

Home Assignment 4: Syntactic Parsing

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Problem 1.a. Recursive rules.

The program tends to generate long sentences because of a recursive rule that may cause a very long rule loop expansions. Each sentence starts by expanding *ROOT* symbol, which always expands with the *S* symbol in it (with some other symbols...). The *S* symbol expands to $S \rightarrow NP\ VP$ and *NP* with a probability of $\frac{1}{2}$ will expand to $NP \rightarrow NP\ PP$ which causes a self-loop (So $NP \rightarrow NP\ VP$ is the grammar rule which is responsible to the long sentences).

In addition notice the *PP* has only one rule which is $PP \rightarrow Prep\ NP$, that means the recursive rule causes not only one *NP* symbol expansion but two!

Problem 1.b. Low probability.

There is only one rule which generates adjectives: $Noun \rightarrow Adj\ Noun$. This recursive rule will cause two sequential adjectives only if *Noun* will be expanded to this same rule once again. The problem is that the *Noun* symbol has another 5 rules with the same weight, which results a probability of $\frac{1}{6}$ to have two sequential adjectives (assuming there is one adjective already). For general length n of sequential adjectives we have probability of $\frac{1}{6^{n-1}}$ (assuming again there is one adjective already).

Problem 1.c. Making the sentences shorter and the adjectives more frequent.

There are several ways to make shorter sentences and more adjectives. One way to achieve shorter sentences is to decrease the weight of the known rule in section 1.a with respect to the other rules which are derived from *NP*, while in order to make more adjectives we can increase the weight of the known rule in section 1.b with respect to the other rules which are derived from *Noun*. That method works because when we decrease the weight of rule 1.a, there is less probability to find ourselves in a *NP PP* loop (therefore shorter sentences) and if we increase the weight of rule 1.b, which is the only rule that cause adjective to appear in the sentence we clearly raise the amount of adjectives.