



M150

DATA, COMPUTING and INFORMATION

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1

Welcome

Welcome to M150 *Data, Computing and Information*. We hope that you will find the course interesting and rewarding.

Before you start to study the course units, please take some time to read through this guide and then work through Sections 1–6 of the Course Companion.

This Course Guide provides you with the information you need at the start of the course and gives you an overview of the course including its assessment.

The Course Companion provides details of things you need to do as preparation before starting your studies, as well as guidance on organising your studies. You will need to refer to it from time to time while you are studying the course.

Structure of the course

The course is divided into three blocks of text comprising 16 units of study material, and there is an assignment associated with each block (and two for Block 1). We have designed each study unit to be studied in about 10 to 15 hours over a two-week period; this includes the time taken to prepare your answers to the assignments.

The Study Calendar provides details of when you should be studying each unit and the cut-off dates (the date by which your tutor must receive your work) for each assignment.

There is an end-of-course assessment but no formal examination.

Course materials

The materials for this course consist of a number of components:

- Course Guide (this document).
- Course Companion which tells you how to study and provides practical guidance on activities such as accessing the conferencing facilities of the course. It also directs you to additional information not in the course.
- Study Calendar* which provides guidance on when you should be studying a particular component of the course or carrying out some task such as completing an assignment.

- Sixteen units of study texts, incorporating study instructions, self-assessment questions (SAQs) and solutions, and exercises and solutions. The study text is the main teaching medium used for the course. You will study each unit over approximately two weeks.
- Software: you will be provided with the software that you will need to study the course; for example, you will be provided with browsers which enable you to access websites and to carry out programming activities.
- M150 website (the course website). This is an integral part of the course, and includes some course materials not available elsewhere.
- Glossary. This provides a description of all the technical terms used in the course.
- Index*. This provides cross-references to all the topics in the course.
- TMAs* (tutor-marked assignments). These are pieces of work that you will have to complete as part of the course assessment. Block 1 has two TMAs and Blocks 2 and 3 each have one TMA. Your tutor will mark these assignments and return them to you with some feedback to guide your study. The assignments are used as a medium for teaching, together with tutorials and day-schools; however, the TMAs provide individual teaching points.
- CMEs* (computer-marked exercises). The TMAs direct you to the computer-marked exercises. Each CME consists of a number of multiple-choice questions. Although the CMEs do not count towards your final score on the course, you are strongly recommended to attempt all of them, as they will provide you with feedback on how well you have understood the key concepts of the course. They also provide practice for the types of question you will meet in the first part of the ECA.
- ECA* (end-of-course assessment). The ECA comprises two parts: the first part is a computer-marked assignment (CMA) which consists of a series of multiple-choice questions, similar to those in the CMEs. The second part offers you a choice of a programming exercise or writing a short report on a specified topic. You will have about three weeks to complete the ECA. The feedback that you receive should help you with your choice of further study.
- Course News*. We try very hard to ensure that the materials we produce are free of errors. In spite of the efforts of the course team, editors and readers, with such a large volume of teaching text and practical activities a few errors are bound to creep in unnoticed. Some are spelling or typographical errors – a nuisance to you, but they do not affect the teaching. Just occasionally it may turn out that something we thought we had explained adequately needs amplification. Course News is the means of fixing such problems. Occasionally the course team may want to communicate directly with all students. Course News is the place to look for information from the course team. You should check the website for news items at least once a week.

*These starred items will be available from the course website only. Other items will be provided as hard copy (print) and/or on CD-ROM.

Note We do not recommend that that you print copies of the course units provided on the CD-ROM. They have been provided in this format as a searchable resource and for use with a screen reader.

2 Before you start

We do not assume that you will have any special formal knowledge, but there are some skills and some knowledge which you will need to have before attempting this course, if you are to study it successfully. If you have those, or are *very* confident that you can acquire them quickly, then this is the course for you. If not, there are other courses that may help you prepare for study at this level, including the Open University's Openings courses. Please read what follows carefully to ensure that you are properly prepared for study. Remember that this course will take considerable time and effort on your part – there is no point in your spending that time if another course or further preparation would be more suitable for you.

2.1 Prerequisite knowledge

You should be comfortable with using your computer for such tasks as accessing the internet, word processing, and installing software from CD-ROM onto your computer.

If you are not sure whether you have the necessary skills, you should consider taking our course U130: *Get Connected* prior to M150. Your Regional Centre may be able to help with advice about which course will better meet your needs.

Look also at the appendix to this guide which contains a short description of the first week's work, an extract of the material for that week, related self-assessment questions and a sample TMA question.

2.2 Skills

Reading skills

Obviously, you need to be able to read the course materials. We do not expect you to know every word we write, but you should be familiar with using a dictionary to look up any unfamiliar words to find their meaning. The dictionary can be a printed one or an online one available on the web or a CD-ROM. The course glossary is useful for technical terms.

Writing skills

We expect that you have the ability to write reasonably grammatical sentences and combine these into paragraphs. We hope to teach you additional useful skills for writing, such as how to organise your writing to make it clear, and how to modify your writing style to address different requirements. (For example, writing instructions for users is quite different from writing a brief article for a newspaper.)

Skills involving arithmetic

Many people are terrified of maths, and many believe that computing is all about maths or that you have to be good at maths to do computing. *You do not need very much maths to study this course successfully.* Simple arithmetic is adequate. You should be able (with a calculator if necessary) to:

- add, subtract, multiply and divide numbers;
- understand simple fractions both in the form of one number over the other (e.g. $\frac{1}{2}$) and as a decimal fraction (such as 0.5);
- understand powers such as 2^2 (2×2) and 2^3 ($2 \times 2 \times 2$).

When it is necessary to introduce any maths we will provide you with a short 'refresher' section.

Computing skills

You should be comfortable with using your computer for such tasks as accessing the internet and word processing. This means that you need to be able to:

- put data into the computer using a keyboard or some other way such as voice input;
- move the cursor around (using a mouse or other similar input device);
- select items (such as a paragraph in a word-processor application or a file in Windows);
- use delete, copy and save (file) functions;
- install software from a CD-ROM by following printed directions or directions displayed on the screen; and
- print a file.

It would be helpful to you, but is not strictly necessary, if you knew how to send an email and how to open and read email sent to you.

The best way of being sure you have the necessary prerequisite skills, if you have not done so already, is to look at the M150 quiz, which you can find on the M150 visitor's site at:

www.open.ac.uk/computing/M150

and click on the link to the quiz.



2.3 Basic computing knowledge

Much of this course is intended to give you basic knowledge about computing. However, it would be helpful if you knew certain things before studying the course.

There are different **computer applications**, sometimes referred to as **applications packages**. Each package has a specific function:

- a *browser* is used to access information on the World Wide Web;
- a *word processor* is used for editing, formatting and producing text;
- a *drawing* package is used for drawing diagrams; and
- a *spreadsheet* package is useful for storing and manipulating numerical data such as financial information in a form similar to that used by bookkeepers.

It is helpful to understand that certain functions which all applications need at some time, such as managing disk space, are done by the Windows operating system and not by any particular application.

2.4 Computing facilities

It is essential that you have the necessary computing equipment and specified software installed before you start the course. In particular ensure you have:

- access to a computer that meets the minimum specification for the course (see below);
- obtained access to the internet by subscribing to an internet service provider (ISP) or an ADSL service;
- installed Netscape Navigator and Internet Explorer browsers (supplied as part of your course materials);
- word-processor software for completing your assignments that produces output that can be read by Word 97.

You can find the current computer specification via the main OU web site <http://www.open.ac.uk/>. From the 'Select an OU web site' drop-down menu select 'Personal Computing Advice' (you will need to scroll down to find it). Then click on the 'go' button.

2.5 OU network services

In order to study M150 you will need to have access to the course website, the OU's FirstClass conferencing facility and the electronic TMA system. You will be able to access all of these services via your own Personal Menu page.



Open University home page

When you see this icon, you will find the link to the site on the course CD.



You can access your Personal Menu at:

<http://www.open.ac.uk/students/>

and click on the **SIGN IN** button.

You will need to refer to your registration letter for your OU username (OUCU) and password. If you have mislaid your letter you will find details of who to contact for help by clicking the proceed button below 'Forgotten your password?'

3 What the course is about

3.1 Course themes

Ubiquity and universality Whether or not we like it, the digital computer has become an integral part of life in the modern world, at work or at play, for individuals and organisations. It has infiltrated almost every aspect of our lives, and is used to carry out tasks unimaginable only a few decades ago. Its versatility and flexibility as a tool mean that its application is only limited by our ability as human beings to utilise its power. It has in many cases become so integrated into the fabric of our everyday environment that it has become almost *invisible*, and yet, at the same time, we are accepting an increasing *dependence* on its correct functioning for the maintenance of our existence as individuals and as society. All successful technologies offer advantages over the technologies that preceded them, but at the same time they impose their own constraints on what can be done and how it can be done.

Change and transience Possibly the most striking feature of what is nowadays referred to collectively as information and communication technology (ICT) has been the increasingly rapid rate of change in the technology itself. This will also be true for the foreseeable future. One technological invention or development after another adds to our capacity for acquiring, storing, transforming, transmitting and representing data. If anything, the technology has developed faster than our ability to make effective use of it. In addition, the sheer volume of data and information that has been made available to us via this technology is also increasingly difficult for us to comprehend. We use the word *comprehend* because it means more than 'understand' as it has a root meaning related to encompassing, or getting 'around' it. The rate of change has been so great that there is an associated effect that both the technology and the information which it generates is increasingly short lived and we are continually having to discard existing systems and to learn afresh.

Demythologising and demystifying Because modern computers and computing applications are so powerful, it is possible for people to think that they are beyond the understanding of the person in the street. However, the complexity of the finished products should not be allowed to obscure the fact that, underlying everything about computing, there are some very simple basic ideas. The process of **digitisation** provides us with a way of reducing data into a form which the computer can understand. Everything in this form can then be stored electronically and manipulated by simple rules, before being returned to us in a form that we can recognise. Even programs written in programming languages ultimately reduce to nothing more than the application of three fundamental operations combined in some appropriate sequence as an **algorithm** representing the solution to a given problem.

Complexity and cognitive overload The perceived complexity arises because we build more and more complicated combinations of the basic elements, layer by layer, in order to solve large-scale problems effectively. This applies equally to the underlying hardware (the circuitry on which our manipulations are carried out on the data that it accesses) and to the software (the programs that manipulate the data). The multiplicative effect of the potential interactions between all the elements in all the layers is more than we can hold in our minds at any one time. We need ways of simplifying the interface between us and the technology. Equally we need ways of structuring, categorising and filtering the vast amount of information presented to us so that we can successfully navigate to our intended goals.

Abstraction and modelling It is rarely necessary for us to understand every single aspect and every detail of a complex situation in order to be able to act appropriately. What is important is to have ways of determining what we need to know and what can be ignored while still being effective and efficient in any given context. This process of abstraction is important for two reasons. First, it is important when we attempt to represent a problem in a form that we can implement on a computer; second, it is important when we attempt to represent the solution in a form that can be understood by a user. Whether we are attempting to describe real-world situations or complex computer-related systems, it is important that we choose models and representations at the right level and right degree of abstraction. In pursuit of this goal we need to be able to identify **patterns** of repeated structure or behaviour in the systems that we need to describe, the problems that we need to solve, the data that we want to process and the processes that we want to carry out. Any successfully captured pattern can be encapsulated, its inner details hidden from view, and its functionality described for subsequent reuse, so that we are not forever re-inventing the wheel.

Communication and standards Information needs to be communicated in some way through **interactions** that occur between individual and individual, between individual and computer, or between computer and computer. In the case of individuals it is useful if we have a shared vocabulary and a shared meaning. Whenever computers are involved – without the extra cultural and contextual clues present in interpersonal, face-to-face communication – it is essential that there is some well-defined language for ensuring consistency in communicating data and instructions. With current computer-based systems operating and cooperating on a global scale there has been a need for the development of international

standards for everything concerned with representing and storing data and sending messages and defining programming languages.

Access and privacy Much of the data that we choose to store and to transmit across networks may well be of a sensitive nature. We cannot simply leave it in a state where anyone with the technical know-how could access it and use it or change it in an inappropriate way. Protection mechanisms to ensure that only authorised individuals can see or modify the data are necessary. Many applications involve the transmission of sensitive data over networks where access is more difficult to control and so a number of systems have been developed for encoding the data in a form which only privileged individuals can decode. Naturally such systems have disadvantages, as criminally-minded people can potentially use them in order to store, acquire or transmit data illegally or immorally without fear of detection. Some balance has to be sought between the rights of the individual and the rights of society in such situations.

Ethics and limitations At the end of the day we need to recognise that computers and all the associated technology are nothing more than tools, and that as with all tools we can use them for positive or negative purposes. There are things that they currently cannot do, and will probably never be able to do. Not all aspects of human activity can be reduced to a form that can be put on a computer and there are applications that are so complex that even with all the advances in technology and after several decades of effort little real progress has been made. There are other areas of application where it is arguable whether it is appropriate for computers to be used at all, and certainly many areas where the ways in which they are used are open to question. Our ultimate responsibility as cyber-citizens, rather than just as the creators and consumers of computer-based systems, is to attempt to ensure that the technology is employed for the good of humankind, and we need to consider the principles that could ensure that this is the case.

3.2 Aims

The course aims to:

- introduce a number of concepts concerning data and information;
- help students to recognise, analyse, and differentiate the diverse ways in which data can be acquired, transformed and presented;
- examine some of the social, political and legal dimensions of data and information;
- challenge students with the dilemma of privacy versus openness;
- relate data, information and computing systems to wider personal, cultural, social, scientific, technological and organisational contexts;
- provide a foundation for future study;
- foster a sense that computers can be used creatively as well as mechanically;
- develop a sense of the joy of enquiry.

3.3 The blocks

The course is presented in three blocks.

Block 1 Learning about data

This block describes what data is and examines techniques of data acquisition and some general aspects of data storage.

Unit 1 Data and information: an introduction

Unit 2 Representation

Unit 3 Crossing the boundary: analogue universe, digital worlds

Unit 4 Integrating data

Unit 5 Storing, getting and sending your data

Block 2 The computer: processing data

Block 2 is an introduction to computer programming. It is very practical, and involves lots of exercises and activities using your computer.

After a brief look at the history of computing, this block teaches the elements of programming in JavaScript. It concludes with a look at the techniques of developing software.

Unit 6 The structure of hardware and software

Unit 7 An introduction to programming using JavaScript

Unit 8 Programs and data

Unit 9 Managing complexity through modularity

Unit 10 Software development

Block 3 From data to information

Once data has been captured, stored and processed on the computer it becomes potentially useful information. In this block we look at some of the ways in which we as humans interact with and make use of this information. The block starts with a general introduction to the way in which the computer can allow us to process data so that we can make more sense of the world around us. It then moves on to consider how the computer provides us with a whole range of non-textual ways of handling data and presenting information.

The final unit of the course attempts to pull all the themes of the course together, looking at what has been achieved by our development and use of computers. We look at what they do well, what they cannot do, and at what perhaps they should not be expected to do.

Unit 11 Computing in the wild

Unit 12 Interacting with information

Unit 13 Sensational computing

Unit 14 Hiding data: an introduction to security

Unit 15 Too many secrets?

Unit 16 Realistic expectations!

3.4 The units

This subsection provides a summary of the course units.

Unit 1 Data and information: an introduction

This unit is an introduction to the course. It looks at how data is transformed into information and relates the topics of data and information to the computer. It aims to:

- use case studies that relate the use of computers to finding, storing, processing, and displaying data and information;
- study instances of computer usage to see how computers can work alone and together with data to produce information; and
- demonstrate how to use a search engine to find information on the World Wide Web.

Unit 2 Representation

This unit investigates the conventions needed to enable people to communicate with computers, and computers to communicate with other computers.

The core idea within this unit is that of representation, for example

- the visual representation of an exclamation mark that occurs when the user makes an error;
- the aural representation of a short beep when a computer alerts the user of an important event such as an email being delivered;
- the tactile shaking of a motor racing game controller when a car drives off the circuit.

The unit explores the world of representations and shows that picking the right representation for a computer application can make a major difference to the success of the application. Conversely, a wrong choice makes an application much more difficult (or even impossible) to implement.

The unit draws on linguistics, internet technology, the history of numbers, cartography, railways and computer standards to illustrate its main points.

Unit 3 Crossing the boundary: analogue universe, digital worlds

The computer and the wider world of which it is a part are fundamentally *different* in kind. Our world is a world of *analogue* things – of colour and sound, of taste and touch. Computers, by contrast, are *digital* machines: they deal only in terms of *numbers*. Unit 3 discusses the differences between analogue and digital entities, and investigates the computer's peculiar *binary* digital world in detail.

So to capture some analogue piece of the world on a computer (e.g. to pick up and store music played by a guitarist) entails crossing a *boundary* between two very different worlds – the world of the analogue and the world of the digital. And if we want to play back the music later, the data will have to cross the boundary again. To achieve all this, a number of problems have to be solved. These problems are described and some solutions offered.

Finally, the unit looks at the range of stunning consequences that flow from one simple fact – that the digital world can be *changed* at will, and with the utmost ease. We can set up detailed copies of real-world entities, such as companies, or even whole towns, and inspect them in detail. We can establish digital models of such systems as the earth's atmosphere, or the stock market, and run them forward in time, to see what may happen in the future. We can even create completely imaginary digital worlds and then explore them as if they were real. The computer opens a window on to the present world, to past and future worlds – and to completely new worlds as well.

Unit 4 Integrating data

The previous units have dealt with data and information. This unit, in a sense, acts as a large case study illustrating many of the ideas presented in the first three units. It is about how information on the web is represented, manipulated and displayed.

An important topic that is discussed in the unit is the integration of media. The last decade has seen an increase in the combining of different media into a single application – a trend reflected in the term *multimedia*. For example, when you access the BBC website you will see not only text but also photographs, sound clips and video clips. This unit discusses the various ways that media can be combined and how it is achieved on the web.

The unit describes a language known as *HTML* (HyperText Mark-up Language) which is used to represent web pages, as well as *XML* (eXtensible Mark-up Language) which is used to describe the *substance* of the document – its informational content.

Unit 5 Storing, getting and sending your data

This unit is the last in Block 1. It has three main themes:

- data storage;
- data transmission; and
- large collections of data.

The storage of data (for example how documents like a word-processor file is stored) is considered at two levels, logical and physical. *Logical storage* is concerned with how the computer presents the user with a logical structure to help to locate documents. *Physical storage* concerns the choice of storage media, such as hard disks, CDs and DVDs.

The second theme is how data is transmitted across a network. In particular it concentrates on how the internet works, how messages are routed and how the potential failure of a computer within the network is dealt with.

The unit looks at schemes for organising large collections of data in order to retrieve data items easily.

The unit concludes with a discussion of ethical, legal and security issues to do with data.

Unit 6 The structure of hardware and software

This is the first unit of Block 2 which deals with how the computer processes data.

The unit explores how early computing machines evolved into the computers we know today. The various components that make up the 'innards' of a computer are identified, and the way in which they work together in order to process instructions and data is explored. A modern computer has to:

- read data from the outside world, e.g. data typed in from a keyboard;
- store that data in the memory of the computer;
- carry out some operations on this stored data – for example, a program that calculates the pressures inside a nuclear reactor will need to carry out operations such as addition and subtraction on numerical data stored in the memory of the computer;
- display data to the user using some output device such as a computer screen.

The unit concentrates on the second and third points above; i.e. on storing data, and carrying out operations on it.

You will also see examples of some of the early programming languages, such as machine code. Also, so that you can better understand how very basic instructions are interpreted and carried out by the computer, you will learn how to read and write very simple programs in a programming language called assembly.

Unit 7 An introduction to programming using JavaScript

This unit starts the process of teaching you some programming skills.

The programming language used in this course is known as JavaScript. It is an amalgam of a number of other programming languages and contains all the features you would expect in a modern programming language. JavaScript is associated with the web in that programs written in it can be embedded within a web page to make the pages dynamic and interactive. For example, a JavaScript program might enable a user to enter data via a web page, the program might then manipulate the data in some way and display the result to the user.

The unit describes the basic mechanisms by which a JavaScript program inputs, stores, manipulates and displays data.

When you have studied the unit you will be able to write very simple programs.

Unit 8 Programs and data

Following on from the introduction to programming in Unit 7, this unit investigates some of the ways in which the range of problems that can be solved using a computer can be extended.

It starts by looking at arrays as a programming structure for storing and processing collections of data.

As problems get larger and more complex, techniques are needed for splitting these problems into smaller tasks that can be programmed separately. The unit looks at the way in which functions allow this to be done. It also shows how such functions can be reused later when similar patterns of activity occur in different problems.

When programs are used in a modern computer environment the user expects to be able to interact with them using a graphical interface and a mouse. The unit looks briefly at how such user interfaces are created when developing programs.

Finally, given that most interaction with a computer is still through the strings of characters typed in from the keyboard, the unit looks at ways of manipulating such strings.

Unit 9 Managing complexity through modularity

Real programs consist of many thousands of lines of code. So, to facilitate the development of large complex programs, an important feature of most programming languages is a mechanism for breaking up programs into separate files of code that implement a particular aspect of the program. In this way the overall complexity of the program is simplified.

The separate files mentioned above are generally called 'modules'. This unit introduces you to the type of external code file supported by JavaScript (.js files) and focuses on:

- how .js files are used to implement function libraries (i.e. collections of related functions);
- introducing you to the idea of documentation and black box programming.

Black box programming is so called because the user cannot (or does not need to) see into the 'box' (a function, say) or consider the internal details, in order to use the box. All the user needs to consider is the black box description (i.e. its documentation). You will have an opportunity to try this out by:

- writing small programs that make use of supplied function libraries;
- augmenting a function library with your own functions.

Unit 10 Software development

This unit looks at the techniques used by software developers for managing large and complex tasks.

In order to manage such complexity, software developers often find it useful to break down the development of software into stages. These include:

- specifying the software in terms of user requirements;
- defining the overall architecture in terms of each of the chunks of the code that make up the software;
- writing the code;
- testing it to ensure that it works correctly.

One of the aims of the unit is to explain some of the techniques used at each stage of the development cycle, in order to give a flavour of what is involved and to equip you with some tools appropriate for use in the programs you develop.

As this unit is the final one in Block 2, another aim is to provide opportunities for you to review and practise what you have been learning throughout the block. Examples and exercises involving a variety of programming tasks are used to:

- illustrate various facets of software development;
- consolidate the programming skills that you have acquired in your studies so far.

Because most students work individually on programming when studying this course, the unit concentrates on the ideas and techniques from which a programmer working alone is likely to benefit. However, it is also important to gain an awareness of different modes of software development so the unit introduces some issues relevant to software development when it is carried out by teams of people.

Unit 11 Computing in the wild

This is the first unit of Block 3 which deals with the way in which humans interact with and make use of information.

The theme of this unit is that the computer is used to tame the wildness that exists in the world – for example, the wildness associated with large amounts of unstructured data. However, in taming the wildness other problems emerge.

The unit shows how human beings reach out into the world in four dimensions and how technology (specifically the computer in this course) allows them to extend their reach in each of the dimensions.

It explains how tools and techniques are used to tame the wildness in the world and describes how computers and computing are different from other tools and techniques.

Finally, it considers some of the trade-offs involved in the construction and use of computers.

Unit 12 Interacting with information

This unit investigates issues of

- interpretation and misinterpretation;
- representation and misrepresentation;
- appropriate and inappropriate representations of information.

We often think of these concepts in terms of printed and broadcast media, but they are also of central importance in the design of all computer-based systems such as the web or an air-traffic control system. For example, a visual representation of planes landing at an airport that does not adequately enable an air-traffic controller to discern the separation between planes would lead to catastrophe.

The unit aims to show how computers can be used to create meaningful visual representations of information which can be used to convey the information content of stored data. It also demonstrates the central importance of human-computer interaction and the design of user interfaces in computer-based systems. The principles which underlie the correct interaction between the human user and the computer are also described.

Unit 13 Sensational computing

This unit explores some of the issues involved in interacting with computers that are, in a sense, more 'natural' than the keyboard, mouse and computer monitor.

Specifically, it investigates:

- speech recognition and speech synthesis (two of the primary modes of human-computer interaction involving sound);
- non-speech audio;
- music.

It also investigates some of the 'hands-on' approaches to human-computer interaction that have been made possible through handwriting and gesture recognition, and through tactile and tangible computing.

A major theme of this unit is the invisible computer. The modes of interaction and technologies described in this unit bring the computer to the point where the user can employ normal modes of communication such as arm gestures and speech as input, and receive back sound and speech as output. The term 'invisible computer' thus refers to the transformation of the computer to an entity which no longer exhibits a conventional computer-like interface.

Unit 14 Hiding data: an introduction to security

This unit looks at the security breaches that can occur in the internet and the technologies used to guard against them. The main technology that is described is cryptography: the science of sending secret messages. Cryptography is centuries old but, in the networked computer age, has achieved a sophistication and maturity that its originators never dreamed of. It involves messages being transformed in such a way that if someone intercepted the message (for example, by placing eavesdropping equipment in a communications computer), it would make no sense.

There are two types of cryptography that are used in the internet:

- 1 *private key or symmetric cryptography* – in which the sender uses a set of characters known as a key to transform a message, and the receiver uses the same key to recover the message;
- 2 *public key cryptography* – which is more secure than symmetric key cryptography, but which uses two keys and requires much greater computing resource.

Unit 15 Too many secrets?

Trying to sell their novel compact disc music, Philips hit upon the slogan 'Perfect Sound – Forever'. Customers flocked to a new format that promised perfect reproduction and the end to noisy, scratched records. As a result the CD virtually replaced the LP.

Today we live in a digital world – our music, movies and games are delivered through the medium of zeros and ones. Digital information offers

unparalleled clarity and brilliance; but it also opens up a world of unlimited information piracy where copyright materials can be stolen and distributed around the world within seconds. The digital world offers total freedom – but at what cost?

This unit looks at new digital technologies and some of their problems. For example, email is now an established technology which together with cryptography enables secret messages to be sent. These messages can be sent by people who legitimately want to keep their communication secure. However, they could also be messages from terrorists alerting others about an outrage that is to occur.

Unit 16 Realistic expectations!

Throughout the course you have encountered many examples of the phenomenal success of the information processing industry, and how this success has been made possible by the continuing advances in information and communication technologies.

As you reach the end of the course you are asked to take a step back and question where all this development is taking us.

- How do people cope with all the changes that result from adopting new technology?
- Are there things that computers cannot do?
- Are there things that computers should not do?
- Are we becoming too dependent on technology, given the number of ways that systems can go wrong?
- Do we put too much faith in technological solutions?
- What principles should we adopt in specifying, implementing and adopting new applications?
- Where do we go from here?

The unit provides an opportunity to open up the discussion of questions like these, but without providing definitive answers. To find out more you will need to continue your studies by taking more advanced computing courses, for which this present course should have provided you with a good foundation.

3.5 The course software

Each block of the course has one CD-ROM associated with it. Each CD-ROM contains:

- computer-based activities for each unit;
- the course units for the block;
- web references mentioned in the units;
- supplementary materials;
- glossary.

The CD included in your first mailing of course materials also contains copies of this guide and the Course Companion, and the web references mentioned in them.



Whenever you need to carry out an activity using the course CD, you will find the CD icon in the margin.



Whenever you need to link to a website, you will find the web icon in the margin.

The supplementary materials have been designed to provide additional study support, should you require it, in key areas such as programming. You may find that you do not need to refer to this material; it is not assessable.

4 Beginning your studies

After you have registered for M150 you will receive some preliminary information, which will include copies of the *Assessment Handbook* and *Learning with the OU starts here*.

You will find introductory information in our *Learner's Guide*, which you can access via the Open University student website at

<http://www.open.ac.uk/students/>

Click on 'Course choice advice', and then click on the 'preparing to study' link.

If you wish to begin preparing for study early you can download a copy of *Learning with the OU starts here* (32 pages) by clicking on the 'get to know the OU' link. The second bullet point listed provides you with the link to download it. Alternatively, you can request a printed copy of the booklet from your Regional Centre.

Also on the OU student website you will find a link to 'Learning skills development' which gives some guidance on brushing up on basic learning skills. You can pick and choose to work through as many of these as you like.



Student home

5

Study support

5.1 Tutorial support

As an M150 student, you will be allocated to a tutor, who will be there to help you with your study of the course throughout the year. Generally your tutor will live in the same OU region as you and will also be responsible for looking after a number of other students on the same course. Before you are due to start the course, your local Regional Centre will provide you with information about your tutor, such as his or her name, address, telephone number and email address.

Your tutor is there to provide support and feedback in a number of ways, in particular by organising tutorials and by marking your assignments.

Your Regional Centre or your tutor will also let you know when any tutorials or day schools will be held.

5.2 Assignment marking

Correspondence tuition is at the heart of your study with the Open University. It is the main way in which you will be able to judge what progress you are making on the course. Doing the assignments will allow you to review the material in the relevant units and to consolidate your knowledge and skills. Your tutor will then have the responsibility for reading and assessing carefully what you have submitted. You will receive detailed individual feedback and guidance on your progress, as well as the overall mark that you have gained for the assignment. This is the most personalised aspect of your tuition and you should ensure that you make use of it. You will get your marked assignments back about two weeks after sending them to your tutor. Even though you will already be well into the study of the next unit, you should make time available to look at your tutor's comments rather than just look at the mark you have been given. There will usually be comments and suggestions and clarifications of misunderstandings that will be beneficial for your understanding of the course.

5.3 Tutorials

For most people there will also be the opportunity for regular face-to-face contact with their tutor and with fellow students via tutorial sessions which will be organised on a regional basis. They will usually be held at your local OU tutorial venue and be a couple of hours in duration. Details of times and places for all the tutorials for your course will be circulated to you by your Regional Centre. There may be occasions when you cannot attend the tutorials run by your allocated tutor, but could go to another one at a nearby centre. Usually this is possible, but it is always polite to check with the other tutor in advance. Although attendance at tutorials is optional, you are advised to attend if at all possible, especially if this is your first Open University course. They provide a valuable opportunity to meet other students and to compare notes on the course materials and on common problems of study that you are experiencing. You will also find that your tutor is able, in these sessions, to focus your attention on important issues for the current block that you are studying, to answer questions you may have about its contents, and to clarify what is expected from the questions in the current assignment. The tutor may also take the opportunity to go over the main issues and misunderstandings that they identified from their marking of the previous assignment. If there are things you think that it would be valuable to have covered in a tutorial, you may find it useful to contact your tutor in advance and make some suggestions. This can often help tutors in planning sessions, as otherwise they have to guess what problems you may be having.

5.4 Day schools

Depending on the region in which you are based you may find that there is the opportunity for one or more full-day tutorial sessions giving you an opportunity for more extended study of the course materials.

5.5 Self-help groups

Many students, having met at the tutorials, find it useful to maintain contact between sessions by organising group meetings or by telephone or email communication. Forming self-help groups like this enables students to help each other with ongoing difficulties, but they should understand that they must not collaborate directly on producing answers to the assignment questions. You can obviously join such a group without attending the tutorials, indeed if you are unable to attend tutorials, you may find that it is even more important to have some ongoing contact with your fellow students. You will be asked at the beginning of the year whether you are prepared to allow your contact details to be made available to other students for such purposes.

5.6 Computer conferencing

You can also meet fellow students within your region and your tutor group, i.e. the other students with whom you share a tutor, electronically. At the start of the course you will be given access to two conferences. The first is a Regional conference that can be used to discuss academic issues with your fellow students in your region, this conference will be supported by one or more tutors. The second conference will be your Tutor Group conference which will be run by your own tutor.

You should note that the course team does not have access to Regional or Tutor Group conferences, so you cannot contact them via your FirstClass conferences. Messages from the course team and any course materials will be available via the course website. For details of how to contact the course team please see Section 9 of this guide.

5.7 Telephone and email tuition

In addition to face-to-face and correspondence tuition, it may be necessary from time to time to contact your tutor about a specific problem that you have encountered. You should endeavour to keep this mode of contact to a minimum and save it for emergencies. Your tutor is generally only working for the Open University on a part-time basis and does not have unlimited time to spend on the course, so although they will expect direct contact from time to time you need to ensure that you are using this time effectively. It may be easier for you to send an email message first and to follow it up later with a phone call when your tutor has had time to think about the problem that you are experiencing.

6

Assessment

Part of your study of the course will involve your being assessed. We use three tools for this:

- tutor-marked assignments (TMAs);
- computer-marked exercises (CMEs); and
- an end-of-course assessment (ECA).

The tutor-marked assignments involve you in submitting the answers to a series of questions. You will be asked to carry out a wide variety of activities in answering a TMA; for example, you might be asked to write an essay on a particular topic or submit a small computer program. An important point to make about TMAs is that they provide your tutor with the opportunity to teach you as well as assess your work.

The computer-marked exercises comprise a number of questions that have multiple-choice solutions and you select what you think is the correct solution. Your chosen solutions are then processed by computer and the result returned to you.

The ECA involves you answering some questions similar to the ones in the CMEs and either writing a short report on a given topic or doing a programming exercise. The ECA will cover broadly all the material of the course. We sometimes provide additional materials or pointers to sources of material for optional study, but these will not be assessed. Optional study will be clearly identified.

Your final course grade is calculated from your TMA marks and your ECA mark. The marks you obtain on CMEs are not taken into account.

You can find out more about how your final grade is calculated from the *Assessment Handbook*.

Sections 7–9 of the Course Companion provide some guidance on how to write assignments and on preparing for the ECA.

7

Credits and qualification

7.1 Links to other programmes

M150 is linked to several systems of credit.

- *CATS points.* CATS is the Credit Accumulation and Transfer System which operates in British universities. When you pass this course you will have 30 CATS points. You can then build up more CATS points by studying further OU courses or, by negotiation, you can take your points with you to another university. You need 360 CATS points for an honours degree, so once you pass M150 you will have a good foundation for further study.
- *OU degree in Computing.* The university offers a BSc (Hons) Computing degree. M150 is a mandatory component of this degree.
- *Other OU degrees.* M150 is an optional component of some other OU degrees. Further information is available from the Courses and Qualifications website.
- *OU certificate.* M150 may also be counted towards a named certificate awarded for completion of 60 points of level 1 study.

7.2 Continuing computing

If M150 is your first course and you wish to continue your studies in computing, then we would advise you to look at the University website which will guide you through the courses on offer. Alternatively, contact your Regional Centre for advice on course choice.

8

Getting started

One of your first tasks will be to download and print a copy of the Study Calendar from the course website.

The Study Calendar will guide you through the course. It will help you pace your studies by showing you when you should be studying each unit of the course and when you need to submit each assignment to your tutor for marking. You might want to keep a copy of the Study Calendar to hand so that you can keep track of your progress.

Your Regional Centre will send you details of tutorials and day schools taking place in your locality. You may find it helpful to make a note of the dates on your Study Calendar.

In order to access the course website you need to have a suitable browser installed on your computer. For M150 we recommend that you use Internet Explorer (IE). If you do not have IE you can install it from the Online Applications CD supplied with your course materials. The instructions for installing the software that you will need on this course are on the leaflet included with the CD.

You will find information on the course website in the Course Companion which provides guidance on how to study. It also points you to sources of additional learning support materials should you need to 'brush up' on a particular skill.

The assignments for M150 are only available from the course website. You will need to submit the assignments via the electronic TMA system (eTMA). Your marked assignments will also be returned to you via the eTMA system. You will find information on the eTMA system in the booklet *Using the Electronic TMAs System: A Student Guide to e-TMAs*, which is included with your course mailing.

The ECA will be available from the course website together with details on completing and submitting it.

9

Getting help

There are many options available to you for obtaining help during your studies. For academic-related queries your first point of contact is your tutor who will advise you at the start of the course how long it will usually take to respond to queries.

For course-related problems you should contact the M150 course manager. You can do this via the Student Enquiry mailbox within First Class; in writing to:

M150 Course Manager
Faculty of Mathematics and Computing
The Open University
Walton Hall
Milton Keynes
MK7 6AA

by phone to 01908 652050 (direct) or to 09108 658211 (courses office) or to 01908 653243 (answerphone).

You should normally receive a reply within 10 working days. We do not recommend that you contact individual members of the course team directly as they may be absent on leave. The other main sources of help are listed in the Stop Press included with your course mailing, and on the course website.

When you have read this guide you should refer to the Course Companion for information on installing the necessary software you will need for the course and work through the practical activities before moving on to Unit 1 of the course.

Appendix

This Appendix contains extracts from the Course Companion and Unit 1 *Data and information*, and a sample TMA question related to the Unit 1 extract. There is also an outline of the work students will undertake in the first week of study. These have been provided to give an indication of the level of study you can expect to experience on M150.

Programme of work – week 1

- Read the Course Guide if you have not already done so. The Course Guide provides you with some important information you will need to study the course.
- Read Sections 1 to 4 of the Course Companion; these sections provide an overview of the course, guidance on how to get the best out of studying the course and pointers to additional study resources should you need them.
- Work through Section 5 of the Course Companion which describes the preparatory tasks you need to complete, such as installing the required software, accessing the computer conferences and electronic TMA (eTMA) system.
- Look at Section 6 of the Course Companion which describes how to use the Study Calendar and how to pace your studies.

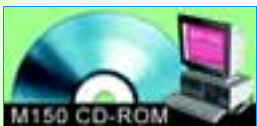
Refer to the remainder of the Course Companion as and when you need; it contains details of how to approach writing assignments and working with others.

When you study the course units you will find that there are sometimes icons in the margin, these are used to draw your attention to the need to use resources outside of the course units.

There are three icons associated with this course:



An icon to indicate that there is a website on a particular topic that may interest you.



An icon to indicate that you need to use the course CD-Rom to access some study material.



An icon to indicate that there is a FirstClass conferencing activity.

- Now study Sections 1 and 2 of Unit 1.

An extract from the Course Companion follows.

1

Introduction

Welcome to the course. You should have this booklet and the Course Guide close to you when you study M150. As this booklet also references web links, if possible have your computer to hand when you are reading it.

These web links are duplicated on the course website so that if a link changes the course website will be updated with the correct link.

1.1 The aims of this booklet

This booklet is a companion to the course. It aims to:

- outline the various components that make up the course, for example, the course booklets (units), the M150 course website and the final end-of-course assessment.
- provide guidance in carrying out the learning tasks associated with the course. For example, what you should do when studying a course unit. This guidance will be of a general nature. However, if you want detailed guidance then the course website will point you to specific university learning resources.
- provide activities which will familiarise you with the tasks you will be carrying out time and time again.

The course uses three marginal icons to help you locate:

computer-based activities



web addresses



conferencing



Section 4.3 gives you more details.

1.2 Assumed skills

For this course, we are assuming that you can:

- use a word processor;
- use a web browser; and
- install software from a CD onto your computer.

If you do not have these skills, you should contact your Regional Centre for advice because one of our other courses may better meet your needs.

M150 students will have varying needs: for some of you this will be your first OU course; others may have already completed one of our Openings courses or a different level 1 course. Some of you may be returning to study after some time while others will be continuing students. To cater for these different needs we provide you with signposts to where you can acquire additional study skills should you require them (see in particular Section 1.3).

1.3 Learner's Guide

The Learner's Guide is a part of the OU website and provides guidance that will be useful throughout your studies. It can be accessed via

<http://www3.open.ac.uk/learners-guide>

or from the 'LINKS' section on the M150 course website (referred to as the course website). Subsection 5.3 has information on how to access it.

ACTIVITY 1.1

Access the Learner's Guide now and browse through it as you read through the remainder of this section. You might like to bookmark the home page.

The Learner's Guide contains a wealth of information, ideas and tips about studying with the OU. It is currently split into four main sections:

- 1 Course choice;
- 2 Services for disabled students;
- 3 Career planning;
- 4 Learning skills.

It is a site you can dip into as and when you need information throughout your OU studies. All the sections are useful, but now, you should look at:

- 'Studying with the OU' which is under 'Course Choice';
- the 'Learning Skills' section, so that you are aware of the help it can provide.



Learner's Guide

Studying with the OU

Click on 'Course choice', then on 'Studying with the OU'; from this click on the button 'Preparing to study' along the top of the page. Then click on 'get to know the OU' link in the middle of the resulting page. On the page that now comes up there is a section 'Read the "Learning with the OU starts here" booklet'. In this section, click on the 'how to download it' link. This brings up a page that offers you the choice of downloading two booklets. Choose the one headed 'Learning with the Open University'. You will find it useful to print out this booklet. Spend a few minutes becoming familiar with its contents so that you can use them for reference later in the course. Some parts on 'Who to contact about what' and 'Organising your studies' are worth reading fully now as they contain useful information for those starting their studies with the OU.

Learning skills

One very useful resource in the 'Learning skills' section of the Learner's Guide is the 'Learning how to Learn' toolkit. This can be found if you click first on the link 'Additional resources available to OU students' and then on the 'Learning strategies' link. This toolkit helps you to develop your learning skills.

(The web address is www3.open.ac.uk/learners-guide/learning-skills/additional_resources/learning_strategies.htm; you will be asked to signed in.)

There are also useful toolkits on:

- taking notes and reading to learn;
- writing assignments;
- extending and developing your thinking skills;
- revising and taking exams.

Another part of the Learner's Guide to look at is the 'study skills quiz' (on the 'Additional resources available to OU students' page). This quiz enables you to assess and develop your study skills.

If you feel you need to develop your key skills of communication or to plan your learning further, then have a look at the section on 'Find out about our Good Study Guides'. The one that is probably most relevant for this course is 'The Good Study Guide'.

When clicking on the 'Additional resources available to OU students' link you will be asked to enter your OU name and password.



Learning how to learn toolkit

1.4 Student Handbook



Another resource on the OU website that you need to use as a reference is the Student Handbook. This can be accessed at:

www3.open.ac.uk/ug-handbook

or from the 'LINKS' section on the home page of the course website. This handbook includes details of the University's administrative arrangements, procedures and policies. You will need to refer to this, for instance, if you want to:

- change your address details;
- find out the rules for late submission of assignments.

2

Learning outcomes for the course

M150 provides opportunities for you to achieve some general learning outcomes listed below.

Knowledge and understanding

After studying the course, you will be able to:

- explain the nature of data, methods of capture and how such data can be converted into different representations;
- identify the operations and data in a simple (not necessarily computing) system and demonstrate how agreed standards are essential;
- describe the basic composition of a simple computing system;
- list the fundamental principles of information design (including principles of human–computer interaction) and apply them in simple situations;
- describe some of the common uses of data and how they influence the way the data is stored.

Cognitive skills

After studying the course, you will be able to:

- analyse a small computer program in terms of its inputs, programming structures and outputs;
- analyse a simple problem in terms of the necessary operations that are required to develop a program;
- modify part of a computer program to incorporate specified operations on given data by choosing appropriate program structures.

Key skills

After studying the course, you will be able to:

- demonstrate study skills at a level appropriate to higher education, such as timetabling study; read critically for meaning and take effective notes; and use study aids such as dictionaries and glossaries;
- read and understand a simple computer program;
- write short discursive pieces appropriate to the subject area, suitable for both technical and non-technical audiences;

- write 'documentation' in the form of a user's guide;
- communicate appropriately with your tutor and other students using email and online conferences;
- write a short discursive piece on a given subject using information located on the World Wide Web.

Practical and/or professional skills

After studying the course, you will be able to:

- discuss the legal and ethical issues surrounding data acquisition, privacy, accuracy, surveillance, and the use of cryptography (and its possible compromise by legislation);
- demonstrate basic skills to enable you to progress to more advanced level studies at the OU or any other university.

Extract from Unit 1

There are three important themes in this case study on maps that will recur throughout this course.

- 1 The right sort of data, properly used, is a very powerful aid in creating appropriate information (e.g. generating maps from geographical data).
- 2 It is possible to present information in a variety of ways to meet different requirements (e.g. a map for a hiker or directions for those who find maps daunting).
- 3 A computer can transform data into information in ways not previously thought possible (e.g. the information on a GPS receiver).

Here are some further examples of how a computer system can use the right sort of data to generate useful information in an appropriate way.

- A computer in a microwave oven transforms the pulses of an electronic clock into a time display that shows how long until the cooking is finished.
- A computer in a satellite television control box obtains the signals emitted by a transmitter satellite and converts them into a television picture and sound for the attached television set.
- The computers in a nuclear power station monitor signals produced by pressure sensors and other devices to provide a moment-by-moment summary of the state of the reactor.
- A computer in a car turns the pressure of the driver's foot on the brake pedal into fine control movements of each wheel's brake so as to prevent the car from skidding.
- A powerful PC turns signals from a scanner into a representation on the computer's screen of the item scanned. The PC can then accept commands from the user to modify that image.

It is transformations like these that lie at the heart of this course.

EXERCISE 4.2

Consider a computer in a modern cooker.

- (a) **What kinds of data might it require and where would these originate?**
- (b) **What kinds of information might it present to the cook?**



Discussion



- (a) The data originates either from the cook (pressing buttons to set a timer, for example) or from signals from the cooker's clock or its temperature sensor inside the oven.
- (b) A small display might show the time on the clock, how much time is left on the timer, and the oven temperature.

SAQ 4.1

- (a) **What is the role of the computer with respect to the data given to it?**
- (b) **How should requirements (such as the need for a user's attention to be focused on a complex task like driving) affect the presentation of information?**
- (c) **What, in your own words, is the meaning of the term *parameter*?**

Answer to SAQ 4.1 ✓

- (a) The role of the computer is to transform data into information.
- (b) The presentation of information needs to be *fit-for-purpose* and, in the example given, presented in a way that lets the user keep their primary focus of attention on the task.
- (c) A parameter is a property or characteristic of something that is measurable or quantifiable.

4.2 Finding information: the web

The web is a vast storehouse of ever changing, linked information on subjects as diverse as dog breeding, astronomy, tiddlywinks, and coping with bereavement.

A *browser*, like Internet Explorer, is used to access the web. However, given that the web contains literally billions of words of text, how would you find information on, say, the Open University?

The internet and the web: what's the difference?

People sometimes confuse the internet and the World Wide Web.

The **internet** refers to the *physical* interconnection of large numbers of smaller data communications networks to form a huge, publicly accessible 'network of networks'. Thus the internet carries electronic mail (email), hosts chat rooms and bulletin boards, enables the transfer of files, and is the physical basis for supporting the World Wide Web.

The **web** is the collection of linked data stored on the internet which is accessed using a browser.

Search engines: what are they?

The computer application that facilitates finding things on the web is known as a **search engine**. This is an application that serves a similar function to an index in a book. Figure 4.6 shows the home page of a typical search engine called Google.

There is a single box shown in Figure 4.6 into which **keywords** (words or terms that identify and distinguish topics from other topics) are typed. The keywords used in Figure 4.6 are 'rugby' and 'wales'.

The use of 'Rugby' and 'Wales' would produce the same results.

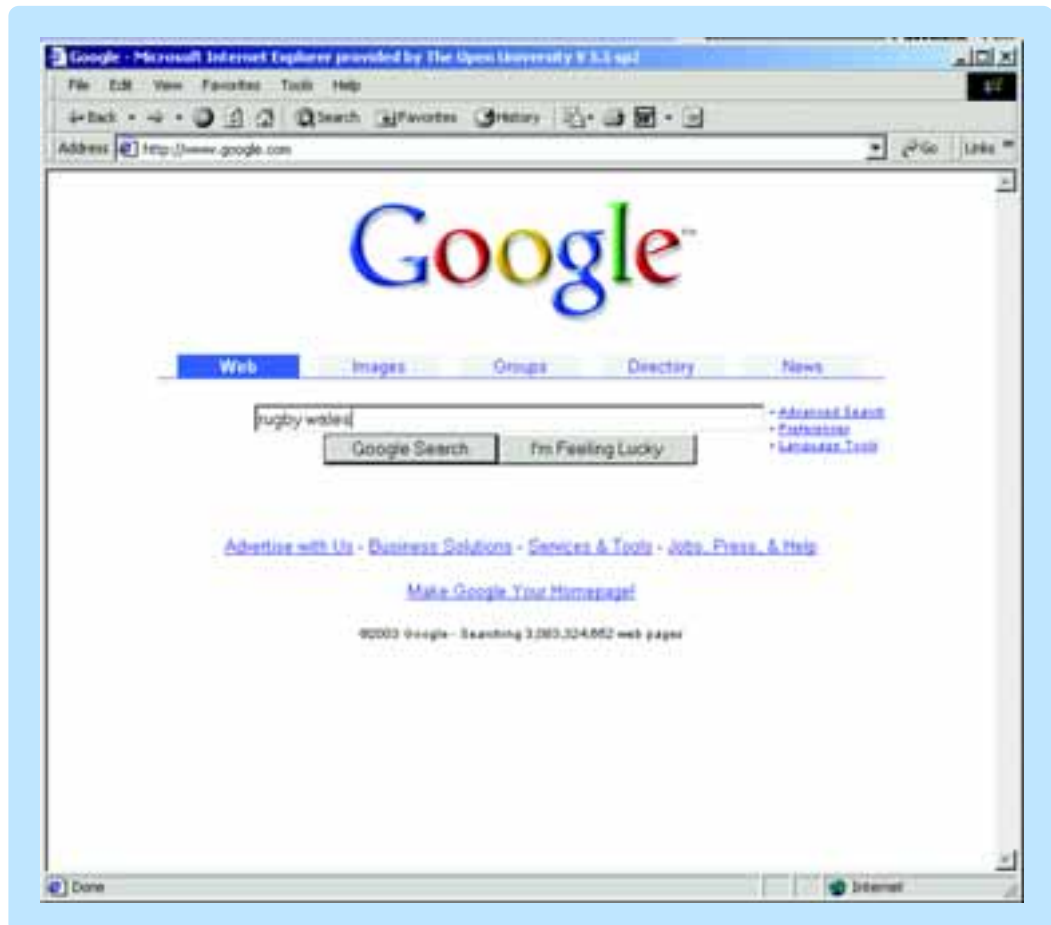


Figure 4.6 The interface to the Google search engine

When the button labelled 'Google Search' is clicked (or the 'Return' key is pressed), the search engine finds and returns a list of references to any websites which match *all* the keywords. Figure 4.7 shows the results of search for 'rugby wales'. In this case there are more results than will fit on a single screen, and only the first screenful of results is shown.

Different search engines give different results owing to the way in which they classify websites, and the relative

As the web changes constantly, repeating a search a few days later may well produce slightly different results.



Figure 4.7 The output from the Google search engine in response to the keywords 'Rugby' and 'Wales'

There are a number of references to the game of rugby in Wales, with the third being to the Welsh Rugby Union's home page. Each of the entries in blue (and also those underlined) can be clicked on to see more detailed information.

Ego surfing

The web is full of its own special jargon, abbreviations and acronyms. An example is the term *surfing*, which refers to the process of wandering around the web searching for information. The term *ego surfing* describes the act of looking for information about oneself.

Yahoo and Lycos are also web search engines. Like Google, they find results based on keywords, although you may find that each gives slightly different results to the same search. Figure 4.8 shows two displays, one from Google and one from Lycos, using the same keywords: 'maps in history'.

MAPS IN HISTORY, ART, AND LITERATURE

HONS 301.84: **MAPS IN HISTORY, ART, AND LITERATURE**. ... Yet analysis of the literary use of **maps** is virtually uncharted in the **history** of cartography. ...
everest.hunter.cuny.edu/~chuck/hons301.84/ - 6k - [Cached](#) - [Similar pages](#)

Syllabus, Hons 301.84: Maps in History, Art, and Literature

... 1 Read and discuss: Articles 1-2 Read and discuss: Wood, Chapter 1, **Maps** work by serving interests Tuesday, September 9 (CE), Overview: **History** of cartography. ...
everest.hunter.cuny.edu/~chuck/hons301.84/syllabus.html - 8k - [Cached](#) - [Similar pages](#)
 [More results from everest.hunter.cuny.edu]

EARLIEST MAPS IN HISTORY?

EARLIEST MAPS IN HISTORY? At three sites (perhaps four now that Site 2 has been rediscovered) in the Eastern desert, lines and squiggles ...
www.lankester.force9.co.uk/earliest.htm - 2k - [Cached](#) - [Similar pages](#)

Maps

... American **History maps** from the Library of Congress - Cities and Towns Panoramic **Maps** Conservation and Environment Yellowstone **Maps** Discovery and Exploration ...
killeenroos.com/link/maps.html - 20k - [Cached](#) - [Similar pages](#)

(a) Top four results of Google search using the terms 'maps in history'

MAPS IN HISTORY, ART, AND LITERATURE

HONS 301.84: **MAPS IN HISTORY, ART, AND LITERATURE** 3 hours, 3 credits
 Code 2968, Section 001 Tuesdays and Fridays, 2:10-3:25 PM Room ...
<http://everest.hunter.cuny.edu/~chuck/hons301.84/index.html> | ...more hits from this domain

MAPS IN HISTORY, ART, AND LITERATURE

HONS 301.84: **MAPS IN HISTORY, ART, AND LITERATURE** 3 hours, 3 credits
 Code 2968, Section 001 Tuesdays and Fridays, 2:10-3:25 PM Room ...
<http://www.hunter.cuny.edu/classics/classics/honors301.84.htm>

EARLIEST MAPS IN HISTORY?

EARLIEST MAPS IN HISTORY? At three sites (perhaps four now that Site 2 has been rediscovered) in the Eastern desert, lines and squiggles have been matched ...
<http://www.lankester.force9.co.uk/earliest.htm> | ...more hits from this domain

Teaching with Historic Maps -- J. Krokar syllabus

... MW 3:30-5:00)DePaul University Autumn 1997 Professor Jim Krokar
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 Description: Jim Krokar is Professor at DePaul University in Chicago. This course, Maps in History and Culture, was a course for advanced history students.
<http://www.newberry.org/nl/smith/teachers/krokar/syllabus1.ht...>

(b) Top four results of Lycos search using the terms 'maps in history'

Figure 4.8 Different search engines, same search (on 'maps in history'), different results! Note that the first, second and third entries on each display point to the same websites, but with different descriptions

It is instructive to understand the steps involved when a web search engine is used; assume you have run your browser, invoked a search engine and chosen the keywords you are interested in.

You will learn how to invoke a search engine in Activity 4.1.

- 1 The keywords are transmitted over the internet to a special computer known as a *web server*. This web server contains an index to websites. Each website is associated with a series of *keywords* which can be found in the site's title, address or contents. The index keywords and the user's requested keywords are compared by the server.
- 2 The web server then retrieves *references* to those websites that contain the right keywords and sends details of each reference back to the user's browser.
- 3 The browser then displays the references for the user.

Servers are explained in greater detail in Unit 4.

Here data (the keywords) is used to assemble information (the references to websites) but I have introduced some additional ideas here.

- Computers can communicate with each other, and two or more computers can cooperate to provide a service to users.
- Some remote computer, the web server, contains data that the user, who could be anywhere in the world, wants to access. This web server computer holds the index used to select those websites relevant to a user's search.
- Possibly the most important idea is concerned with the sentence in step 2, 'The web server then retrieves references to those websites that contain the right keywords ...'. The computer certainly does this, but how? The answer is that a *computer program* stored inside a computer carries out the actions necessary to do whatever it is that the computer system is designed for (in this case, to search through an index of websites seeking keywords that match the user's request).

A **computer program** is essentially a step-by-step set of instructions that tell the computer what to do. In other words, it's analogous to a cookery recipe.

Computer programs are often referred to as *software programs* or simply *programs*. Notice the spelling. You'll learn more about programming in Block 2.

Translated into English the instructions in a computer program (all written in specially designed language) might read as follows:

- extract the keywords from the user's search engine web page;
- send the keywords to the web server.

This would happen on the user's computer (often referred to in this context as a *client*). On the web server, the instructions might be:

- extract each keyword from the message sent by the user's browser over the internet;
- search the index for all websites that contain all the keywords.

Computer programs can be as small as a few instructions or contain hundreds of thousands of instructions.

Using the web more effectively: gateways



Looking at gateways

A gateway can also refer to a computer that acts as a message router on the internet.

A **gateway** on the web is a website intended to direct users to other *pre-selected* websites containing information on a particular topic.

University librarians often set up gateways for particular areas of study, although they may be set up by anyone with sufficient expertise in a topic. Gateways may be fairly general, such as a gateway site for sciences, or more specific, such as a gateway for particle physics.

Professional or vocational bodies may also develop gateways useful to their members, as may hobby organisations. A well-known gateway for people interested in family history and genealogy is Cyndi's List. This is updated by volunteers who notify new links relevant to topics of interest such as seventeenth and eighteenth century ships' passenger lists, local history websites, lists of names of war veterans, and so on.

Many gateway sites are searchable, often using the same search engines (e.g. Google) that are available directly through browsers. Because the search engine limits its search to the gateway site's indexes, this can prove to be a more focused way to search, particularly if the topic is one that is likely, in the wider web, to yield lots of spurious results.

Figure 4.9 shows the main page of a gateway website about historical maps and cartography aimed at academics, students, historians and map collectors. It contains the following:

- a selectable list of main topics on the left, each of which may contain links to other pages or other websites;
- selectable boxes at the top giving the index to the site, a site map page explaining how the site is organised, an 'ABOUT' link telling the user who hosts the site (the Institute of Historical Research at the University of London), and a 'WHAT'S NEW' link with information about recent changes to the site;
- welcoming messages (stating who the intended audience of the site is);
- a search engine with which to search the site.

Using a search engine more effectively

The search shown in Figure 4.7 above is an example of how to use a search engine in a simple way. However, one of the problems with finding information on the web is that there is so much! And not all of it is relevant to what you want. My search for 'rugby' and 'wales' using the Google search engine yielded a total of 38 screenfuls of websites which, at about 10 sites per screen, gives a total of nearly 400 websites. The first few sites listed will probably tell me what I want to know. But what about all the others? Are they all about the *game* of rugby in Wales?

The answer is 'no'. A website about rugby in New South Wales, Australia also appeared as a result of this search. Google didn't make a mistake since the site contains the chosen keywords. However, it wasn't smart enough to distinguish between Wales and New South Wales.

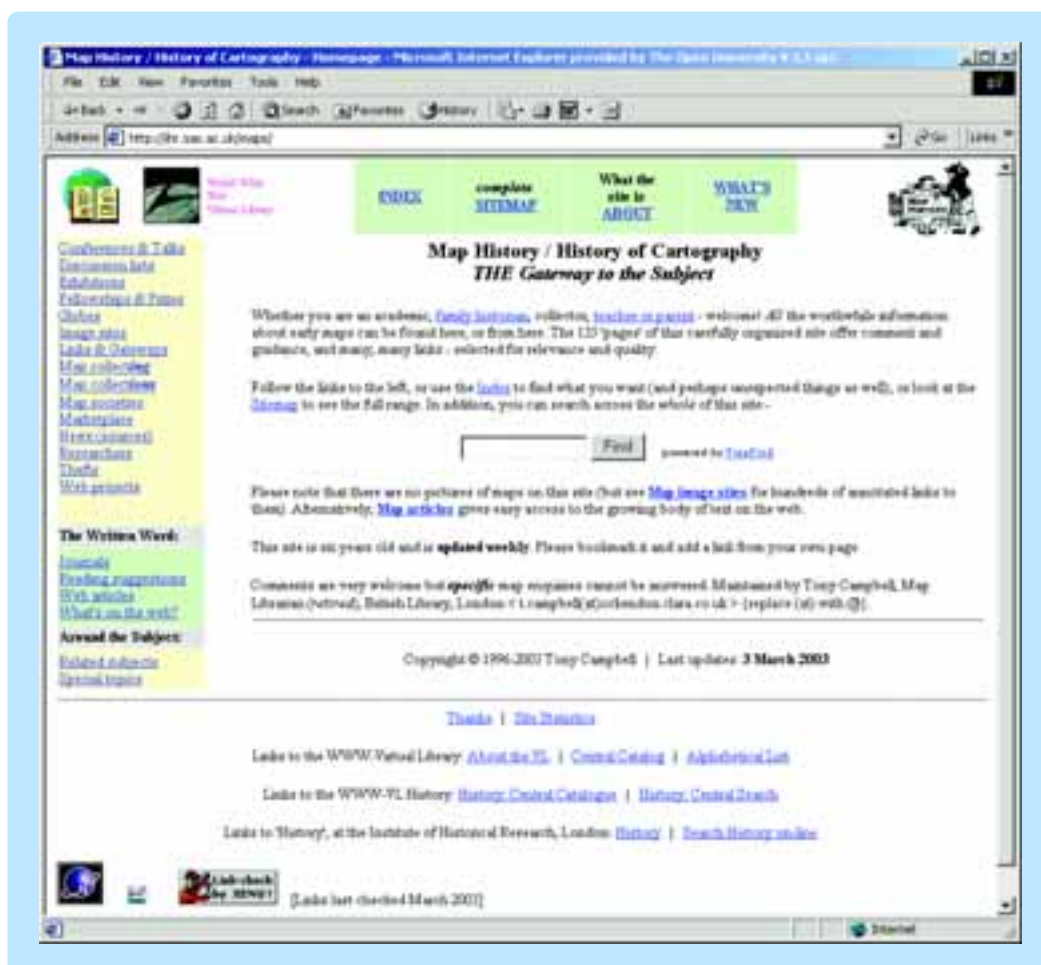


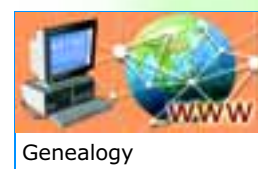
Figure 4.9 The main page of the gateway website for map history and the history of cartography

If you are just looking ('surfing') for information in a general way, too much information isn't always a problem. Where it becomes irritating and counter-productive is when you are looking for some quite specific information.

Example 4.1

Suppose you're interested in genealogy, and your surname is Bird. If you search on the web by typing in the keywords 'bird' and 'family', the web server will return every website it finds with those two words in it, so you'll probably find scientific and hobby sites on bird 'families' such as the passerines! It's clearly not what you want, but do you need to examine all the websites returned (which could run into hundreds) to find the one you're looking for?

The answer is that there are 'tricks' that you can use to narrow down your search to eliminate at least some of the things you aren't looking for. Each search engine has its own 'tricks', though the concepts of making more targeted searches are common to most search engines. Search engine screens will generally have a selectable topic called something like 'Advanced Search' or 'Search Tips'.



One obvious trick is to choose your keywords carefully. The more specific the keywords you choose, the more likely you are to get what you want. For example, if you want to find information on antique chairs, typing in just the keyword 'antique' will return all websites that use the word antique, and typing in the keyword 'chair' by itself will return all websites that use the word chair. But typing in both keywords will only return websites that use both words. The more keywords you add, the more targeted will be the websites returned to you. So adding 'British' to 'antique' and 'chair' will only return websites that have all three words in them.

EXERCISE 4.3

How could you adapt this trick of using more keywords to help you look for the Bird family?



Discussion



You could choose to enter the keywords 'bird' and 'genealogy' (the study of family lineages). This will almost certainly eliminate websites about storks and flamingos, or you could add an additional term to 'bird' and 'family' by specifying 'bird family history'.

Interestingly, if you have misspelled the keyword 'genealogy' as 'geneology' some search engines will not match it to websites containing the term 'genealogy'. Others will respond with the closest word possible. Google, for example, will respond to 'geneology' with the message 'Did you mean genealogy' together with some websites related to genealogy. Some search engines can't match 'family', say, with its plural 'families'. So if, in a particular search you don't get any matches (called **hits**), one strategy is to try making plural keywords singular and vice versa. Also remember to check your spelling carefully.

Another useful strategy is to look for phrases rather than individual words. In Exercise 4.3, I mentioned that you might use 'bird family history' to look for information on the Bird family. This might yield a response that includes anything about the animal 'bird' using the scientific term 'family' and any use in any context of the word 'history'. However, if you were to enclose the words 'family' and 'history' in quotation marks (as 'family history'), the web server will only return websites that contain the word 'bird' and the phrase 'family history'.

SAQ 4.2

- (a) What is a search engine? How does it differ from a browser?
- (b) In carrying out a web search, how many computers (at least) are involved?
- (c) What makes a computer actually do work?
- (d) In what way is a gateway useful?

Answer to SAQ 4.2 ✓

- (a) A search engine is a computer program that uses keywords to help users locate websites containing information they want.
- (b) At least two are involved: the user's computer (the client) and the web server.
- (c) A program of instructions, stored in the computer, called a computer program.
- (d) A gateway provides a pre-chosen set of links on the web for a particular topic. Instead of searching the whole of the web for information, a gateway provides a very focused means of getting information that usually has been compiled by an expert.

4.3 Computer-based activities



Note that when this icon appears you need to check the CD for a related activity.

ACTIVITY 4.1

This introduces you to search engines. It shows you how to invoke a search engine from your browser and make simple searches for topics of interest.

ACTIVITY 4.2

This gives you the chance of using some advanced search facilities (such as the two mentioned above) to make more targeted searches.

4.4 Summary

This section described how computers can be used in geographical applications (and in doing so it discussed maps and showed how modern maps are composed of layers of different data).

It discussed the GPS to demonstrate how computers can communicate in order to solve a problem, such as navigation.

It also showed how the geographical data that supports both map-making and the GPS navigation system can be presented in different forms such as a map, a list of directions, a moving graphical display on a navigation device such as a GPS receiver or as spoken directions. The reasons why one form of presentation is preferable over another were discussed: it depends on fitness-for-purpose, i.e. on the requirements of the user and/or the situation in which the information is needed.

Finally the section described how computers can be used to find information on the web. The two activities associated with this section introduced you to gateways and to the simple and advanced use of search engines.

Sample TMA question

Q1 (Unit 1) (25 marks)

Your grandmother has just learned to use a computer including being able to use a browser. In her retirement she is keen to develop a family tree which stretches back to the early nineteenth century. For this TMA question we would like you to write her a short letter (no more than 500 words) which describes how she could use a search engine to find information that would help her in this task. Assume that she has never used a search engine before.

You will gain marks for this question by explaining:

- what a search engine does;
(7 marks)
- how to use a search engine;
(9 marks)
- what the results of a search are and how they can be used.
(9 marks)

For the second point above you do not need any technical details just a high-level description of the use of a search engine.

Acknowledgements

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Figures

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