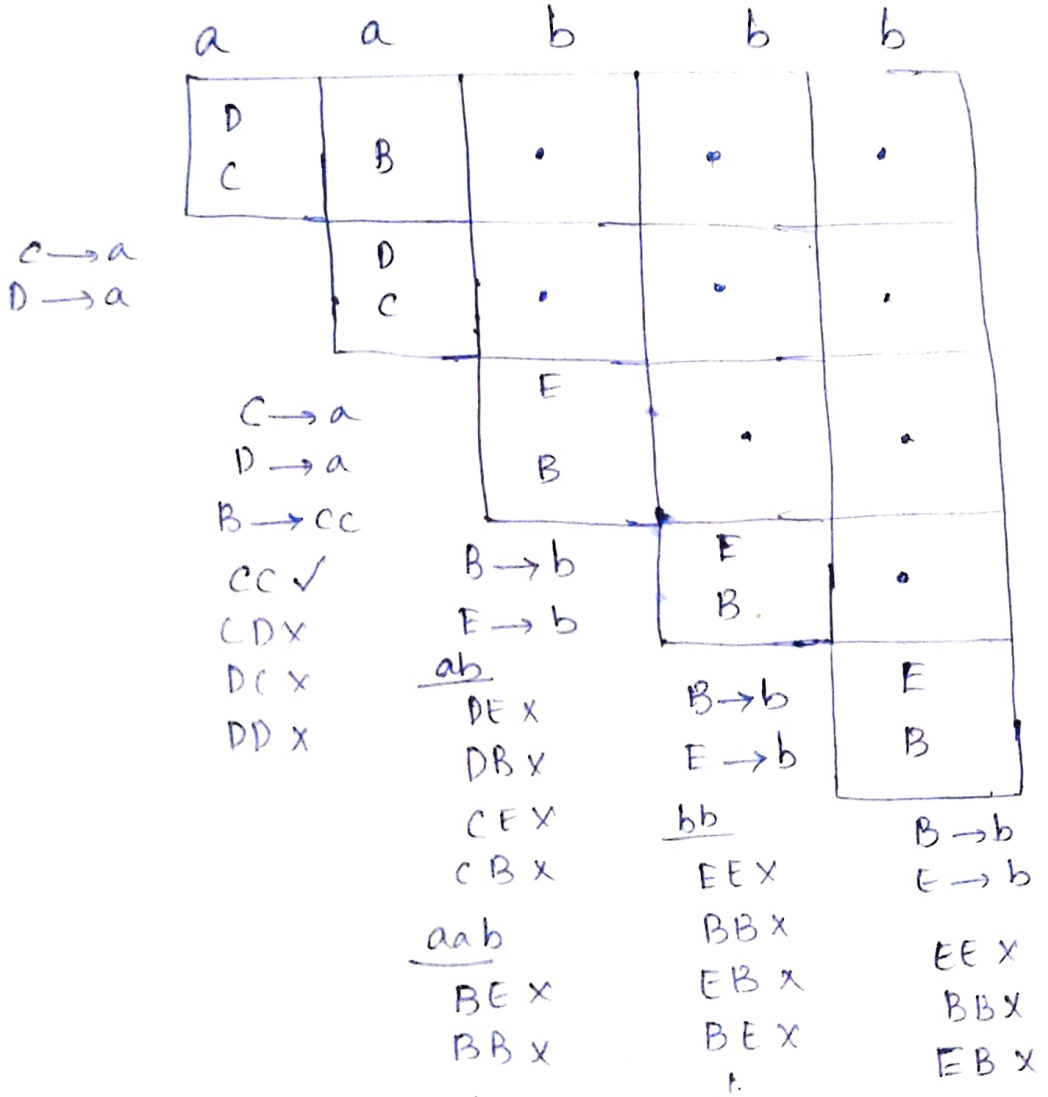


Probability (t_2) = $1.0 \times 0.5 \times 0.5 \times 0.3 \times 0.5 \times 0.5 \times 1.0 \times$
$1.0 \times 0.5 \times 0.5 \times 0.5 \times 0.5 \times 1.0 \times$
0.5×0.5
$= 0.00048828 = 4.89 \times 10^{-4}$.

5.3 Probability (t_1) = Probability (t_2)
So, both the trees are probable parse trees.

---

(4) aabbb



Since, the cell at the top-right is empty & doesn't start with start symbol (s), the sentence can't be generated by this grammar.

⑥ Root I → shot an ← elephant → in my ← pajamas .

stack	buffer	Action
[Root]	[I, shot, an, elephant, in, my, pajamas, .]	shift.
[Root, I]	[shot, an, elephant, in, my, pajamas, .]	shift
[Root, I, shot]	[an, elephant, in, my, pajamas, .]	shift.
[Root, I, shot, an]	[elephant, in, my, pajamas, .]	shift
[Root, I, shot, ~~elephant~~]	[elephant, in, my, pajamas, .]	left-arc
[Root, I, shot, elephant]	[in, my, pajamas, .]	shift
[Root, I, shot, elephant, in]	[my, pajamas, .]	shift
[Root, I, shot, elephant, in, my]	[pajamas, .]	left-arc ~~shift~~
[Root, I, shot, elephant, in]	[pajamas, .]	right-arc
[Root, I, shot, elephant]	[in, .]	right-arc
[Root, I, shot]	[elephant, .]	right-arc
[Root, I]	[shot, .]	~~shift~~ right-arc
[Root]	[I, .]	shift.
[Root, I]	[.]	

[Root] [I] [right-arc]