Exercises:
- How can you modify the production frequencies so that longer sentences can be generated? Explain how and why.

To increase the chances of generating longer sentences you would increase the production frequencies of the non-terminal or pre-terminal generating rules. This means increasing the production frequencies of the recursive rules. For example if we increase the likelihood of Noun -> Det Noun compared to Noun -> terminal then our generator will be more likely to generate a longer sentence. In our small grammar there aren't many recursive rules but in a larger grammar there would be many.

- Is every sentence generated by the grammar can be parsed by the CYK algorithm using the same grammar? Give your intuition.

Yes. The CYK parser might find more than one viable parse tree but it will always find the original generative tree. This is because the generator is using the same grammar as the CYK parser. Since the parser is able to parse every possible parse tree for a given sentence it is guaranteed to generate the original tree. This might be the only tree the parser finds or the parser might find additional trees as well.