INB370 / INN370, *Software Development*, Semester 1, 2010

Practical 1 (Week 1) — Introducing Java and Eclipse

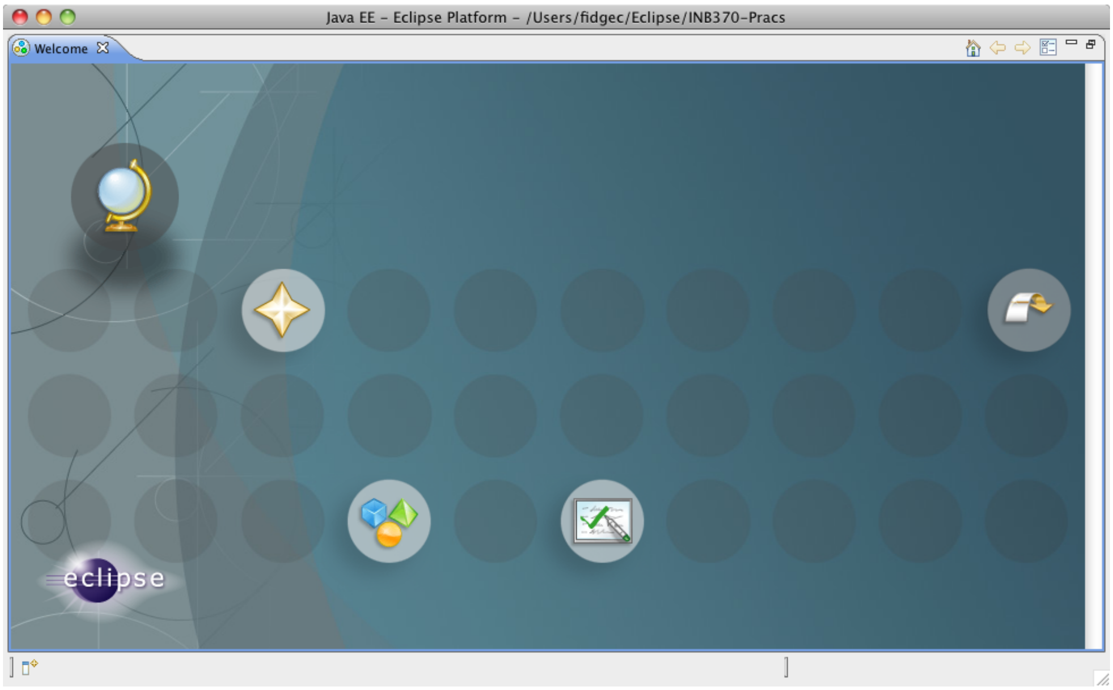
This week’s practical exercises aim to get you familiar with writing and debugging simple Java programs using the Eclipse integrated development environment.

Exercise: Getting Started

Consult the *INB370 Software Environment Handbook* for instructions on how to install Java and Eclipse on your own computer, or follow your tutor’s instructions for how to find the pre-installed version in the labs.

When you first start Eclipse you will see a splash screen. This may be followed by a request to choose your *workspace*, or a default may be used. The workspace is the folder where Eclipse will store your files. If you want to save your work for later you should choose a location from which you can retrieve the files afterwards, such as your home drive (H:) or a memory stick. To change the (current or default) workspace go to `File` > `Switch Workspace`.

When Eclipse is started for the first time you will see a Welcome screen similar to the one below. The big arrow on the right will enter an Eclipse development session in your selected workspace.


Java EE – Eclipse Platform – /Users/fidgec/Eclipse/INB370-Pracs
Welcome
eclipse

Explore the various buttons and options available. In particular, make sure you know how to:

- switch perspectives (especially `Java` and `Debug` Debug Java);
- minimise and maximise views;
- delete and recover views (via the `Window` > `Show View` pulldown menu);
- detach views from the workbench as free-floating windows and dock them again (by right-clicking the label and un/selecting `Detached`);

- create a project, package and class ; and
- create new workspaces (by ‘switching workspaces’ to `Other`).

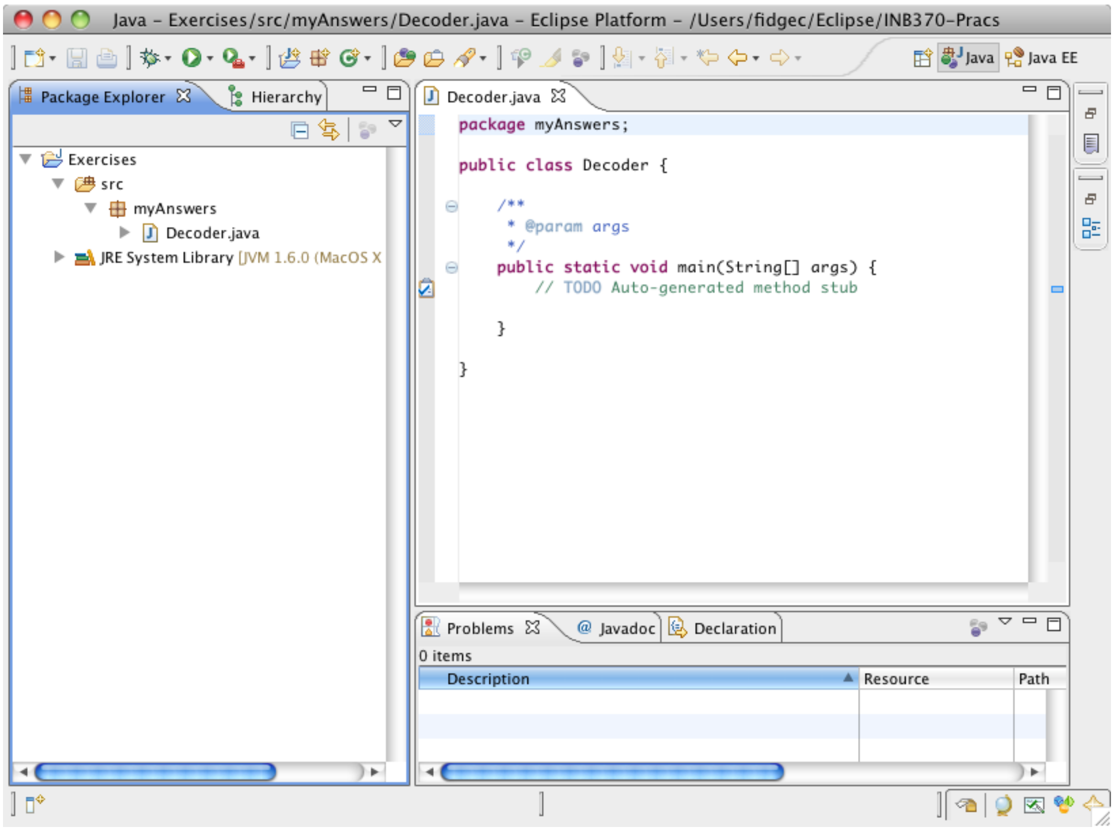
Exercise: A message decoder

As a first exercise involving iteration and console output in Java you will develop a small program to decode a secret message. In a fresh *workspace* (e.g., ‘`Prac01`’) in Eclipse’s Java perspective, create a new *project* (e.g., ‘`Exercises`’). Within that project create a new *package* (e.g., ‘`myAnswers`’). Then create a new *class* called ‘`Decoder`’, making sure that you check the box for a

```
public static void main(String[] args)
```

method stub (or you can just type this text in later).

You should now see an editing window with an empty program template something like this:


Java – Exercises/src/myAnswers/Decoder.java – Eclipse Platform – /Users/fidgec/Eclipse/INB370-Pracs
Java
Java EE
Package Explorer
Hierarchy
Exercises
src
myAnswers
Decoder.java
JRE System Library [JVM 1.6.0 (MacOS X
Decoder.java
Problems
Javadoc
Declaration

```
package myAnswers;

public class Decoder {

	/**
	 * @param args
	 */
	public static void main(String[] args) {
		// TODO Auto-generated method stub

	}

}
```

0 items

Description	Resource	Path

The challenge from this point is to create a program which will decode a “secret message”. The message is encoded as an array of numbers, declared as the following constant:

```
/* The secret message */
final int[] message =
	{82, 96, 103, 103, 27, 95, 106, 105, 96, 28};
```

It can be unlocked with a particular key, declared as follows:

```
/* The key for unlocking the message */
final int key = 5;
```

Copy these two declarations into your main program. Then, to unlock the message, you need to write Java code that will:

1. add the key to each number in the message;
2. convert each number in the message to its equivalent character representation (most easily done by type-casting the numbers to **`char`** type); and
3. print each of the resulting characters (which is most easily done using method `System.out.print()`).

Ask your tutor if you're not sure how to do any of these things.

As you edit your program, take note of how Eclipse generates error and warning messages for incomplete or incorrect code segments. In particular, try out the 'quick fix' feature by right-clicking on an error or warning icon , and select a suitable solution for your problem, if one is available.

Hint: As usual when programming, *think* before you type. This exercise can be solved *very* concisely.

Hint: This is a good opportunity to use a 'for each' loop.

Extra exercise: If time permits, develop a corresponding 'encoder' program that prints a string as a sequence of numbers. This time the key should be *subtracted* from the number corresponding to each character. You may find a helpful method or two in Java's `String` class—look it up in the *Java API Specification*. (You'll be spending a lot of time browsing this document in coming weeks!)

Exercise: Debugging a 'summation' program

This exercise will give you practice in using Eclipse's debugger. Download the Java program `Summation.java` from the INB370/INN370 Blackboard site. This program is meant to calculate the sum of the natural numbers in a given range. The range is expressed by constants for the starting and finishing numbers, inclusive. Recall, for instance that $\sum_{1 \le i \le 5} i = 15$.

Load the program into your project, either by copying it into your Eclipse workspace and alerting Eclipse to the change (via `File` > `Refresh`), or by creating a new class and copying the program text into Eclipse's Java editor. (Either way, make sure the **`package`** declaration at the beginning of the program matches the name of your package.)

(a) Run the program with a `START` value of 1 and an `END` value of 5. Is the answer what you expected? Use Eclipse's debugging perspective to examine the program's behaviour as it executes. In the `add` method double click in the grey bar just to the left of the **`for`** loop statement. This adds a *breakpoint* to the application. Now 'debug' rather than 'run' the program. You will be able to control the program's execution using the various debugging buttons . Step through the program and watch how variables `index` and `total` change. By doing this you should be able to spot and fix the coding error.

Note: If you hover the cursor over a variable when the program is stopped the variable's value is displayed.

Note: If you want to observe the behaviour of code in a ‘`main`’ method, make sure that the ‘`Stop in main`’ box is checked under `Run > Debug Configurations`.

(b) Having ‘fixed’ the program, now change the value of constant `END` to 1000. Run the program. Does the answer look correct? Go back into the debugging perspective and see if you can identify and fix this new problem. (This may require some patience!)

Exercise: A ‘decision making’ method

This exercise will give you practice at writing a subroutine (method) in Java involving a conditional (**`if`** or **`switch`**) statement.

Quadcharts are a commonly-used technique for making decisions involving two independent variables. For instance, the following quadchart suggests the response you should make when asked to complete a job, given its level of difficulty and expected duration.

	Easy job	**Hard job**
Short deadline	Discuss	Decline
Long deadline	Accept	Discuss

If the job is easy and there is plenty of time you should accept it. If the job is hard and there is very little time to complete it you should decline. If the job is easy but the deadline is short you should negotiate for an extension of time. If there is plenty of time to complete the work but the job is hard you should negotiate for more staff.

As a management aid, your task is to define a function that accepts estimates of job duration (in months) and job difficulty (on a scale of 1 to 10) and returns a string indicating which of the three possible responses you should make, `"accept"`, `"decline"` or `"discuss"`. Jobs with a duration of three months or less are considered ‘short’ and jobs with a difficulty level of seven or more are considered ‘hard’. (To simplify the solution you can hardwire these values as constants into your program, although this is not necessarily good programming practice.)

To get started download the Java file `DecisionMaker.java` from the INB370/INN370 Blackboard site. This program template contains a ‘`main`’ method which serves to test the desired `decision` method. Your task is to complete the program by writing the missing `decision` method so that the program produces the results ‘accept’, ‘decline’, ‘discuss’ and ‘discuss’ for the four proposed projects, respectively. (Later in this unit we will introduce a more systematic way of testing programs.)

Observation: This exercise is good practice at writing conditional statements. Making a three-way decision based on two variables is awkward, no matter how it’s coded!