Advanced Methods in Natural Language Processing – HW 4

# **Basic Grammar**

1. The rule responsible for the long sentences is “1 NP NP PP”. Almost all the rules derive to NP which gives high chance of deriving NP. Moreover, this rule have half the weight of lhs=NP and it is recursive (derives again to NP) so it is hard to “escape” from deriving it again and again.
2. The rule responsible for multiple adjectives is “1 Noun Adj Noun”. The weight of this rule when lhs=Noun is 1/6 (there are 5 rules deriving Noun to a terminal) so there is a low chance of deriving this rule.
3. For the problem in (a) we changed the weight of the rule “1 NP Det Noun” to 5, thus giving it more weight. This is the only other rule derived from NP so by doing so the probability to derive it is higher than the probability to derive the problematic rule.

For the problem in (b) we changed the weight of the rule “1 Noun Adj Noun” to 5, thus giving it more weight against the other rules derived from Noun and the probability to derive it is higher.

# **CKY Parser**

1. Implementation in code
2. Implementation in code
3. **Extending the Grammar**
4. Implementation in grammar file
5. Implementation in grammar file
6. We tried to parse the following sentences (examples from exercise and wrong sentences):

Sally ate a sandwich .

Sally and the president wanted and ate a sandwich .

the president sighed .

the president thought that a sandwich sighed .

it perplexed the president that a sandwich ate Sally .

the very very very perplexed president ate a sandwich .

the president worked on every proposal on the desk .

Sally is lazy .

Sally is eating a sandwich .

the president thought that Sally is a sandwich .

the pickle kissed the president that ate the sandwich .

the pickle kissed the sandwich that the president ate .

the pickle kissed the sandwich that the president thought that Sally ate .

the citizens choose the president .

the president chooses the chief of staff .

the president and the chief of staff choose the sandwich .

the president table .

Sally choose the table .

the very very table is a sandwich .

We got the following results:

(ROOT (S (NP Sally) (VP (Verbt ate) (NP (Det a) (Noun sandwich)))) (Mark .))

(ROOT (S (NPS (NP Sally) (NP|CC.NP (CC and) (NP (Det the) (Noun president)))) (VP (Verbt (Verbt wanted) (Verbt|CC.Verbt (CC and) (Verbt ate))) (NP (Det a) (Noun sandwich)))) (Mark .))

(ROOT (S (NP (Det the) (Noun president)) (VP sighed)) (Mark .))

(ROOT (S (NP (Det the) (Noun president)) (VP (VerbC thought) (SBAR (Comp that) (S (NP (Det a) (Noun sandwich)) (VP sighed))))) (Mark .))

(ROOT (S (Pro it) (Pro|VerbD.NP.SBAR (VerbD perplexed) (Pro.VerbD|NP.SBAR (NP (Det the) (Noun president)) (SBAR (Comp that) (S (NP (Det a) (Noun sandwich)) (VP (Verbt ate) (NP Sally))))))) (Mark .))

(ROOT (S (NP (Det the) (Noun (Adj (Enhancer very) (Adj (Enhancer very) (Adj (Enhancer very) (Adj perplexed)))) (Noun president))) (VP (Verbt ate) (NP (Det a) (Noun sandwich)))) (Mark .))

(ROOT (S (NP (Det the) (Noun president)) (VP (VP (Verbt worked) (PP (Prep on) (NP (Det every) (Noun proposal)))) (PP (Prep on) (NP (Det the) (Noun desk))))) (Mark .))

(ROOT (S (NP Sally) (IP (Aux is) (Adj lazy))) (Mark .))

(ROOT (S (NP Sally) (IP (Aux is) (VPProg (VerbProg eating) (NP (Det a) (Noun sandwich))))) (Mark .))

(ROOT (S (NP (Det the) (Noun president)) (VP (VerbC thought) (SBAR (Comp that) (S (NP Sally) (IP (Aux is) (NP (Det a) (Noun sandwich))))))) (Mark .))

(ROOT (S (NP (Det the) (Noun pickle)) (VP (Verbt kissed) (NP (NP (Det the) (Noun president)) (REL (Comp that) (VP (Verbt ate) (NP (Det the) (Noun sandwich))))))) (Mark .))

(ROOT (S (NP (Det the) (Noun pickle)) (VP (Verbt kissed) (NP (NP (Det the) (Noun sandwich)) (REL (Comp that) (Comp|NP.Verbt (NP (Det the) (Noun president)) (Verbt ate)))))) (Mark .))

(ROOT (S (NP (Det the) (Noun pickle)) (VP (Verbt kissed) (NP (NP (Det the) (Noun sandwich)) (REL (Comp that) (Comp|NP.VerbC.REL (NP (Det the) (Noun president)) (Comp.NP|VerbC.REL (VerbC thought) (REL (Comp that) (Comp|NP.Verbt (NP Sally) (Verbt ate))))))))) (Mark .))

(ROOT (S (NPS (Dets the) (Nouns citizens)) (VPPresPlur (VerbtPresPlur choose) (NP (Det the) (Noun president)))) (Mark .))

(ROOT (S (NP (Det the) (Noun president)) (VPPresSing (VerbtPresSing chooses) (NP (Det the) (Noun (Noun chief) (GP (Gen of) (Noun staff)))))) (Mark .))

(ROOT (S (NPS (NP (Det the) (Noun president)) (NP|CC.NP (CC and) (NP (Det the) (Noun (Noun chief) (GP (Gen of) (Noun staff)))))) (VPPresPlur (VerbtPresPlur choose) (NP (Det the) (Noun sandwich)))) (Mark .))

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