Assignment 3: Of objects and features

ETH Zurich

Handout: Monday, 28 September 2015
Due: Wednesday, 7 October 2015

Goals

• Understand the difference between a class and an object.
• Read and write query call chains.
• Process user input.
• Add new features to a class.

1 Classes vs. objects

To do

1.1 Describe the difference between a class and an object (1–2 sentences).

1.2 Find an analogy (not an example!) that illustrates the relationship between objects and classes in real life.

To hand in

Hand in your answers.
2 Query call chains

As you already know, queries (unlike commands) always return an object. The type of this object can be determined from the signature of the query [Touch Of Class, page 220].

For example, Zurich is defined in the class ZURICH_OBJECTS as Zurich: CITY, which means that it always returns an object of type CITY. This, in turn, means that you can call features defined in class CITY on Zurich, as in Zurich.name, which returns an object of type STRING.

You can form even longer chains of query calls in the same way, as in:

```
Zurich.line (24).west_terminal.is_exchange
```

This query call chain answers the question “Is the west terminal of line 24 in Zurich an exchange station?” and returns an object of type BOOLEAN (i.e., true or false).

It is also possible to use query call chains as arguments, e.g.,

```
Zurich.station ("Central").position.distance (Zurich.station ("Polyterrasse").position)
```

This query call chain answers the question “What is the distance between the positions of stations Central and Polyterrasse in Zurich?” and returns object of type REAL_64 — a 64 bit real number.

To do

1. To answer the questions below you will need to read feature declarations, so download http://se.inf.ethz.ch/courses/2015b_fall/eprog/assignments/03/traffic.zip, unzip it, copy the dir assignment_3 into directory traffic/examples and open assignment_3.ecf from within EiffelStudio. All query call chains in this task start with the query Zurich, so open ZURICH_OBJECTS, where the query is defined.

2. For each query call chain below, determine the type of the object it returns and state informally the question it answers, following the examples given above. To understand what individual queries mean, read the header comments in their declaration.

   2.1 Zurich.line (5).kind.name

   2.2 Zurich.station ("Hardplatz").position.length

   2.3 Zurich.line (2).distance (Zurich.station ("Bellevue"), Zurich.line (2).west_terminal)

3. For each question below write a query call chain that answers the question. You can test your answers in the feature explore of class PREVIEW (following the examples that are already there).

   3.1 How bright is the color of line 13?

   3.2 How many meters to the north of the city center is the third station of line 31 located?

   3.3 What is the next station of line 31 after Loewenplatz in the direction of its west terminal?

   3.4 (Optional) How many public transportation lines go through station Paradeplatz?

   3.5 (Optional) Does line 7 connect stations Paradeplatz and Rennweg directly?
Hint

To navigate between classes and features in EiffelStudio, in addition to the mechanisms described in the previous assignment, you can use the ‘pick-and-drop’ technique. Just ‘pick’ a class (or a feature) by holding down the [SHIFT] key and right-clicking on the class (feature) name. The cursor will change shape to an oval (or a thick cross in case you picked a feature). You can then ‘drop’ it in another tools pane within EiffelStudio by right-clicking again. When this is not possible, a thin red cross appears on the cursor.

To hand in

For the queries 2.1–2.3 hand in the type of the object they return and the question they answer; for the questions 3.1–3.5 hand in the queries that answer the question.

3 In and out

In this task you will read some input data from the user and then output the processed data back to the user. You will also have to add new features to a class.

To do

1. Download http://se.inf.ethz.ch/courses/2015b_fall/eprog/assignments/03/business_card.zip and extract it into a directory of your choice.

   Open business_card.ecf in EiffelStudio. This project consists of a single class BUSINESS_CARD; open it in the editor.

   BUSINESS_CARD contains three attributes: name, job and age, which are meant to store the corresponding data about the business card owner. The class is also equipped with commands set_name, set_job and set_age that change the values of the corresponding attributes.

2. Modify the feature fill_in so that it prompts the user for his name (i.e., prints Your name: or Please enter your name:), then reads the user input and stores it in the attribute name using the command set_name.

   Like in the previous assignment, use the predefined object Io to perform input and output.

   To read input data use the commands read_line, read_integer, read_character, read_real, etc.

   To access the data read by the last read_x command, use the queries last_string, last_integer, last_character, last_real, etc., accordingly. For example, the sequence of instructions:

   ```eiffel
   Io.read_line
   set_country (Io.last_string)
   ```

   reads a line and passes it as an argument to a command set_country.

3. Modify the feature fill_in so that after asking the user for his name, it also asks for his job title and his age. Store this information in the corresponding attributes. After this step, a run of your program should look similar to this:

   Your name: John Smith
   Your job: Programmer
   Your age: 20
4. In the feature clause “Output” declare a new procedure \texttt{print\_card} [Touch Of Class, page 219]. This procedure should output a textual representation of the business card, containing all the data that it stores (name, job and age), each on a separate line.

To assemble a string out of several parts use the string concatenation operator +. For example, an expression \texttt{"Hello" + ", " + "world!"} results in a string \texttt{"Hello, world!"}. Insert \texttt{"%N"} into a string at the position where you want a new line to be printed.

Use the function \texttt{age\_info} already defined in the class \texttt{BUSINESS\_CARD} to output information about the age.

Don’t forget to format your code properly (for instance, using EiffelStudio’s pretty-printing feature, CTRL-SHIFT-P) and add a header comment.

5. Now add a call to \texttt{print\_card} at the end of the feature \texttt{fill\_in}. After this step, a run of your program should look similar to this:

\begin{verbatim}
Your name: John Smith
Your job: Programmer
Your age: 20
John Smith
Programmer
20 years old
\end{verbatim}

6. To make the output of your program look more like a business card let’s put a border around it. After this step a run of your program should look similar to this:

\begin{verbatim}
Your name: John Smith
Your job: Programmer
Your age: 20
---------------------------------------------------
| John Smith  |
| Programmer  |
| 20 years old |
---------------------------------------------------
\end{verbatim}

Modify the procedure \texttt{print\_card} so that it also prints the border. For the top and the bottom border use the function \texttt{line (n: INTEGER): STRING} already defined in \texttt{BUSINESS\_CARD}, which returns a horizontal line of length \(n\). Use the constant attribute \texttt{Width} [Touch Of Class, page 250] every time you refer to the width of the card.

To output the right border you need to print a correct number of spaces between it and the text. For this, define a new function \texttt{spaces (n: INTEGER): STRING}, which would return a string consisting of \(n\) spaces. Use the function \texttt{line} as an example.

To get the number of characters in a string use the query \texttt{count}.

7. What is the benefit of using the constant attribute \texttt{Width}?

What will happen with your program if the name entered by the user is longer than \texttt{Width}? How could you solve this problem (describe the general idea)?

8. \textit{Optional}. Surprise your assistant: add any information you like to the business card or change its style (for example, add a double border or a logo).

\textbf{To hand in}

Hand in the code of the class \texttt{BUSINESS\_CARD} and your answers to the questions in point 7.
4 MOOC: Interfaces, commands, and queries

To do

1. Access the main MOOC course web page at http://se.ethz.ch/mooc/programming.

2. Listen to the lecture “Interfaces and Information Hiding” and take the corresponding quiz.

3. Listen to the lecture “Commands and Queries, Uniform Access Principle”, and take the corresponding quiz.

Your goal is to provide all correct answers to the quizzes. You can take the quizzes as many times as you want. If you succeed, you will be awarded a badge for each fully solved quiz.