Physics 2A: Scientific Programming

Course Organiser : Dr WJ Hossack

Synopsis

The aim of this course is to teach the basics of scientific computer programming using JAVA in the Unix environment. This course is taught "on-line" in a series of **six** 3 hour sessions using the School's Computational Physics Laboratory and one EUCS Micro-lab.

Timetable:
This course is taken in weeks 2 to 7 of Semester 1, starting on Monday 26th September, 2005.

Syllabus

1. **Introduction:** Introduction to course, basic structure of a computer, the computer being used, the UNIX operating system, components of a program, utilities for programming, books.

2. **Environment:** Logging in, the window manager, concepts of files and directories, basics UNIX commands, MOZILLA, the `emacs` editor.

3. **Minimal Java program:** "`hello world`", *Checkpoint 1*.

4. **Data Types, Variables and Operations:** data types, variables, variable names and declaration, assignment, basic arithmetic, floating point arithmetic, integer arithmetic, mixed arithmetic and type conversions.

5. **Basic input and output** basics use of local *Display* class for input and output of variables. *Checkpoint 2*.

6. **Functions (Mathematical):** basics mathematical methods from the *Math* class, additional special functions, pre-defined constants and user define constants.

7. **Conditional Statements:** `boolean` data types, the `if()` statement, logical statements, double conditionals, multiple conditional, the `System.exit()` method, additional statements. *Checkpoint 3*.

8. **Loops:** the `while` loop, `do while` loop, the `for` loop, nesting of loops, the `break` statement.

9. **Graphical Output** Use of the local SIMPLEGRAPH method. using the SGT toolkit. *Checkpoint 4*.

10. **Arrays and Strings**: one dimensional array, initialisation and constant arrays, addressing arrays, multi-dimensional arrays, `Srrings`, extending `Strings`, and useful `String` methods.

11. **Introduction to Methods:** simple static methods, arrays and methods, overload of methods, `main` as a method. *Checkpoint 5*.

12. **Introduction to Objects**: Basic introduction, a simple `Point` objet, using objects in `main` program. *optional Checkpoint 6*

13. **Basic File IO**, Use of `PrintWriter` for character file output, Reading lines from character files, Reading lines from the keyboard, Tokenizing strings and conversion to integer and doubles. (Additional material).

This course contributes **10%** towards the total mark for the Physics 2A course.

Resources

The three most useful book are:

1. JAVA GENTLY FOR SCIENTISTS AND ENGINEERS Judith & Nigel Bishop, Addison-Wesley.
   Good simple book with physicist in mind. Uses its own classes. ≈£37.00.

2. Small Java: How-to-program by Deitle and Deilte. Deitel & Associates Inc Pub.
   short(er) version of the full book, see below, with little on graphics or user interfaces, but sill 600 pages. Starts as the very beginning and explains every step in detail. ≈£43.00.

3. Java: How-to-program by Deitle and Deilte. Deitel & Associates Inc Pub.
   Very very long detailed book (1,500 pages). It starts at the very beginning and explains every step in detail, including graphics and user interface. ≈£54.50, but available second hand from about £30.00.

This course is available on-line at:

`http://www.ph.ed.ac.uk/~wjh/teaching/Scientific-Programming/`