UNIVERSITY OF WALES, ABERYSTWYTH

Department of Computer Science

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Modules for Life Sciences Level 2

1995-96

Contents

Computer Science Modules For Life Sciences

Introduction

Outlined in this brochure are the Level 2 modules in Computer Science intended for students studying in the Life Sciences.

These modules are:

- **CS20010** 'Basic Computer Equipment'
- **CS20210** 'Computer Programming for Life Sciences'
- **CS20510** 'Computing for Life Sciences'

CS20210 will typically be taken by students in their third year.

CS20010 is not available to those students with significant previous experience of computing. It is designed for beginners. **CS20510** expects previous experience which might have been obtained in **CS20010** or through other formal or informal means.

The modules make use of the College's IBM PC clones. As appropriate, these are used as workstations running applications packages, or as terminals to mainframes.

General Advice to Students

The practical work is very important; one cannot become proficient at using computers without practice. What is more, it is time consuming and cannot be done in a hurry, so it is most important for you to keep abreast of practical assignments as they are set.

It is expected that students will spend some of their own time, over and above that spent in the practical sessions, working on the assignments associated with these modules. The extent of this varies between the modules.

Most practical assignments will have more than one component. Often these are, to some extent, independent. You should beware of concentrating on one component to the exclusion of others since marks will be available for each component and a good overall mark cannot be achieved on the basis of only one.

The following recommendations should be carefully noted.

- Spread the work load for practical assignments evenly throughout the time allotted. Leaving work to accumulate near a deadline usually means that there are insufficient computing resources available to complete the work on time.
- Come to the computer prepared with detailed plans of action.
- Use the published lists of available terminal rooms and the times at which they are available to plan your work schedule carefully.

Although zeal in one's studies is generally accounted a very good thing, there are dangers. Some students can become hooked on computing to the detriment of their studies in other subjects. If you find that you have a talent for computing and that you enjoy it, beware of spending a disproportionate amount of your time doing it. If you can complete the practical assignments well within the set time, spend the rest of the time working on your other subjects.

Additional Information

All students following modules in the Department should receive a copy of a departmental 'Student Handbook'.
1.2 This should be read carefully and acted on.

Descriptions of Modules

The rest of this brochure provides details for each module.

CS20010 Basic Computer Equipment

General Description

This is a basic introduction to the use of computers for any student in the faculty of science who has no significant previous experience of such equipment. It is particularly suitable for students in the School of Life Sciences. Students who complete the course successfully will be able to use personal computers and the campus mainframe for general purpose applications and have an appreciation of the range and capabilities of computer equipment. Intermediate level wordprocessing will be covered.

Commitment	Number of lectures	12
	Number of workshops	0
	Number of practicals	20 x 2 hours
Co-ordinator	Mr. Nigel Hardy	
Other staff	Not yet known	
Pre-requisites	None	
Co-requisites	None	
Incompatibilities	Not available to students who have significant experience of using computers. **CS10010**	
Assessment	Assessed coursework - 100%	
Timing	This module is offered only in Semester 1	

Aims

This module will:

- introduce students to potential benefits of information technology in their academic lives;
- introduce them to the campus computing facilities and their use;
- allow them to develop skills and confidence in general computer usage;
- begin the development of an understanding of when and how computers can and cannot assist effectively.

Objectives

On successfull completion of this module, students will have an understanding of:

- the hardware components found in typical computer systems and broadly what their functions are;
- the typical cost and performance characteristics of a range of technologies and products;
- the major benefits of using computer technology to assist with document product;
- the basic functionality of spreadsheets and databases.

On successful completion of the module students should be able to:

- use Microsoft Windows to launch applications and handle multiple applications at once;
- access a command string interpreter interface to a Computer Unit UNIX machine and perform a small range of simple tasks;
- create and maintain a personal directory structure;
- produce effective and well designed documents of significant complexity using Microsoft Word;
- create graphics (using bit-mapped and object based packages) and charts and include them in wordprocessed documents;
- create and use simple spreadsheets;

- create and use simple, single table databases at a ‘cardfile’ level;
- use electronic mail;
- use on-line facilities such as the CD-ROMS and Internet services;
- evaluate and select appropriate equipment for a range of non-technical applications; this to include software and display, printing and storage devices.

Syllabus

1. INTRODUCTION — 1 lecture
   Course organisation. Aims and Objectives.
2. SURVEY OF SOFTWARE — 2 lectures
   Operatings systems; user interfaces, utilities; applications programs; user written programs.
3. SURVEY OF HARDWARE — 2 lectures
   Processors; primary store; secondary store; displays; printers; pointing devices; digitisers.
4. NETWORKING AND COMMUNICATIONS — 1 lecture
   Range of technology and bandwidth; campus network; Janet, Super Janet and the Internet.
5. GRAPHICS APPLICATIONS — 1 lecture
   "Draw", "Paint", charting and image packages; the bit-mapped and object based storage techniques and their implications.
6. DATABASES — 2 lectures
   Tables, records and fields; validation; the need for and complexities of multiple table databases.
7. SPREADSHEETS — 1 lecture
   Practical examples of more powerfull facilities; macros; available functions.
8. DATA PROTECTION LEGISLATION — 1 lecture
   The Data Protect Act and its implications.
9. ADVANCED APPLICATIONS — 1 lecture
   The concept of artificial intelligence; its historical development; the application of expert systems.
10. MICROSOFT WINDOWS — 1 practical
    General use and manipulaton of Windows; launching applications.
11. E-MAIL; FILES I. — 1 practical
    Creation, manipulation and maintenance of a directory structure.
12. WORD PROCESSOR — 4 practicals
    General use of Microsoft Word.
13. FILES II — 1 practical
    Revision of the use of directory structures following practical experience of them.
14. GRAPHICS — 2 practicals
    Bit mapped and object orientated graphics applications (Mircrosoft Paint and Draw).
15. SPREADSHEETS — 2 practicals
    A brief introduction to the potential of spreadsheets (using Microsoft Excel).
16. MAINFRAME USE — 3 practicals
    Logging on to campus mainfarmes; simple use of a UNIX shell; the UNIX filestore; I/O redirection; simple editing.
17. DATABASES — 2 practicals
    Experience of setting up a simple database; search and report generation.

18. ASSIGNMENTS 4 practicals
Time is allocated for the work on assignments.

Booklist

The following should be consulted for different approaches or for further information:

Nancy B. Stern and Robert A. Stern. *Computing in the Information Age*. John Wiley and Sons Inc, New York, 1993. 4.1

CS20210 Computer Programming for Life Sciences

General Description

This module introduces the principles of procedural computer programming. It is intended for students doing degrees in life sciences but may be taken by others. On successful completion of the course students will be able to design and implement simple programs in a particular high level language. They will also have an appreciation of the software development process which would enable them to evaluate new software as a potential tool in their work and to liaise meaningfully with software developers. Other programming paradigms will be briefly introduced.

Commitment	Number of lectures	24
	Number of workshops	0
	Number of practicals	0 (Students are expected to spend unscheduled time on the significant practical aspects of this course)
Co-ordinator	Mr. Nigel Hardy	
Other staff	Not yet known	
Pre-requisites	**CS20510** or equivalent experience	
Co-requisites	None	
Incompatibilities	CS10210, CS10310, **CS11010**, **CS21020**	
Assessment	Assessed coursework - 50% Written exam - 50%	
Timing	This module is offered only in Semester 1	

Aims

Through an introduction to the software life cycle; a study of the principles of procedural programming; examination of the details of one high level language; experience of building small programs; consideration of relevant case studies and examination of procedural languages in a wider context this course will:

- give students an insight into the process of building software;
- allow them to assess the efficacy of building new software as a potential solution to application problems in their own discipline
- allow them to work more effectively with and to modify and customise existing software;
- give them the skills to build small items of software.

Objectives

On successful completion of this course, students will have an understanding of:

- the size and importance of the stages in simple software life cycles;
- the elements of procedural programming languages;
- the resources necessary to build new software.

They will be able to:

- use a development environment available at Aberystwyth;
- develop small programs of reasonably high quality.

Syllabus

1. INTRODUCTION — 1 lecture
   A practical overview of machines and instruction sets; high level languages; interpretation and compilation; data and algorithms.
2. NOTATION AND AN INTRODUCTORY CASE STUDY — 1 lecture
   Syntax and semantics; lexical conventions; reserved words and identifiers. A small code example will be considered from these aspects.
3. THE DEVELOPMENT ENVIRONMENT — 1 lecture
   Practical details of using the chosen environment.
4. SIMPLE DATA TYPES AND VARIABLE DECLARATION — 1 lecture
   The concept of type; constants; the concept of a variable; the need for a value of data declarations.
5. BASIC CONTROL STRUCTURES — 5 lectures
   The need for control constructs; basic branching and looping; the need for and form of boolean expressions; control construct syntax. Subprograms as control constructs; procedures and functions.
6. A CASE STUDY IN CONTROL STRUCTURES — 1 lecture
   A structured program to demonstrate the benefits of control structures.
7. DATA STRUCTURES — 4 lectures
   The need for compound data structures; arrays and records. User defined types; enumerated types. Simple data structure design.
8. A FULL CASE STUDY IN CODING — 1 lecture
   A case study covering all aspects of coding covered to date.
9. PROGRAM DESIGN — 2 lectures
   The need for a design phase. Simple design aids; flow diagrams; pseudocode.
10. ESTABLISHMENT OF FUNCTIONAL REQUIREMENTS — 1 lecture
    The need for a requirements establishment phase. Examples of poor definition. The difficulties of establishing requirements.
11. TESTING — 1 lecture
    The need for testing; test strategies and plans. Examples of testing schemes.
12. THE SOFTWARE LIFE CYCLE — 1 lecture
    A review of the stages met, in context. The relative importance of the stages in projects of different types.
13. A MAJOR CASE STUDY — 4 lectures
    The interactive development of a program of significant complexity. Example requirements, design and testing documents.

Booklist

Students are likely to need ready access to the following:

Walter J. Savitch. *An Introduction to the Art and Science of Programming*. Benjamin/Cummings Pub. Co, Redwood City, Calif, 3rd edition, 1991. 4.1

CS20510 Computing for Life Sciences

General Description

This module is intended primarily for students taking degrees in Life Sciences. The function, value and effective use of spreadsheets and simple databases will be covered. The availability and use of network information resources will be explored.

The benefits of simple interfacing for environmental monitoring and for the control and monitoring of experiments will be outlined and the basic technology and techniques of such interfacing will be introduced.

Commitment	Number of lectures	24
	Number of workshops	0
	Number of practicals	10 x 2 hours
Co-ordinator	Mr. Nigel Hardy	
Other staff	Not yet known	
Pre-requisites	**CS20010** or equivalent experience	
Co-requisites		
Incompatibilities	**CS10010**, **CS10510**, **CS10610**, **CS10810**, **CS21020**	
Assessment	Assessed coursework - 50% Written exam - 50%	
Timing	This module is offered only in Semester 2	

Aims

This module aims to increase general familiarity with and appreciation of the potential of computing techniques to Life Scientists. The following four particularly relevant areas or technology are considered:

- spreadsheets for general purpose use and for model building;
- databases;
- network information resources;
- interfacing techniques for sampling and experimental control.

Objectives

On successful completion of the module students will be able to:

- use most facilities of a modern spreadsheet, including charting and macro recording;
- recognise and analyse potential applications of database technology;
- perform data design for simple relational databases;
- recognise a number of potential problems in implementing such a database;
- set up tables, relationships, queries and reports using Microsoft Access;
- search for and retrieve information available on the Internet;
- recognise the potential for using microcomputer technology to monitor and sample simple sensor data during observation, trials or experiments both in the laboratory and in the field;
- recognise the potential for using computers to control experimental systems.

Syllabus

1. SPREADSHEETS — 4 lectures and 3 practicals
   Revision of basic operation; complex expressions; conditionals; lookup tables; advanced charting; macros. The exploration and guided extension of a provided Microsoft Excel spreadsheet.

2. SINGLE TABLE DATABASES — 3 lectures
   Uses; examples. Definitions - table, record, field. Queries, forms and reports.

3. USE OF MICROSOFT ACCESS — 1 lecture and 3 practicals
   Practical explanation and guidance. Creation of a simple single table database from a provided design; entry of data; searching and report generation.

4. MULTI-TABLE DATABASES — 4 lectures and 3 practicals
   The need for multiple tables. Entities, attributes, relationships, E-R modelling. Domain key normal form. Examples. Exploration and guided enhancement of a provided multi-table database.

5. FREE TEXT AND HYPERTEXT — 1 lecture
   Searching and browsing. The principles of hypertext production. Example systems in Life Sciences.

6. ON-LINE INFORMATION RESOURCES — 4 lectures and 1 practical
   CD-ROM access and use. The Internet; ftp, news, gopher and WWW operation; obtaining information; searching for information. Exploration of on-line resources as available.

7. SIMPLE COMPUTER COMMUNICATIONS — 3 lectures
   Serial and parallel communications; standards; configuration parameters; data rates; applications. Local and wide area networks; data rates; applications.

8. INTERFACING — 4 lectures
   The analog/digital distinction; converters and their characteristics; example applications.

Booklist

The following should be consulted for different approaches or for further information:

David M Kroenke. *Database Processing - Fundamentals, Design, and Implementation*. Prentice Hall International Editions, 5th. edition, 1995. ISBN 0-13-320128-7.

Nancy B. Stern and Robert A. Stern. *Computing in the Information Age*. John Wiley and Sons Inc, New York, 1993. 4.2