

Formal Languages and Compilers
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Written exam¹: laboratory question
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Course: ☐ Laurea Specialistica ☐ 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 `weighted sum` expression which is defined through a list of expressions and an array storing the weights. The list of expressions is enclosed in square brackets (i.e., `[]`) the elements of the list are separated by commas. The array is assumed to have the same size of the list. Let x be an array of size n and e_1, \dots, e_n be a list of expressions. The weighted sum expression evaluates to

$$\sum_{i=0}^{n-1} e_i \cdot x[i].$$

An example is provided in the following snippet of code.

```
int x[5];

int y,z,k;

...

// y = 2
// z = 4
// x = [1,2,3,1,1]
k = sum weighted by x [1, y+2, y*z, -1, 0];

// k = 1*1 + 4*2 + 8*3 + -1*1 + 0*1
```

Figura 1: Esempio

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**). (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)

The solution is in the attached patch.

4. Given the following Lance code snippet:

```
if (x)
    x=y<<1-z*2;
```

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

5. (**Bonus**) Describe how to modify your solution to allow the user to employ the `weighted_sum` construct whenever the array and the list have different size. If the array size is smaller than the size of the provided list then elements which are not associated with a value of the array are weighted by 1 (default value).

