NLP - HW 5

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Question 1 – Basic grammar

(a) The program generates long sentences because of the grammar rules that we have. Our grammar rules contain only one rule for the root (S -> NP, VP), and by the other rules we can see that NP contains at least 2 words, and VP contains at least 3 words. This means that the final sentences contain at least 5 words each.

(b) The generated sentences rarely contain multiple adjectives. This is because the probability for x adjectives before a noun is $\left(\frac{1}{6}\right)^x$, as we can see in the grammar rules (5 rules in which noun leads to a leaf, and one rule in which noun leads to an adjective before it; all rules are with the same weight).

(c) To generate shorter sentences (problem a) – we can add more rules for the root, with the same weight. For example: S -> NP V, S -> N VP, S -> N V. If we would like to make the adjectives more frequent (problem b), then we can increase the weight of rule number 6 (Noun -> Adj Noun).

- We implemented all the above changes. We increased the weight of rule #6 from 1 to 5, and now the probability to get x adjectives before a noun is $\left(\frac{1}{2}\right)^x$. We can see by the results that we got shorter sentences, and more adjectives before a noun. For example:

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sandwich understood !
fine delicious fine delicious president wanted a perplexed delicious sandwich .
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Question 3 – Extending the grammar

(a) We modified the grammar rules, as follow:

- Discriminated between adjectives for verbs and adjectives for nouns, and created new class called CVerb which includes adjectives that describe a verb.

- Added new Non-Terminals and rules:
  - Pro (proposition)
  - Cls (the word that starts a new clause)
  - CLAUSE (Cls + S; S is the clause itself)
  - OBJ (NP + CLAUSE)
  - CLSVP (phrase of CVerb and OBJ)
  - Aux (auxiliary verb, for example: is, are)

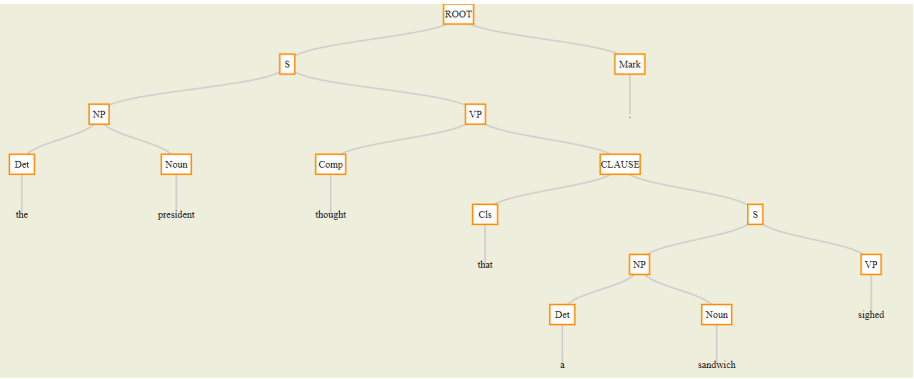
- PROG (action that occurs now, like eating)
- PROGVP (PROG + NP)
- IP (Aux + one of the following: Adj/NP/PROGVP/PP)
- Trans (describe an action that occurred in the past, like ate)
- Conj (conjunctions that describe relation, like: ”and” / ”or”)
- NPCJ, VPCJ, TRCJ (NP, VP, Trans which comes after Conj)
- Gen (conjunctions that describe belonging, like: “of”)
- GP (Gen + Noun)
- Quant (quantity related words like “very”)
- Comp (comprehensive past tense like thought or understood)

(b) We modified the grammar rules, as follow:

- Added new non-terminals and rules:
  - REL - for relative clause which can include object-trace or subject-trace
  - VPREL – Comp + REL
  - SREL – NP + VPREL or Trans
  - Nouns – plural noun class, like citizens

(c) Test examples:

- (ROOT (S (NP (Det the) (Noun president)) (VP (Comp thought) (CLAUSE (Cls that) (S (NP (Det a) (Noun sandwich)) (VP sighed))))) (Mark .))



- (ROOT (S (Pro it) (VPC (CVerb perplexed) (OBJ (NP (Det the) (Noun president)) (CLAUSE (Cls that) (S (NP (Det a) (Noun sandwich)) (VP (Trans ate) (NP Sally))))))) (Mark .))

- (ROOT (S (NP (Det the) (Noun (Adj (Quant very) (Adj (Quant very) (Adj (Quant very) (Adj perplexed)))) (Noun president))) (VP (Trans ate) (NP (Det a) (Noun sandwich)))) (Mark .))