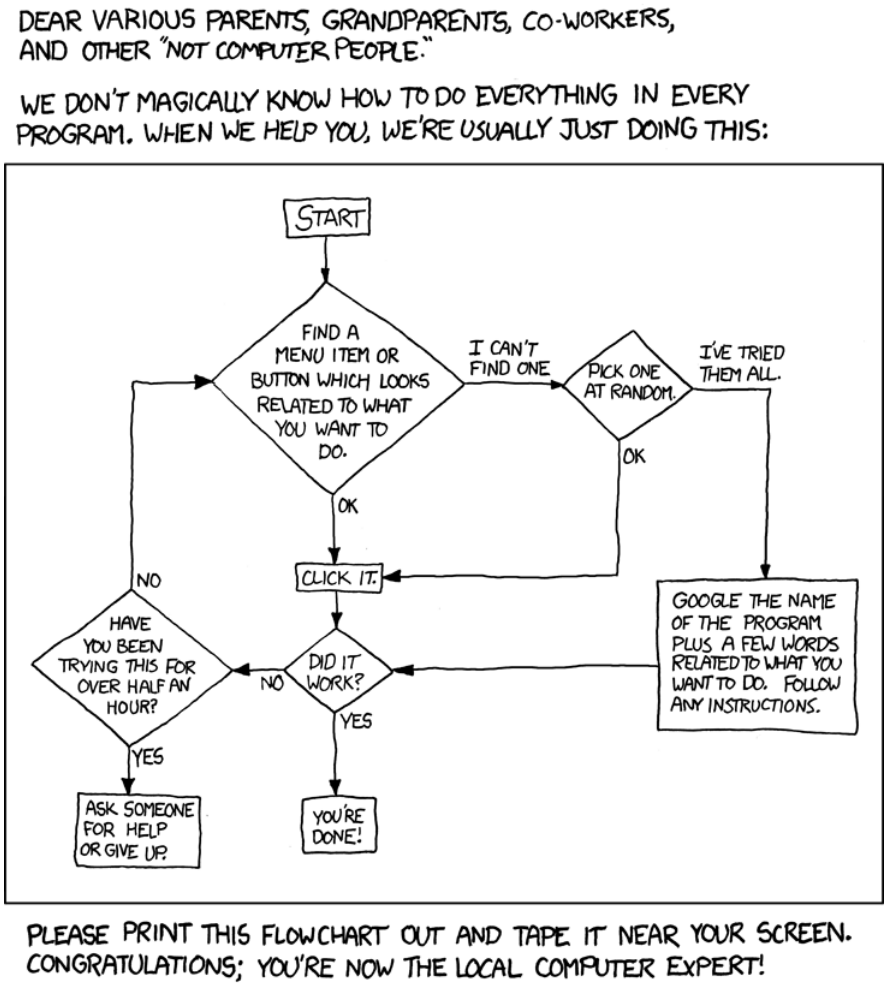
Assignment 6: Loops and conditionals

ETH Zurich

Hand-out: 22 October 2010
Due: 2 November 2010



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Goals

- Practice loops and conditional instructions.

1 Reading loops

To review the structure and semantics of loops refer to section 7.5 of Touch of class.

It happens very often that you want to iterate through all the items of a container in Traffic (e.g. through *Paris.stations*, *Paris.lines*, or *Paris.passengers*). To do this you can use the following scheme (here for *Paris.lines*, similar for the other containers in a *TRAFFIC_CITY*):

Listing 1: Looping through map item containers

```
from
  Paris.lines.start -- Move cursor to the first element;
until
  Paris.lines.after -- until cursor is beyond the last element
loop
  Paris.lines.item_for_iteration.highlight -- do something with the element at the current
      cursor position
  Paris.lines.forth -- and advance the cursor.
end
```

To do

Assume that the two code extracts in Listing 2 and Listing 3 intend to loop through a list of stations and search for the station named "Cite Universitaire" and highlight it.

1. For each version (Listings 2 and 3) decide whether it does what it is supposed to do.
2. If you think it is not OK, then correct the errors.

Hints

Operator = used on expressions of a reference type compares two references. If they are pointing to the same object the result is true, otherwise is false. In contrast, feature *is_equal* compares the content of two objects.

For this exercise you may assume the following:

- There are no compilation problems
- All the entities are not Void (i.e. they are all attached to an object)

To hand in

This is a pen-and-paper exercise: you do not need to write code in EiffelStudio. Hand in the corrected versions of Listing 2 and Listing 3.

2 Equipping Paris

In this task you will be exercising loops in the context of Traffic.

To do

1. Download http://se.ethz.ch/teaching/2010-H/eprog-0001/assignments/06/assignment_6.zip and extract it in `traffic/example`. You should now have a new directory `traffic/example/assignment_6` with assignment_6.ecf directly in it.

Listing 2: Version A

```
explore is
    -- Highlight "Cite Universitaire".
  local
    found: BOOLEAN
  do
    Paris.display
    from
      Paris.stations.start
    until
      Paris.stations.after or found
    loop
      if Paris.stations.item_for_iteration.name
          = "Cite Universitaire" then
        found := True
      else
        Paris.stations.forth
      end
      if not Paris.stations.after then
        Paris.stations.item_for_iteration.
            highlight
      end
    end
end
```

Listing 3: Version B

```
explore is
    -- Highlight "Cite Universitaire".
  do
    Paris.display
    from
      Paris.stations.start
    until
      Paris.stations.after or Paris.stations.
          item_for_iteration.name.is_equal ("
          Cite Universitaire")
    loop

    end
    if not Paris.stations.after then
      Paris.stations.item_for_iteration.highlight
    end
end
```

2. Open and compile this new project. Open class *LOOPINGS* and solve the tasks below.

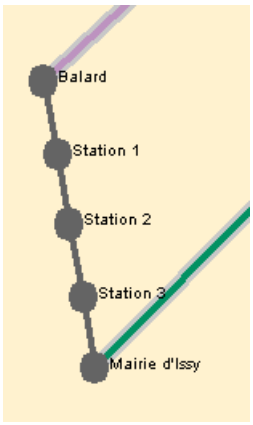
3. Implement the feature *generate_trams_for_line*. This feature has a line as an argument. If the line is of tram type then the feature should create for every second station a tram that starts moving at this station. So the first tram should start at the first station of the line, the second tram at the third station, the third tram at the fifth station, etc. Use feature *set_to_station* to set the initial position of a tram. Don't forget to add the generated trams to *Paris* and don't forget to add contracts.

4. Implement feature *equip* to generate trams for all the lines of the city. To achieve this use *generate_trams_for_line*.

5. Implement the feature *generate_connecting_bus_line*. The idea of this feature is to create a new bus line with n intermediary stops that connects the given *start_station* to the *end_station*. Create a new line starting at *start_station*, then use a loop to create n new stations and extend the line with them, and finally add the *end_station* to the line.

   The locations of the intermediary stations should be evenly distributed along the straight line between the *start_station* and the *end_station*. In the example seen in the figure below, n is 3, the start station is Balard and the end station is Mairie d'Issy. To calculate the locations of the newly created stations you need to do some vector calculations based on the locations of the start and end stations. *TRAFFIC_POINT* provides some so called **infix**-features ($+$, $-$, $*$) that will help you:

Vector addition	*a, b, c: TRAFFIC_POINT*	c := a + b
Vector subtraction	*a, b, c: TRAFFIC_POINT*	c := a - b
Scalar multiplication	*a, b: TRAFFIC_POINT* *f: DOUBLE*	b := a * f (Note: the scalar needs to be the second operator)
Scalar division	*a, b: TRAFFIC_POINT* *f: DOUBLE*	b := a / f (Note: the scalar needs to be the second operator)



Another hint is that you may want to perform some rounding on the computed locations (see feature *rounded* in class *DOUBLE*). Dont forget to add the line and the stations to *Paris* and don't forget to add contracts.

6. Test your implementation of *generate_connecting_bus_line* with some stations (e.g. *Station_balard* and *Station_mairie_d_issy*), adding code to feature *equip*.

To hand in

Hand in the code of class *LOOPINGS*.

3 Loop painting

To do

Write a program that does the following:

1. Asks the user to input a positive integer.
2. Displays, using asterisks, a checkered rectangled triangle having as hypotenuse a number of asterisks equal to the user input (see Figure 1.). Stars and white spaces should be alternating.
3. Displays, using asterisks, a diamond having as side the same number of asterisks as the user input. Here as well, stars and white spaces should be alternating.
4. Take into consideration that the user might not always input values you expect. Make sure your program does not crash, no matter what the user inputs.

To hand in

Hand in your class text.

4 Programming a boardgame: Part 2

In this task you will implement a given set of classes. They may not coincide with the ones you picked last week, but it is easier to go on altogether in this way.

As a reminder, you will find below the description of the problem. It has been slightly modified because it mentions six-sided dice. While this is a little detail, it gives you an idea of

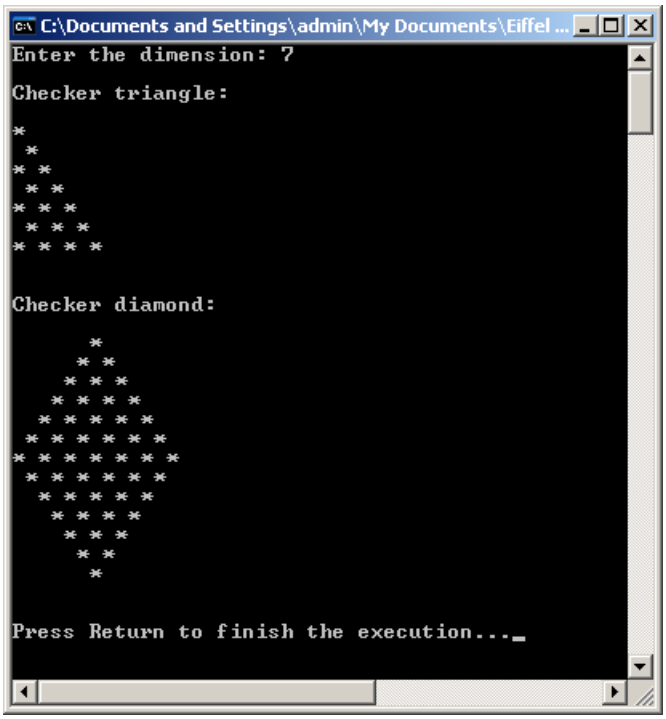


Figure 1: Example with value 7

the fact that across different iterations of the design and development process the specifications can actually change.

The board game comes with a *board*, divided into 40 *squares*, a pair of six-sided *dice*, and can accommodate 2 to 6 *players*. It works as follows:

- All players start from the first square.
- One at the time, players take a *turn*: roll the dice and advance their respective *tokens* on the board.
- A *round* consists of all players taking their turns once.
- The winner will be the player that first advances beyond the 40th square.

To do

Implement the prototype of the boardgame using the following classes:

- *GAME*: encapsulates the logic of the game (start state, the structure of a round, ending conditions).
- *DIE*: provides random numbers in the required range.
- *PLAYER*: stores the state of each player in the game and performs a turn.

You can also use class *APPLICATION* as root class of your system, which is responsible for interaction with the user.

To hand in

Submit the code of classes *GAME*, *DIE*, *PLAYER*, *APPLICATION*.

If you feel lost...

If you tried really hard but you don't have a clue on how to organize the given classes internally, you may want to download the class skeletons (with empty feature bodies) from http://se.ethz.ch/teaching/2010-H/eprog-0001/assignments/06/board_game.zip