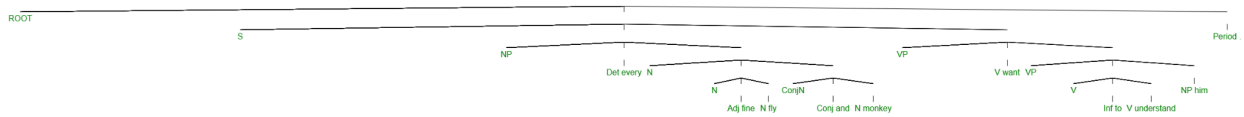
Q1 (10 POINTS)

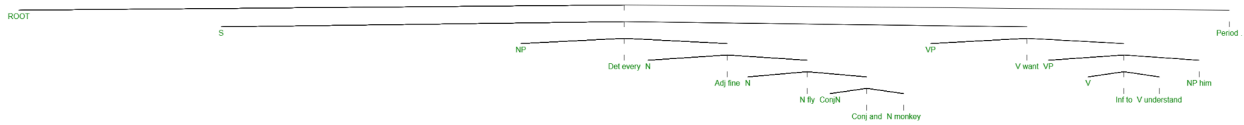
For the sentence "every fine fly and monkey want to understand him .", there are two parses with the same weight. What meanings do these parses correspond to? Why does the grammar assign the same weight to the two parses? Could you change the weights in this grammar to prefer one of the parses over the other? Explain. Be specific!

PARSING:: every fine fly and monkey want to understand him .
Tree 1 weight: 46.66
Tree 1 parse:
(ROOT (S (NP (Det every) (N (Adj fine) (N (N fly) (ConjN (Conj and) (N monkey))))))
(VP (V want) (VP (V (Inf to) (V understand)) (NP him)))) (Period .))



Parse 1 meaning: Every fine fly wants to understand him, as well as every monkey.

Tree 2 weight: 46.66
Tree 2 parse:
(ROOT (S (NP (Det every) (N (N (Adj fine) (N fly)) (ConjN (Conj and) (N monkey)))))
(VP (V want) (VP (V (Inf to) (V understand)) (NP him)))) (Period .))



Parse 2 meaning: Every fine fly wants to understand him, as well as every fine monkey.

In Parse 1, the adjective *fine* is modifying just the noun *fly*, whereas in parse 2, it is modifying both the fly and monkey, as they are joined in one noun by the conjunctive *and*. The grammar assigns the same weight to the two parses because they consist of the same rules, just in two different structures. Therefore, they are adding the same log probabilities together, despite the difference in what the adjective is modifying, resulting in the same weight for both parses. Even if you changed the weights in the grammar, you could not prefer one of the parses over the other as their weights are calculated by adding the same weights for the same rules.

Q2 (10 POINTS)

For the sentence "the monkey think -ed that the president want -ed his pickle on his sandwich .", there are three parses. Explain what meaning each of these parses corresponds to. Are any of these parses the one you get when you read the sentence? Explain.

PARSING:: the monkey think -ed that the president want -ed his pickle on his sandwich .
Tree 1 weight: 73.95
Tree 1 parse:
(ROOT (S (NP (Det the) (N monkey)) (VP (VComp (VComp think) (Vsuff -ed)) (SBAR (Comp that) (S (NP (Det the) (N president)) (VP (V (V want) (Vsuff -ed)) (NP (Det his) (N (N pickle) (PP (P on) (NP (Det his) (N sandwich)))))))))) (Period .))
Parse 1 meaning: The president has a pickle and a sandwich, and the monkey thought that the president wanted the pickle to be on top of the sandwich.

Tree 2 weight: 76.06
Tree 2 parse:
(ROOT (S (NP (Det the) (N monkey)) (VP (VComp (VComp think) (Vsuff -ed)) (SBAR (Comp that) (S (NP (Det the) (N president)) (VP (VP (V (V want) (Vsuff -ed)) (NP (Det his) (N pickle))) (PP (P on) (NP (Det his) (N sandwich)))))))) (Period .))
Parse 2 meaning: The president has a sandwich, which he was on top of, and the monkey thought that the president wanted a pickle.

Tree 3 weight: 76.06
Tree 3 parse:
(ROOT (S (NP (Det the) (N monkey)) (VP (VP (VComp (VComp think) (Vsuff -ed)) (SBAR (Comp that) (S (NP (Det the) (N president)) (VP (V (V want) (Vsuff -ed)) (NP (Det his) (N pickle)))))) (PP (P on) (NP (Det his) (N sandwich))))) (Period .))
Parse 3 meaning: The monkey has a sandwich, which he was on top of, and he thought that the president wanted a pickle.

Parse 1 was the meaning that I got when I read the sentence because seeing a monkey or president on top of a pickle is quite unusual in comparison to a pickle on a sandwich, so my mind did not immediately imagine those scenarios.

Q3 (20 POINTS)

How does this grammar prefer to parse the PP in sentences of the form NP V NP PP?

a) Construct a sentence your grammar can generate of this form and parse it. Save this sentence as Q3.sen and your parser's output on this sentence as Q3.out.
b) Why does the grammar prefer this parse? (hint: consider the rules involved)
c) Keeping the rules the same, change the weights in the grammar so the other parse is preferred for your sentence. What rule weights did you have to change and how? Save your updated grammar as Q3.gr.
d) Consider the meanings of sentences like "I ate soup with a spoon" and "I kissed the puppy with a tan coat". Why are both grammars (the original one and your modified one) inadequate for parsing sentences like these? Be specific!

a) Sentence: Bart want -ed a duck on the sandwich .

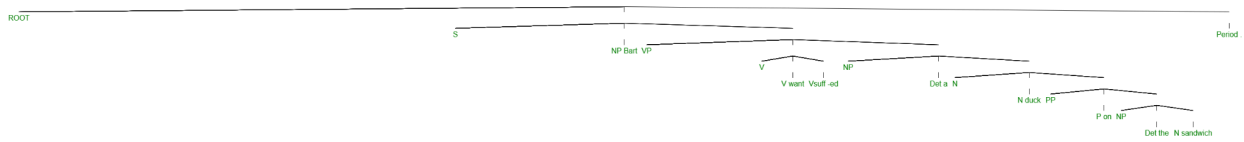
Output:

PARSING:: Bart want -ed a duck on the sandwich .

Tree 1 weight: 45.68

Tree 1 parse:

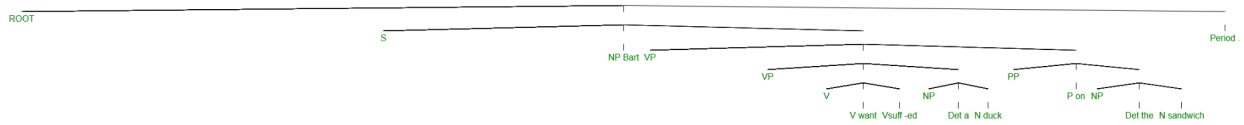
(ROOT (S (NP Bart) (VP (V (V want) (Vsuff -ed)) (NP (Det a) (N (N duck) (PP (P on) (NP (Det the) (N sandwich))))))) (Period .))



Tree 2 weight: 47.79

Tree 2 parse:

(ROOT (S (NP Bart) (VP (VP (V (V want) (Vsuff -ed)) (NP (Det a) (N duck))) (PP (P on) (NP (Det the) (N sandwich))))) (Period .))



When using log probabilities, the lower weight is the preferred: we can see that the grammar prefers Parse 1, which has a weight of 45.68, as opposed to Parse 2, which has a weight of 47.79.

b)

In Parse 1, the PP *on the sandwich* is modifying the N *duck*, whereas in Parse 2, the PP is modifying the VP *want -ed a duck*.

In order to see why the grammar prefers Parse 1 to Parse 2 despite having the same form NP V NP PP, we must look at where they differ. The only place in which the two parses differ is the way in which the PP is parsed. Parse 1 has a lower weight because the rule N -> N PP has a weight of 3.70, which is lower than the VP -> VP PP, which has a weight of 5.81. We can verify this by subtracting the overall weights of the parses and seeing if it is equivalent to the result of subtracting the weights of the rules. In doing so, we see that

both result in 2.11, meaning that it is indeed only the parsing of PP that the parse weights depend on. In summary, the grammar prefers to parse sentences with NP V NP PP form with the PP modifying the N rather than the VP because the weight for the rule N -> N PP is better than that of the rule VP -> VP PP.

c)

PARSING:: Bart want -ed a duck on the sandwich .
Tree 1 weight: 45.68
Tree 1 parse:
(ROOT (S (NP Bart) (VP (V (V want) (Vsuff -ed)) (NP (Det a) (N (N duck) (PP (P on) (NP (Det the) (N sandwich))))))) (Period .))

Tree 2 weight: 42.980000000000004
Tree 2 parse:
(ROOT (S (NP Bart) (VP (VP (V (V want) (Vsuff -ed)) (NP (Det a) (N duck))) (PP (P on) (NP (Det the) (N sandwich))))) (Period .))
I changed the VP -> VP PP rule to be lower than the N -> N PP rule, which resulted in the grammar preferring the PP modifying the VP rather than the N, as seen by the lower weight for Parse 2 as opposed to Parse 1.

d)

Both of these sentences cannot reasonably have both parses, with the PP modifying either the VP or the N:
“I ate the soup with a spoon.”:
The only reasonable parse of this sentence is with the PP modifying the VP, meaning the act of eating the soup is done with a spoon. On the other hand, if we consider the parse with the PP modifying the N, we somehow have the soup being in possession of a spoon. The meaning of this parse does not make any sense.

“I kissed the puppy with a tan coat.”:
The only reasonable parse of this sentence is with the PP modifying the N, meaning the puppy is in possession of a tan coat. On the other hand, if we consider the parse with the PP modifying the VP, the act of kissing the puppy is somehow being done with a tan coat. The meaning of this parse does not make any sense.

Both of these sentences only have one valid parse semantically, whether that involves the PP modifying the N or the VP. Neither of the grammars (original or modified) can adequately capture this by simply preferring one parse of PP over another, as the grammars do not consider the meaning of the parses that they prefer.