

MSc in Bioinformatics for Health Sciences

PER. Introduction to PERL

Syllabus Information

Academic Course: 2018/19

Academic Center: 804 - Official Postgraduate Programme in Biomedicine

Study: 8045 – Bioinformatics for Health Sciences - MSc

Subject: 31033 – PER. Introduction to PERL

Credits: 5.0

Course: 1st

Teaching languages: English

Teachers: Josep Francesc Abril Ferrando

Teaching Period: 1st term

Presentation

This course will introduce the basic elements of programming, using PERL as a vehicular language. PERL is a programming language commonly used in bioinformatics applications and, in general, for text processing, filtering, etc. Programming capabilities will be reinforced during this course.

Associated skills

General competences:

Knowledge of programming language tools and concepts needed to create a program.

To acquire basic abilities to outline and design specifications and algorithmic approaches to solve specific questions.

To implement those solutions into software tools in the form of Perl scripts and libraries.

Specific competences:

Understanding the logic of interpreted and compiled programming languages, using Perl as vehicular language.

Acquiring good programming skills on Perl but also practicing Linux programming tools (editors, shell, version control, ...).

Understanding control execution flow with conditionals and loops.

Knowledge of Perl specific syntax to build data structures using variables and references.

Programming modularity and code reuse, understanding functions and modules, as well as an overview of object oriented programming in Perl.

Pinpointing useful Perl modules and searching for specific modules from CPAN repository.

Advanced Perl programming skills, focus on Bioinformatics libraries.

Prerequisites

Classes will be at an introductory level. However, students are expected to have basic knowledge of Linux and UNIX commands, editors, window manager systems and so on. Some confidence with command-line interfaces will be good. Ideally the students would also have GNU/Linux installed on their computers. However, those basic Unix capabilities can be acquired from the "Introduction to Algorithmics" [ALG] optional subject of this Master Course.

Contents

Contents section 1: Perl Basics

- 1.1. Introduction to Perl.
- 1.2. Variables and Control Structures.

Contents section 2: Programming with Perl

- 2.1. Scalar Variables and Operators.
- 2.2. Arrays: Vectors and Matrices.
- 2.3. Hashes: Working with Dictionaries.
- 2.4. Filehandles: Accessing to Data Streams.
- 2.5. Reusing Code: Functions and Modules.

Contents section 3: Mastering Perl

- 3.1. Regular Expressions: Pattern Matching and Substitution.
- 3.2. Perl Objects.
- 3.3. Advanced Perl Programming.

Teaching methods

Approach and general organization of the subject:

The course will be focused on getting the students able to follow more advanced programming courses and to develop their own software tools in Perl.

1. The fundamental programming concepts will be presented and reviewed, adapted to the specific syntax of Perl.
2. Practical hands-on experience will be as important as theoretical knowledge, so students will be introduced during class to problems that will be solved in the computer lab, with or without the help of the teacher.
3. Proactive participation and discussion will be encouraged during lab sessions.

Concepts	Procedures	Goal
Perl introduction and basic syntax	Statements, built-in functions, operators, control flow, types of variables.	Basic understanding of building a Perl script or command-line.
Perl variables and data structures. References. Input/output control	Scalars, arrays, hashes, references, filehandles.	Understand how to store and manage data with Perl.
Code reuse: functions, modules and objects.	Closures, user-defined functions, modules and basic OOP.	Learning to modularize and reuse code throughout our software.
Regular expressions.	Pattern syntax, pattern matching and substitution	Finding patterns and processing input records with regular expressions.

Training activities:

Students are expected to follow the data analysis steps described in each “hands-on” lecture, playing with the presented Perl code by themselves and trying to complete missing parts of the scripts. At the end of several “hands-on” session there will be one or more exercises proposed to the student to help him/her consolidating the concepts illustrated during the session. Students will submit those proposed exercises for the assessment of their programming skills progress. Students will have to develop a programming project, from those proposed at mid-term or defined “ad hoc” for the student, which will be delivered for final evaluation of the subject.

Evaluation

Assessment system:

Continued self-evaluation: Being this a course with a substantial amount of practical work done in the computer lab, students can be assessed during hands-on exercises, where they can show their interest and ability to follow the explanations and solving the challenges in-class. A small amount of course time will be dedicated to quick assessment of students’ progress, by reviewing practices and exercises proposed at the end of several of the practices.

Coursework: Students will be asked to submit those exercises, which will be assigned from week 1 to week when end-term projects will be proposed. This will motivate them to spend time revising the course materials before engaging in the end-term programming project.

Exams: There will be a final programming project for which the students must provide the program and a report documenting how they implemented the solution. There will be a week in the mid-term where the students will be able to choose a pre-defined project or a customized one.

Grading system:

Programming exercises (30%).

Final programming project (70%).

A minimum final performance of 50% is required to pass the subject.

Bibliography and Information Resources

Most of the references will be listed at the subject website, here we list a selection of useful reference books describing related topics:

- AL Johnson
"Elements of Programming with Perl"
1999, Manning Publications.
- K Bradnam & I Korf
"Unix and Perl to the Rescue!"
2012, Cambridge University Press.
- L Wall, T Christiansen & J Orwant
"Programming Perl"
3rd Ed', 2003, O'Reilly Media Inc.
- C Gibas, P Jambeck
"Developing Bioinformatics Computer Skills"
2001, O'Reilly Media Inc.
- J Tisdall
"Beginning Perl for Bioinformatics"
2001, O'Reilly Media Inc.
- J Tisdall
"Mastering Perl for Bioinformatics"
2003, O'Reilly Media Inc.
- RA Dwyer
"Genomic Perl"
2003, Cambridge University Press.
- T Christiansen & N Torkington
"Perl Cookbook"
2nd Ed, 2003, O'Reilly Media Inc.
- S Cozens
"Advanced Perl Programming"
2nd Ed, 2005, O'Reilly Media, Inc.
- J Orwant, J Hietaniemi & J Macdonald
"Mastering Algorithms with Perl"
1st Ed, 1999, O'Reilly Media Inc.
- A Oram & G Wilson
"Beautiful Code: Leading Programmers Explain How They Think"
2007, O'Reilly Media Inc.