

# Formal Languages and Compilers

## Proff. Breveglieri, Morzenti

### Written exam<sup>1</sup>: laboratory question

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The laboratory question must be answered taking into account the implementation of the Acse compiler given with the exam text.

Modify the specification of the lexical analyser (`flex` input) and the syntactic analyser (`bison` input) and any other source file required to extend the Lance language with the **if statement with initializer** construct.

The construct allows a programmer to specify, withing the round braces following the `if` keyword of a common if-statement both the condition which should be holding true, and an arbitrary statement. The entire statement, including its mandatory terminating semicolon is prefixed to the usual if-statement condition. The if statement with initializer construct is denoted by the `iiif` keyword in place of the usual `if`.

An example is provided in the following code snippet

```
int i, j;  
i=5;  
j=7  
iiif (i=i+2; (j*5)>i) {  
    j = i;  
}
```

The computation of the initializing statement is always executed before the evaluation of the condition of the if statement is evaluated and its usual behaviour is followed, i.e., the code block is executed if the condition is true.

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<sup>1</sup>Time 60'. Textbooks and notes can be used.  
Pencil writing is allowed. Write your name on any additional sheet.

1. Define the tokens (and the related declarations in **Acse.lex** and **Acse.y**). (3 points)
2. Define the syntactic rules or the modifications required to the existing ones. (4 points)
3. Define the semantic actions needed to implement the required functionality. (18 points)



4. Given the following Lance code snippet:

```
a= b << c - d * a;
```

Write down the syntactic tree generated during the parsing with the Bison grammar described in Acse.y *starting from the assign\_statement nonterminal*. (5 points)

5. (**Bonus**) Describe the modifications to be made to your solution to allow any valid ACSE statement, including the newly added *if statement with initializer*, to appear as the initializing statement of the new construct.