

Stellenbosch University Computer Science Assignment Declaration

I know that using another person's ideas (including written work and source code) and claiming them as my own constitutes plagiarism. I am aware that the potential penalties for this offence, as specified in the University's policy on academic integrity, may include expulsion from the University and other serious consequences.

1. This submission is entirely my own work, excepting the inclusion of resources explicitly permitted for this assignment, and assistance as noted in the following item. I have not used any generative AI technology or tools (such as ChatGPT), unless explicitly permitted in the assignment.
2. My submission acknowledges the source of all libraries and external sources used, and identifies any other students and/or staff (including demis, tutors, and lecturers) with whom I have discussed this assignment, as well as the extent of those discussions. Note that, unless explicitly stated otherwise, submissions or solutions to assignments in previous courses at this University or any other educational institution which even partly correspond to this assignment may not be used as external sources; in particular, do not look at or use solutions to assignments from previous years.
3. I have not allowed, and will not in the future allow, anyone to copy any portion of my work, or give them access to it in any way. In addition, I will not make my work publicly available in any way, including posting my code in public source code repositories or forums, unless explicitly permitted by the lecturer.
4. I have not and will not facilitate plagiarism, such as by distributing any written work or source code created by a fellow student.
5. I understand that any code I submit may be inspected for plagiarism detection (either manually or by automated systems) and be retained for detecting plagiarism in other courses.

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Please fill out and submit a scan or photo together with your homework. Submissions without signed declaration will not be marked.

Question 1.

Consider the grammar G defined by the following rules:

$$\begin{aligned} S &\rightarrow A \# \\ A &\rightarrow (A) \mid B \\ B &\rightarrow B 0 \mid B 1 \mid C \\ C &\rightarrow 2 \mid \varepsilon \end{aligned}$$

where S is the start symbol.

1. List any non-terminal symbols which are nullable. For each non-terminal symbol X in the grammar G list the elements of $\text{FIRST}(X)$ and $\text{FOLLOW}(X)$. **3 marks.**
2. Create a parsing table for a predictive parser for the grammar G . Explain why this grammar is not LL(1). Is this grammar LL(k) for any k ? Justify your answer. **4 marks.**
3. Transform the grammar G into a grammar G' that accepts the same language but can be parsed by an LL(1) parser. Explain why your grammar G' accepts the same language, and construct the parsing table for G' that shows that G' is indeed LL(1). **8 marks.**

Question 2.

Use the ANTLR system to write a lexer and parser for the Draco language; more details of the language are contained in the Draco documentation folder on the sunlearn course page. You must implement the language as specified in Sections VII to XII, XIV, and XV.

Note that the informal language description may be incomplete or even inconsistent, and may not be consistent with the examples provided by the language designer; resolve any conflicts in a consistent manner, and document your choices.

Your grammar must have the name `draco` so it can work with the our driver program. You must submit all ANTLR grammar files, and all auxiliary sources (if any). Marks will be given for performance over a test suite and the general quality of the submission. Document your grammar. **85 marks.**

Notes:

1. For this assignment, you may use generative AI tools such as ChatGPT. If you do so, you must outline and discuss your prompting strategy in a short write-up, and you must submit **all** interactions with the applied tool (i.e., your prompts, and the system's answers). You must also explain how you manually improved the generated grammar, if applicable, or why you abandoned your attempts.
2. See the notes from Assignment 1 for more details.

Submission:

1. Submission deadline is **Mar 18, 2024, 17:00**.
2. Please submit all files on your Gitlab repository. Please create a directory `assignment2` for this submission.
3. Please submit a pdf or jpeg image of your signed declaration statement.
4. For Question 1, you can submit a pdf scan or jpeg image of a handwritten solution.
5. For Question 2, please submit all *source* files that are required to build a running version; please don't submit any ANTLR jars. If you used a generative AI tool, you must submit the system interactions and explanations, as outlined above.
6. We will be using ANTLR v4.13.1 and Java 17 for marking.