

# Programming languages (TC-2006)

## Extra points challenge 03

In this challenge, you will design some grammars for recognizing specific structures. This challenge may be solved in teams of at most three members. If you want, you can submit this challenge individually.

### 1 Designing grammars

Design the following grammars.

- A grammar that produces binary strings that always end with the character 'b'. Please note that the shortest binary strings allowed are "0b" and "1b".
- A grammar that produces strings formed with the alphabet {1, 2, 3, ;}, but the characters in the string are sorted from lowest to largest and always end with a semicolon. For example, the strings "11222223;", "2;", and "13333;" can be produced with such a grammar, while the strings "132;" and "2333332:", cannot.
- A grammar that produces the four arithmetic expressions (addition, subtraction, multiplication and division). For example, the expression  $(4 * 2) + 8$  can be produced with such a grammar. For simplicity, assume that the terminals `number` and `operator` define any number and operation valid by your grammar, respectively. Also assume that all the operations take always two operands.
- A grammar that produces the four arithmetic expressions (addition, subtraction, multiplication and division) in polish notation (the function appears before the operands). For example, the expressions 10, (MUL 4 2), and (ADD 5 (SUB 30 (MULT (DIV 4 2) 3))) can be produced with such a grammar. For simplicity, assume that the terminals `number` and `operator` define any number and function valid by your grammar, respectively. Also, to avoid problems with the precedence of operators, assume that any expression involving at least one function will be wrapped in parenthesis. Then, with this grammar it is not possible to produce the expression `ADD 5 3` since it would need to be indicated between parenthesis: `(ADD 5 3)`.

### Deliverables



Prepare a brief PDF document (at most two pages that contains the information requested and submit it to Canvas. **Please, do not submit other formats but PDF.**



I promise to apply my knowledge, strive for its development, and not use unauthorized or illegal means to complete this activity, following the Tecnológico de Monterrey Student Code of Honor.