



ASSIGNMENT 3.1 – LANGUAGE GRAMMAR (used in Parser)

General View

Due Date: prior or on **Nov 27th 2021 (midnight)**

- **2nd Due date** (until **4th Dec**) - **50%** off.

Earnings: **5%** of your course grade.

Development: Activity can be done **individually** or in teams (**only 2 students** allowed).

Purpose: Define the BNF of **your language**.

- ❖ This is an important activity from front-end compiler that is based on the definition of your language.
- ❖ Your next activity (*parser implementation*) will be based on the definitions given for your language.
 - Start reviewing and **fixing** your definitions done in A11 (Language Proposal).
 - Then, continue **defining all the grammar** for your language: define the non-terminals and terminals of your language.
- ❖ MAIN IDEA: Use the section **SOFIA Model Definition** ([Sofia_LGR_A31_S21_Sol](#)) to answer your assignment correctly.
 - Change the document in order to describe **your language**.
 - You can remove elements not used in **your language**.
 - You can include new elements if necessary (for instance, if you are including new datatypes).
 - What does matter is the final consistency between your BNF and the language that you are creating.
 - **TIP:** One strategy is checking the code examples that you are using for each assignment and check if they are obeying the rules that you are defining in your grammar.

NOTE 1:

Your language **can be updated** in order to prepare it better for the implementation. But be careful about some effects.

- *For instance, if you are changing the tokens (replacing), your scanner – see the tokenizer function and your transition table – should reflect. Otherwise, you will have a difference version of the grammar that you can recognize between scanner and parser.*

Task 1: BNF (5 marks)

See the [Sofia_LGR_A31_S21_Sol](#) document that defines the **SOFIA** language (or, eventually, check the **Appendixes** in the **Lecture Notes**). You need to create your own language grammar.

- Start defining instructions to define the syntax based on some **basic elements**: keywords, comments, etc.
 - Use the tokens that you have defined in the **scanner** (for instance, INL_T for integer literals, etc.)
- Define correctly **syntax**, including elements of your program, the statements, etc..

TIP: Your language can be reviewed / updated. What does matter is that you can define your own specification, that must be different from **SOFIA**.

- Be sure that all elements of your grammar are there.
- Also check the compatibility with your specification and what you have previously defined.
- Finally, check if you have solved the following problems:
 - **LR - Left recursion** (avoid the recursion without prefix)
 - **LF - Left factoring** (your language must have one prefix).

NOTE 2:

Sometimes, you can start defining rules using LR or LF. However, you need to solve them (some examples are shown in [Sofia_LGR_A31_S21_Sol](#)).

- *If you do not solve these problems, your parser will not be able to work in the end.*

How to Test

The basic tests that you need to test in your BNF are related to the following cases:

- *One method to use variables;*
- *Inputs and outputs (including string messages);*
- *Define mathematical expressions (using float-point variables).*
- Change this file (starting with the **name** of your language) and check all BNF rules described here, adapting it to your language.
- **Example:** How to calculate the volume of a sphere (the mathematical formula is: $V = \frac{4}{3} \pi r^2$).
- Showing a Sofia input example:

```
@ SOFIA Example (Volume of a sphere) @
&MAIN {
    DATA {
        FLOAT %f1, %f2, %f3;
        STRING $text;
    }
    CODE {
        %f1=3.14;
        READ(%f2);
        %f3 = 4 / 3 * %f1 * (%f2 * %f2);
        WRITE(%f3);
    }
}
```

Submission Details

- ❖ **Due Date:**
 - **Week 1** (no deduction): Sat, 27th Nov 2021 (midnight)
 - **Week 2** (50% deduction): Sat, 4th Dec 2021 (midnight).
- ❖ **Digital Submission: Compress** into a **zip** file with **ALL files** that you are using in this model – essentially, DOC file, but you can eventually include pictures. Also include a cover page.
- ❖ The submission must follow the course submission standards. You will find the Assignment Submission Standard as well as the Assignment Marking Guide ([CST8152_ASSAMG.pdf](#)) for the Compilers course on the Brightspace.
- ❖ Upload the **zip** file on Brightspace. The file must be submitted prior or on the due date as indicated in the assignment.

- ❖ **IMPORTANT NOTE:** The name of the file must be **Your Last Name** followed by the last three digits of your student number followed by your lab **section number**. For example: **Sousa123_s10.zip**.
 - If you are working in teams, please, include also your partner. For instance, something like: **Sousa123_Melo456_s10.zip**.
 - **Remember:** Since we have just one lab professor, students from the **different sections** can constitute a team.
- ❖ **How to Proceed:** You need to demonstrate your progress to your Professor in **private Zoom Sections** during Lab sessions.
 - If you are working in teams, **you and your partner** must do it together, otherwise, only the student that has presented can get the bonus marks.
 - **Eventual questions** can be posed by the Lab professor for any explanation about the code developed.
 - Each demo is related to a **specific lab** in **one specific week**. If it is not presented, no marks will be given later (even if the activity has been done).

Marking Rubric

Maximum Deduction (%)	Deduction Event
CRITICAL	Severe Errors
100%	Late submission (1 week after due date)
Up to 100%	Plagiarism detection (remember languages are different)
Task 1	Language BNF
Up to 50%	Syntax Definition
Up to 30%	Correctness / Completeness
Up to 20%	No left-recursion, no left-factoring
Up to 20%	Compliance with examples provided
Up to 10%	Input example(s) provided.
ADDITIONAL	Small problems
Up to 20%	Language adaptation (missing elements – ex: datatypes / constants)
Up to 20%	Unjustified modification (if you changed the language, explain why)
up to 10%	Other minor errors
up to 10%	Bonus: original ideas developed by language.
Final Mark	Formula: $5 * ((100 - \sum \text{penalties} + \text{bonus}) / 100)$, max score 5%.

Final Message

Remember that your language (your city name) must have a proper grammar (different from Sofia). Remember to provide the inputs that you are using – they will be specially necessary to the next (and final) assignment.

File update: Nov 16th 2021.

Good luck with A31!
