NT908-10 Programming for Biomedical Data Analysis

22/23

Department
Warwick Medical School
Level
Taught Postgraduate Level
Module leader
Sascha Ott
Credit value
10
Module duration
10 weeks
Assessment
100% coursework
Study location
University of Warwick main campus, Coventry

Description

Introductory description

Computer programming is increasingly essential to the study of all aspects of biology. It is now required for accessing and managing data or performing statistical analyses. This module intends to provide advanced programming skills for students to solve biomedical problems.
The module teaching format will take an active learning, student-centered approach. Classes will consist of introductions to programming techniques and associated biological problems, followed by hands-on exercises.

In summary, this module prepares students for data-intensive research in the biomedical area by teaching data analysis methodology, decision making and computer programming to enable students to become less constrained by limitations of pre-existing computational skills.

Module aims

The module aims to:

1. Equip students with computer programming tools and knowledge (e.g.; programming in R) for analysis of systems essentially related to biomedical problems.
2. Equip students with analytical and creative skills by developing own code to tackle

experimental data.
3. To enable students to develop their problem-solving skills, individually and in groups, in particular areas of biomedical research.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Computer programming is done as learning-by-doing. Short lectures are followed by exercises that students attempt by themselves while receiving help from teaching assistants where needed.

1. Students will first learn to formulate one-line statements: function calls, named and unnamed parameters, mathematical terms, assignments, variables, plotting.
2. Students will be introduced to control structures (if-statements, loops). Training focuses one single-loop programs at first.
3. Once students have mastered single-loop programs, the complexity of programs is gradually increased to double-loop programs and multi-loop programs.
4. Elements of good programming style are introduced. During the term, four mock exams of increasing length and difficulty are taken and students receive detailed feedback on each mock exam. The mock exams are purely for training and do not form part of the assessment.

Learning outcomes

By the end of the module, students should be able to:

- Understand fundamental programming skills and data analysis
- Develop computer programs to analyse complex biological data
- Critically appraise the quality of large data sets

Indicative reading list

"A First Course in Statistical Programming with R", Braun, Murdoch
http://www.r-tutor.com/r-introduction

View reading list on Talis Aspire

Interdisciplinary

Computer programming is a universal skill to powerfully analyse large data sets of all kinds, and this can be applied to many areas of research such as biology, medicine, chemistry, physics, maths and/or engineering but also social sciences, health sciences or epidemiology. This module's aim is to teach the fundamentals of programming in an interdisciplinary context.

Subject specific skills

1. Key skills:
   Ability to creatively go beyond the use of existing tools by writing code.

Critical appraisal of appropriate approaches for a given problem.

2. Professional skills:
   Use of advanced computational tools to analyse complex biological data.
   Develop own computer programs.

Transferable skills

At the end of this module, students will be able to:

1. Demonstrate interdisciplinary knowledge
2. Critically appraise metholodogy
3. Use tools and technology
4. Demonstrate creativity and independent thinking as well as adaptability skills
5. Demonstrate time-management skills

Study

Study time

Type	Required
Lectures	10 sessions of 3 hours (30%)
Tutorials	8 sessions of 2 hours (16%)
Private study	54 hours (54%)
Total	100 hours

Private study description

Self-directed studies: 54 hours that include preparation for next session (e.g.; formative problem-solving exercises)
Students will be advised to dedicate 40% of their time towards the preparation of the sessions and 60% towards the preparation (revision) of the assessed exam.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A

	Weighting	Study time
Programming Exam	100%	

Length: 1 X 2 hours written exam based on problem-solving.
To demonstrate the student's ability to analyse a problem and develop the appropriate coding methods to solve it.
There will be only one assessment method (final exam), as programming skills acquisition is progressive throughout the module and coding requires all skills to be learnt before being implemented.
However, there will be formative assessments throughout the module. 4 mock exams (non-assessed) on particular aspects of the module content will be organized at different milestones of the module, to ensure and evaluate learning progress.
Module Pass Mark:
A module pass mark will be awarded if an average mark of 50% or higher is achieved.
Re-assessment:
The student will have to re-sit the final exam if the student does not achieve the pass mark in the first sit.
The mark of the re-assessed work will be capped at 50%.

Feedback on assessment

The final exam will be first marked by the Module Lead. The Course Director will moderate marks and individualized feedback in line with WMS assessment criteria (note that due to the nature of coding, plagiarism will not be checked). Feedback will be available to students on request throughout the module, particularly after mock exams. Any student failing the assessment will be offered an appointment with the module lead for face-to-face feedback.

Availability

Courses

This module is Option list A for:

- Year 4 of UMDA-CF10 Undergraduate Integrated Natural Sciences (MSci)