

Formal Languages and Compilers
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Written exam¹: laboratory question
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Course: ☐ Laurea Specialistica ☐ V. O. ☐ Laurea Triennale ☐ Other: ...
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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 ability to handle the arithmetic `if` construct. Consider the following code snippet as an **illustrative example** of its use:

```
int a,b;

over: a=b;
if A( a-b )A sum,over,print;
b=b*2;
print: write(a);
sum: a=a+b;
```

The arithmetic `if` construct evaluates the expression enclosed by the special parentheses `A(` and `)A` and, depending on whether its result is negative, zero, or positive, causes the control flow of the program to continue from the first, second, or third label which follow it. The syntax for the labels and labelled statements is the same as the one of C language. At most one label per statement is allowed. If the arithmetic `if` construct points to a label which is not present in the program, the modified compiler should raise a *compile time* error

¹Time 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**). (2 points)
2. Define the syntactic rules or the modifications required to the existing ones. (3 points)

3. Define the semantic actions needed to implement the arithmetic `if` statement. (20 points)

4. Given the following Lance code snippet:

```
; a = -a & b;
```

write down the syntactic tree generated during the parsing with the Bison grammar described in Acse.y *starting from the statements nonterminal*. (5 points)

5. (**Bonus**) A common misuse in the languages supporting the arithmetic `if` is to employ it to build iterative constructs. Describe how it is possible to detect such a behaviour at compile time and emit a warning for the programmer.