Advanced Programming

Final Term Paper

Start Date: 04/07/2014
Submission deadline: 24/07/2014 (send a single PDF file to attardi@di.unipi.it)

Rules:

The paper must be produced personally by the student, signed implicitly via his mail address.

You are allowed to discuss with others the general lines of the problems, provided that each student eventually formulates his own solution. Each student is expected to understand and to be able to explain his solution.

You are allowed to consult documentation from any source, provided that references are mentioned.

It is not considered acceptable:

- **to consult or setup an online forum, to request help of consultants in producing the paper**
- to develop code or pseudo-code with others
- to use code written by others
- to let others use someone's code
- to show or to examine the work of other students.

Violation of these rules will result in the cancellation of the exam and a report to the Presidente del Consiglio di Corso di Studio.

For the programming exercises you can choose a programming language among C++, C# and Java.

The paper must:

1. be in a single PDF file, formatted readably (**font size ≥ 10 pt** with suitable margins, single column), of **no more than 10 numbered pages**, including code: for each extra page one point will be subtracted from the score.
2. include the student name
3. provide the solution and the code for each exercise separately, referring to the code of other exercises if necessary. **Do not include in an exercise code only needed for a later exercise**.
4. cite references to literature or Web pages from where information was taken.

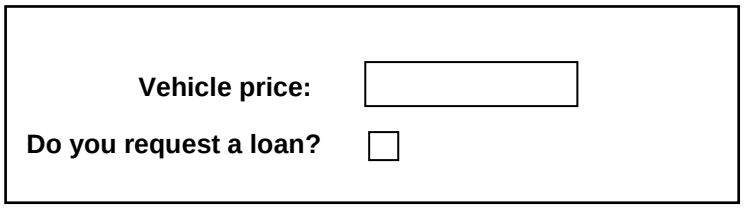
Introduction

We will develop a DSL for generating interactive forms. For example:

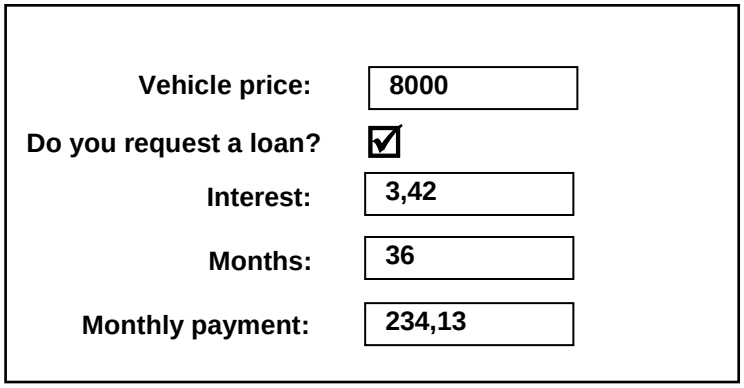
```
form CarLoan {
    price: "Vehicle price:" money,
    wantLoan: "Do you request a loan?" boolean,
    if (wantLoan) {
        interest: "Interest rate:" real,
        months: "Months" integer,
        payment: "Monthly payment:"
           money(price * interest / 1200 / (1-(1+price^-months)))
    }
}
```

This form definition should generate a GUI allowing the following interaction:

Step 1



Step 2



Expressions should incude booleans (e.g., &&, || and !), comparisons (<, > and ==) and arithmetic (+, -, *, / and ^). The required types are: boolean, string, integer, real, date and money.

Updates to computed values should occur as soon as new values are entered in the fields of the form.

Exercise 1

Design a hierarchy of classes to represent DSL forms.

Exercise 2

Write a recursive descent parser for analyzing the DSL.

Exercise 3

Write a set of widgets that implement the GUI, for example using JavaScript and jQuery.

Exercise 4

Write a compiler that generates code for a form using the widgets. Show the generated code for the example.

Exercise 5

Extend the solution to handle multiple choices, for example to select a car model, with associated price, to be shown in the price field. Show an example of its usage.

Exercise 6

Describe the issues that have to be addressed in the implementation of exceptions in a programming language, in particular how the search for a handler is performed and how the stack is traversed. How can C++ destructors get called in case of an exception in an inner frame?