PROFESSIONAL ISSUES IN INFORMATION TECHNOLOGY

Second edition

Frank Bott

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The Chartered Institute for IT

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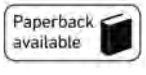

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CONTENTS

	List of figures and tables	ix
	Author	x
	Acknowledgements	xi
	Abbreviations	xii
	Useful websites	xiv
	Preface	xviii
1.	**LAW AND GOVERNMENT**	**1**
	1.1 What is the law?	1
	1.2 Criminal law and civil law	2
	1.3 Where does the law come from?	3
	1.4 The legislative process in the UK	3
	1.5 The legislative process in other countries	5
	1.6 The law across borders	6
	Further reading	7
2.	**THE COMPUTING PROFESSION**	**8**
	2.1 The concept of a profession	8
	2.2 Royal charters	9
	2.3 Professional conduct	10
	2.4 Education	13
	2.5 The advancement of knowledge	15
	2.6 Continuing professional development	15
	2.7 Representing the profession	17
	2.8 Membership grades	17
	2.9 Reservation of title and function	18
	Further reading	20
3.	**WHAT IS AN ORGANISATION?**	**21**
	3.1 The role of organisations	21
	3.2 Commercial organisations	21
	3.3 Limited companies	23
	3.4 Setting up a company	24
	3.5 The constitution of a limited company	25
	3.6 Directors	25
	3.7 Takeovers, mergers and outsourcing	27
	3.8 Non-commercial bodies	31
	Further reading	34

4.	**STRUCTURE AND MANAGEMENT OF ORGANISATIONS**	**35**
	4.1 Organisational models	35
	4.2 Structuring principles	37
	4.3 Depth of structure	42
	4.4 Centralisation	43
	4.5 Setting up a structure in practice	43
	4.6 Job design	44
	Further reading	46
5.	**FINANCING A START-UP COMPANY**	**48**
	5.1 Why capital is needed	48
	5.2 The business plan	49
	5.3 Sources of finance	50
	5.4 Gearing	53
	Further reading	53
6.	**FINANCIAL ACCOUNTING**	**55**
	6.1 Disclosure requirements	55
	6.2 The balance sheet	55
	6.3 The profit and loss account	61
	6.4 The cash flow statement	64
	6.5 The overall picture	67
	Further reading	69
7.	**MANAGEMENT ACCOUNTING**	**70**
	7.1 Planning and management information	70
	7.2 Budgets and overheads	70
	7.3 Cost of labour	73
	7.4 Allocation of overheads	74
	7.5 Cash flow forecast	76
	Further reading	78
8.	**INVESTMENT APPRAISAL**	**79**
	8.1 Investment proposals	79
	8.2 The time value of money	80
	8.3 Applying DCF to a simple investment project	81
	8.4 Assessment of a software product proposal	84
	8.5 Pitfalls of DCF	86
	Further reading	86
9.	**HUMAN RESOURCES ISSUES**	**88**
	9.1 What are human resources?	88
	9.2 The legal context	88
	9.3 Recruitment and selection	91
	9.4 Staff training and development	93
	9.5 Remuneration policies and job evaluation	93
	9.6 Appraisal schemes	96
	9.7 Redundancy, dismissal and grievance procedures	98
	9.8 Contracts of employment	101
	9.9 Human resource planning	102
	Further reading	103

10.	**ANTI-DISCRIMINATION LEGISLATION**	**104**
	10.1 The development of anti-discrimination legislation	104
	10.2 What is discrimination?	105
	10.3 Discrimination on grounds of sex	106
	10.4 Discrimination on racial grounds	109
	10.5 Discrimination on grounds of disability	109
	10.6 Discrimination on grounds of age	112
	10.7 Avoiding discrimination	112
	Further reading	113
11.	**INTELLECTUAL PROPERTY RIGHTS**	**114**
	11.1 Intellectual property	114
	11.2 Copyright	116
	11.3 Examples of copyright cases involving software	119
	11.4 Confidential information	122
	11.5 Patents	125
	11.6 Trade marks	129
	11.7 Domain names	130
	Further reading	131
12.	**SOFTWARE CONTRACTS AND LICENCES**	**133**
	12.1 What is a contract?	133
	12.2 Licence agreements	134
	12.3 Outsourcing	135
	12.4 Contracts for bespoke software	136
	12.5 Contracts for consultancy and contract hire	139
	12.6 Liability for defective software	141
	12.7 Health and safety	143
	Further reading	144
13.	**DATA PROTECTION, PRIVACY AND FREEDOM OF INFORMATION**	**145**
	13.1 Background	145
	13.2 Data protection	146
	13.3 Privacy	153
	13.4 Freedom of information	154
	Further reading	155
14.	**INTERNET ISSUES**	**157**
	14.1 The effects of the internet	157
	14.2 Internet service providers	158
	14.3 The law across national boundaries	160
	14.4 Defamation	161
	14.5 Pornography	164
	14.6 Spam	170
	14.7 Ecommerce regulations	173
	Further reading	174

15. COMPUTER MISUSE **175**
15.1 The problem 175
15.2 The Computer Misuse Act 1990 175
15.3 Amendments to the Act 177
15.4 Operation of the Act 178
15.5 Computer fraud 180
Further reading 181

APPENDIX – SAMPLE CONTRACT OF EMPLOYMENT **182**

Index 185

LIST OF FIGURES AND TABLES

Figure 4.1	A function-based structure	38
Figure 4.2	Twelve people organised into a four-level structure	42
Figure 4.3	Twelve people organised into a three-level structure	42
Figure 4.4	An organisational structure for a bespoke software house	44
Figure 6.1	Sources and destinations of cash flows	66
Figure 6.2	The relationship between the three financial statements	68
Figure 6.3	How the cash flow statement and the profit and loss account affect the items in the balance sheet	68
Table 6.1	Balance sheet for a student.	56
Table 6.2	Balance sheet for a services company	58
Table 6.3	Income and expenditure account for a student	62
Table 6.4	Profit and loss account for a services company	63
Table 6.5	Cash flow statement for a student	65
Table 6.6	Cash flow statement for a software company	67
Table 7.1	Direct costs and expected sales	71
Table 7.2	An example budget	72
Table 7.3	Calculation of the number of revenue-earning hours in a year	74
Table 7.4	Effects of different overhead calculations	75
Table 7.5	A six-month cash flow prediction	76
Table 8.1	Discount factors for periods up to five years	81
Table 8.2	DCF analysis of van purchase v. leasing	82
Table 8.3	DCF analysis of a proposed software package development	85

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Frank Bott studied mathematics at Trinity College, Cambridge, where he was awarded the Yeats Prize. After several years working in the University's Computer Laboratory he joined SPL International and managed large projects in shipbuilding, the electronics industry and the NHS. He was for two years a visiting professor at the University of Missouri. For ten years he was Head of the Aberystwyth University Computer Science Department, where he still lectures part-time. He has been an active member of BCS since 1963 and is a long-standing member of its Professional Examinations Board, as well as of a number of other committees.

Frank has published extensively in the field of software engineering and professional issues in IT. He also writes on classical music and is joint author of a biography of the Welsh-American composer Joseph Parry.

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Finally, I would like to thank my wife for her patience, forbearance, love and support, not only during the period that this book was being written, but throughout our years together.

ABBREVIATIONS

ACAS	Advisory, Conciliation and Arbitration Service
ACM	Association for Computing Machinery
BCS	BCS, The Chartered Institute for IT
CEng	Chartered Engineer
CEPIS	Council of European Professional Informatics Societies
CITP	Chartered IT Professional
CMA	Computer Misuse Act 1990
CPD	continuing professional development
DCF	discounted cash flow
DPA	Data Protection Act 1998
ECDL	European Computer Driving Licence®
EEA	European Economic Area
EHRC	Equality and Human Rights Commission
EU	European Union
EUCIP	European Certification of IT Professional
FoI	Freedom of Information Act 2000
GATT	General Agreement on Tariffs and Trade
ICANN	Internet Corporation for Assigned Names and Numbers
ICRA	Internet Content Rating Association
IEE	Institution of Electrical Engineers
IEEE	Institute of Electrical and Electronic Engineers
IEEE-CS	IEEE Computer Society
IET	Institution of Engineering and Technology
IRR	internal rate of return
ISEB	Information Systems Examination Board
ISM	Industry Structure Model
ISP	internet service provider
IT	information technology
IWF	Internet Watch Foundation
LLP	limited liability partnership

MBO	management by objectives
MP	Member of Parliament
NPV	net present value
PIDA	Public Interest Disclosure Act 1998
PJA	Police and Justice Act 2006
PLC (or plc)	public limited company
QA	quality assurance
RAM	random access memory
RCVS	Royal College of Veterinary Surgeons
RIBA	Royal Institute of British Architects
RIPA	Regulation of Investigatory Powers Act 2000
SFIA	Skills Framework for the Information Age
TUPE	Transfer of Undertakings (Protection of Employment) Regulations
UKCES	UK Commission for Employment and Skills
UML	Unified Modelling Language
URL	uniform resource locator
W3C	World Wide Web Consortium
WIPO	World Intellectual Property Organization

USEFUL WEBSITES

The following are the URLs of the websites referred to in the text. In most cases I have given the URLs of the home pages, since these are much less likely to change than those of individual pages. All the URLs were checked and found to be correct in August 2013.

UK government and official bodies

www.parliament.uk
This website covers both the House of Commons and the House of Lords. It includes materials placed before Parliament, records of all debates, details of all members and much else.

www.legislation.gov.uk
All UK legislation from 1988 to the present can be found on this website, as well as most primary legislation from before that date.

www.gov.uk
This general government website includes a great deal of information relating to the law, to running a business, to the rights of disabled people and many other topics.

www.equalityhumanrights.com
The website of the Equality and Human Rights Commission contains much valuable guidance for organisations that have to comply with anti-discrimination legislation.

www.ico.org.uk
The website of the Information Commissioner's Office contains useful information relating to data protection and freedom of information, including reports of cases that have been taken to court.

www.acas.org.uk
The website of the Arbitration, Conciliation and Advisory Service (ACAS).

www.ukces.org.uk
The website of the UK Commission for Employment and Skills.

www.innovateuk.org
The Technology Strategy Board's website.

US government sites

www.house.gov
The website for the US House of Representative.

www.senate.gov
The website for the US Senate.

Trade associations

www.corporate-responsibility.org/wp-content/uploads/2009/09/directors_guidance_final.pdf
The Corporate Responsibility (CORE) Coalition has produced a guide to directors' responsibilities.

www.sfia-online.org
The website of the SFIA Foundation.

www.iwf.org.uk
The website of the Internet Watch Foundation.

http://opensource.org
The Open Source Initiative's website.

www.fsf.org
The Free Software Foundation's website.

www.gnu.org
The website of the Gnu Project.

www.ukbusinessangelsassociation.org.uk
The website of the UK Business Angels Association.

www.eban.org
The website of the European Business Angels Network.

www.wbaa.biz
The World Business Angels Association's website.

Professional bodies and international organisations

www.bcs.org
The website of BCS, The Chartered Institute for IT.

www.theiet.org
The website of the Institute of Engineering and Technology.

www.computer.org/portal/web/guest/home
The Institute of Electrical and Electronic Engineering – Computer Society's website.

www.acm.org
The Association for Computing Machinery's website.

www.ifip.org
The website of the International Federation for Information Processing (IFIP).

www.cepis.org
The website of the Council of European Professional Informatics Societies (CEPIS).

www.wipo2.int
The website of the World Intellectual Property Organization.

Company reports

www.cgi.com/en/investors/annual-reports

The section of the CGI website that provides annual reports.

www.microsoft.com/investor/reports/ar12/index.html
The section of the Microsoft website that provides annual reports.

www.investors.sage.com/reports_presentations/reports
The section of the Sage website that provides corporate reports.

Legal case reports

www.humphreys.co.uk/articles/software_1.htm
A report on Cantor Fitzgerald versus Tradition (UK).

www.5rb.com/docs/Navitaire-v-Easyjet%20Airline%20Co%2030%20Jul%202004.pdf
A report on Navitaire Inc versus easyJet and Bulletproof Technologies Inc.

http://en.wikipedia.org/wiki/Oracle_Corporation_v._SAP_AG
A report on Oracle Corporation versus SAP AG.

www.scotchspam.org.uk/transcom.html
A report on Gordon Dick versus Transcom Internet Services Ltd.

www.pcworld.com/article/148780/spam.html
An article about Robert Soloway.

www.bailii.org/ew/cases/EWHC/Admin/2009/2021.html

www.publications.parliament.uk/pa/ld200708/ldjudgmt/jd080730/mckinn-1.htm
Two reports about Gary McKinnon.

Other legal material

www.bitlaw.com/software-patent/index.html
A clear statement of the position regarding software patents in the USA.

www.bitlaw.com/software-patent/bilski-and-software-patents.html
This gives an excellent description of the confused situation regarding software patents in the USA as it stood at the beginning of 2012.

www.lawcom.gov.uk/files/defamation2.pdf
The Law Commission report entitled *Defamation and the Internet*.

http://webjcli.ncl.ac.uk/1996/issue3/akdeniz3.html.
http://usir.salford.ac.uk/15815/7/MacEwan_Crim_LR.pdf
The two papers referred to in Chapter 15 that discuss the operation of the Computer Misuse Act.

Other sites

www0.cs.ucl.ac.uk/staff/A.Finkelstein/las/lascase0.9.pdf
This website provides information about the London Ambulance System disaster, including a copy of the official report.

http://sunnyday.mit.edu/therac-25.html
An updated version of the original Leveson and Turner paper on the Therac 25 Disaster.

www.midstaffspublicinquiry.com/report
Report of the Mid-Staffordshire NHS Foundation Trust Public Enquiry (the Francis report).

http://philarcher.org/icra/ICRAfail.pdf
Report on the failure of the ICRA initiative.

www-hcid.soi.city.ac.uk/research/DRC_Report.pdf
The Disability Rights Commission's report on disabled access to the internet.

PREFACE

When employers of newly qualified information systems professionals are asked what it is they would most like them to know, the answer is very rarely technical. Much more commonly, the answer is an understanding of the business environment. For this reason, BCS, The Chartered Institute for IT insists that accredited courses contain a significant element of 'professional issues' and, in its own examinations, BCS requires candidates to take a compulsory paper entitled *Professional Issues in Information Systems Engineering*. This book has been written as a guide for students taking that paper and it covers the whole syllabus. It is hoped, however, that the book will also prove useful to others, both students on other courses and those who are already embarked on a career in the information systems industry.

It is important for candidates to realise that mere knowledge of the syllabus is not enough, by itself, to pass the paper. Candidates are expected to be able to apply that knowledge to simple scenarios. Failure to do this is one of the commonest reasons for failing the paper. The book includes many such scenarios, some real and some fictitious.

Many of the candidates for the Institute's examinations are from overseas. BCS is a British institute and it has to give priority to the situation of the IT professional in the United Kingdom. For this reason the syllabus refers to Acts of the UK Parliament and to the laws of England and Wales (and Scotland where Scottish law differs significantly). However, it is expected that overseas candidates will be concerned with the position in their own countries and, where relevant, this book tries to illustrate how this varies from country to country. (Nowhere is this more evident than when discussing the legal status of professional engineers.) UK candidates should also find it beneficial to learn about the position in other countries.

Despite the existence of some very large and well-known multinational companies, much of the IT industry consists of small enterprises with less than six employees. Many young entrants to the profession aim to set up such a business of their own. One of the purposes of the Professional Issues module in the Institute's Diploma examination is therefore to give practical guidance in a range of legal, financial and organisational areas relevant to small IT businesses. This is reflected in many aspects of the book.

A word of warning is needed here. This book tries to explain the central principles and issues in the areas covered, so that you will be aware of areas you need to think about and areas where you will need professional advice. The book should give you enough knowledge to talk intelligently to professionals in the fields that it covers. But what the book covers is inevitably introductory and much is omitted. Just as you would not regard an accountant who had read a book on computing and learned to use a spreadsheet

and a word processor as competent to design the software for the space shuttle, so you must not regard yourself as a competent lawyer, accountant or other professional on the strength of having studied this book.

The book can be regarded as falling into four main parts. Chapters 1 to 4 are concerned with the general context in which professionals work – the law and how it is created, the professions and the nature and structure of commercial organisations.

Chapters 5 to 8 are concerned very specifically with financial matters – the financing of start-up companies, the nature of financial statements, costing, budgeting and cash flow and the evaluation of investment proposals. Chapters 9 and 10 cover the human aspects of running a company, including human resources and anti-discrimination legislation.

More specific legal issues are covered in the final chapters, including software contracts and licences, intellectual property rights and legislation that affects the way in which computers and the internet are used or misused. Many of these topics are matters of day-to-day concern for most computer users.

There are *Further Reading* sections at the end of each chapter. These are intended to:

- enable those who are teaching courses for the examination to deepen and broaden their knowledge so that they can respond to questions and initiate discussion in their classes;
- help students who feel they need to read more in order to get a better understanding of the material;
- provide guidance to readers who need or want to go more deeply into particular topics to satisfy their own professional needs.

The first edition of this book was written in 2004. In the nine years since then there have been many changes in the law and important new legislation, such as the Equality Act 2010 and the Companies Act 2006, has been enacted. The way the internet is used has also developed in many important ways and is the subject of some political controversy. All these developments are reflected in the revisions that have been made.

Since the first edition was published, the structure of the IT industry has changed considerably. Although there are still many very small independent companies – under six employees, say – takeovers and mergers have dramatically reduced the number of small to medium-sized independent companies in the sector. Many of the companies referred to in the first edition no longer exist. A new section on takeovers and mergers has been added, along with additional material on outsourcing, and references to specific companies have been comprehensively revised to reflect the current state of the industry.

Frank Bott
Aberystwyth
August 2013

1 LAW AND GOVERNMENT

After studying this chapter, you should:

- *understand the nature of the law and the difference between criminal law and civil law;*
- *understand what is meant by the terms legislature, judiciary and executive and appreciate the variety of ways in which these concepts are implemented in different countries;*
- *understand the ways in which law comes into existence.*

1.1 WHAT IS THE LAW?

There are many ways of defining the law. For the purpose of this book we shall take a very straightforward definition. We shall define law as 'a set of rules that can be enforced in a court'. These rules are different in different countries. The best known examples of such differences are probably in the rules governing things like divorce or the sale of alcohol. From the point of view of the IT professional, however, differences in the rules governing data protection, the rights of access to information and the misuse of computers are much more significant.

As well as having different laws, different countries have different legal systems, that is, different systems of courts, different rules for court procedure, different procedures for appealing against a court decision and so on. The word **jurisdiction** is used to mean the area covered by a single legal system and set of laws.

Even within a single country, the law and the legal system may be different in different areas. This is most obviously the case in large countries with a federal system of government, where the country is divided into a number of states each of which can make its own laws in certain areas. Obvious examples are India and the United States.

In the UK, for historical reasons, Scotland, Northern Ireland and the Isle of Man each have different legal systems and different laws. However, as far as the topics covered in this book are concerned, their laws are, in almost all cases, the same as those of England and Wales. When we refer to British law or UK law, we shall be referring to laws that apply across the UK. Sometimes we shall refer to the law of England and Wales, indicating that there are differences elsewhere in the UK.

1.2 CRIMINAL LAW AND CIVIL LAW

The popular image of the law sees it as the set of mechanisms that tries to punish wrongdoers by fines or imprisonment. This aspect of the law is known as the criminal law. It can be considered to represent society's view of the minimum standard of acceptable behaviour. It defines what constitutes a crime, lays down the mechanisms for deciding whether a person accused of a crime is guilty or innocent and specifies the range of punishments applicable to different categories of crime.

In general, the police are responsible for discovering who has carried out a specific criminal offence and for collecting evidence that will convince a court that the person in question really did commit the offence. The state, in the form of the Crown Prosecution Service in England and Wales, will then start proceedings by prosecuting the person concerned (who is known as the **accused** or the **defendant**) in a criminal court. The court will decide whether or not the case against the person has been proved and, if it finds the case proved, will sentence the offender to a suitable punishment.

We shall not be very concerned with the criminal law in this book. We shall be much more occupied with the **civil law**. The purpose of the civil law is to provide rules for settling disputes between people.

Notice that we have referred to disputes between people. Does this mean that the civil law doesn't apply if one or both sides in a dispute are companies, or organisations of some other kind? It doesn't mean this, of course, but, in order to overcome the difficulty, we need the idea of a **legal person**. A legal person is an organisation that has gone through a process called **incorporation** that gives it the same legal status, so far as the civil law is concerned, as a **natural person**, that is, a human being. There are several different ways in which an organisation can be incorporated. In Britain, an organisation can be incorporated by an Act of Parliament, by registering as a company or by the grant of a royal charter. We shall discuss this process in Chapters 2 and 3.

Court action under the civil law is known as litigation. It must be initiated by one of the **parties to the dispute**, that is, by the person, legal or natural, who feels they have been wronged. The person who initiates the court action is known as the **claimant**, although in the United States and some other countries the older term **plaintiff** is still preferred.

Two important differences between British civil law and criminal law relate to the **standard** of proof and the **burden** of proof.

For a person to be found guilty of a criminal offence, the prosecution must demonstrate that he or she is guilty beyond all reasonable doubt. For a claimant to win his case under civil law, he only has to show that his claim is correct on the balance of probabilities. In other words, the standard of proof required in criminal cases is higher than that required in civil cases.

In a criminal case, the burden of proof lies on the prosecution. This means that it is up to the prosecution to prove its case. Defendants do not need to prove their innocence. They are assumed to be innocent until they are proven guilty. In a civil case, on the other hand, both parties present their arguments and must convince the court of their correctness.

1.3 WHERE DOES THE LAW COME FROM?

The two main sources of law in England and Wales are the **common law** and **statute law**. The common law is essentially traditional law that is not written down but which depends on the judgement of judges over the centuries. When deciding the rights and wrongs of a case, a court will look at the way in which similar cases have been decided in the past; such cases are known as **precedents**.

The common law tradition is shared by many other countries. Almost all the countries of the Commonwealth share the tradition; so, most importantly, does the United States of America. This means that a judgement made by a judge in the United States can be used as a precedent in, for example, a court in Singapore, or vice versa.

The tradition of common law is not found in the countries of continental Europe, such as France and Germany. Their law is based entirely on written codes, one for the criminal law and one for the civil law. Those parts of the world that were once colonised by such countries have generally kept such a system of written codes. Confusingly, this system of written codes is often also referred to as civil law. However, in this book, we shall always use the term civil law in the sense described in the previous section, that is, the law used for settling disputes between people.

Statute law is law laid down by Acts of Parliament. It is often referred to as **legislation**. Two hundred years ago, most cases that came to trial would have been tried under the common law. There was comparatively little statute law. Over the past two hundred years the position has changed a lot. On the one hand, technical developments and social changes make new laws urgently necessary. Laws to regulate child labour and laws to prevent the misuse of computers are just two examples of Parliament creating new laws for such reasons. On the other hand, in some areas the millions of common law judgements from the past make it increasingly difficult for courts to apply the common law and Parliament has passed legislation to bring together the common law in these areas into a single statute. A good example of this is the Theft Act 1968, which consolidated the common law provisions regarding crimes involving stealing.

1.4 THE LEGISLATIVE PROCESS IN THE UK

Like many other democratic countries, the UK has what is known as a **two-chamber** or **bicameral legislature**. This means that the law-making body (the legislature) is made up of two chambers or groups of people.

The British legislature is known as **Parliament**. One of the chambers is called the House of Commons; its members are elected and everyone over the age of 18 has a vote. The country is currently divided into 659 constituencies, each of which elects one member of parliament, who is the person who gets the most votes in the election. This is known as the 'first past the post' system.

The other chamber in the UK Parliament is known as the House of Lords; most of its members are appointed but a significant number are chosen from amongst the hereditary peers, although this situation may not last very much longer. (Reform of the House of Lords has been an active political issue in Britain for over a hundred years but,

although most people agree that reform is needed, it has proved possible to get agreement only on some very limited reforms.)

The British government is made up of members from both the House of Commons and the House of Lords. Members of the House of Lords are never more than a small proportion and the Prime Minister, the Chancellor of the Exchequer, the Foreign Secretary and the Home Secretary are now always members of the House of Commons.

Most new legislation is initiated by the government although it is possible for individual members of parliament to initiate legislation in certain circumstances. It is introduced in the form of a **bill**; this is a set of proposals that parliament is invited to discuss, possibly modify and then approve. The bill is usually introduced first in the House of Commons. It will be discussed and possibly amended there, a process that includes a number of stages. If it is approved by the House of Commons, it is passed to the House of Lords. If the House of Lords approves the bill, it becomes an Act of Parliament. It is then passed to the Queen for her formal approval (the **royal assent**), after which it becomes law. (The Queen cannot refuse to give her approval when parliament has approved a bill.) Acts of Parliament are usually referred to by their title, followed by the year in which they received the royal assent, e.g. Computer Misuse Act 1990.

If the House of Lords rejects a bill or modifies it, the bill is returned to the House of Commons for further consideration. The House of Commons has the power to override any changes that may have been made by the House of Lords or even to insist that a bill rejected by the House of Lords should, nevertheless, be passed and proceed to receive the royal assent. The justification for this is that the House of Commons is democratically elected and so represents the will of the people in a way that the members of the House of Lords, not being elected, cannot do.

In many cases, the government may want to canvass opinion before asking Parliament to approve legislation. It may publish a **green paper**, which typically explains why the government wants to create new laws in a certain area and discusses a number of possible approaches. The green paper will be discussed by Parliament and comments on it will be invited from the public and from bodies that have an interest in the area. Thus BCS, along with many other bodies, was specifically asked for its views when the question of legislation to address the problem of computer misuse was raised.

Once the government has decided on its general approach, it may publish a **white paper**, which describes the proposed legislation and will be used as the basis for discussing and possibly modifying the details of what is proposed. At the end of this process the government will take into account these discussions and produce a bill.

Acts of Parliament constitute what is known as **primary** legislation. The complexity of modern society makes it impossible for all laws to be examined in detail by parliament. To overcome this difficulty, an Act of Parliament will often make provision for **secondary** legislation to be introduced. This means that detailed regulations can be introduced without full discussion in parliament. Instead, the proposed regulations are placed in the library of the House of Commons so that members of either house can look at them. If no objections are raised within a fixed time period, the regulations become law. An example of secondary legislation in the computer field are the regulations that were

produced to apply the Copyright, Designs and Patents Act 1988 to protect the design of semi-conductor chips.

The UK is a member of the European Union (EU). This is a grouping of 28 European countries which are working towards a high level of economic and social integration involving the harmonisation of many of their laws. The EU has its own parliament, elected by individual voters in all the member countries. The EU is run by a Commission that has the power to issue directives that require member countries to modify their own legislation, if necessary, to meet a common standard. These directives must be discussed by the European Parliament and approved by the member states before they come into effect. Several of these directives relate to topics, such as data protection and the protection of software, that are particularly important for IT professionals and we shall be referring to many of them later in the book.

In addition to the British national parliament, there are separate elected assemblies in Wales and Northern Ireland and a Scottish parliament. These have certain limited powers but they do not affect the topics covered in this book.

1.5 THE LEGISLATIVE PROCESS IN OTHER COUNTRIES

Although this book is concerned primarily with the UK, the influence and power of the United States in the world of information technology is so great that IT professionals need to know something of how government in the USA works.

In the US, the legislature is known as Congress. It consists of two houses, the Senate and the House of Representatives. Both houses are elected but on very different terms. Members of the House of Representatives (representatives) are elected for a period of two years. Each congressman represents a district and each district contains (roughly) the same number of people. The Senate contains two members (senators) for each state; senators are elected for seven years.

Legislation must be approved by both the Senate and the House of Representatives before it can become law; neither chamber can override the other. Furthermore, the President must also give his assent before an Act of Congress becomes law. Unlike the Queen, who cannot withhold her assent to legislation passed by Parliament, the President is allowed to veto legislation passed by Congress and this regularly happens. As in other countries with a written constitution, there is also a Supreme Court, which can strike out legislation approved by Congress and the President, on the grounds that it is unconstitutional. As we shall see in Chapter 14, this has happened with legislation concerned with pornography on the internet. This is in contrast to the situation in the UK, where the doctrine of the **sovereignty of Parliament** means that the courts cannot override primary legislation made by Parliament, although they can override secondary legislation.

The members of the government of the US are not members of Congress. The President is, in practice though not in theory, directly elected by the people. The members of the government are individuals chosen by the President and their appointment must be approved by Congress. The founders of the United States believed that it was very important to separate three functions, that of:

- the legislature, that is, Congress, which makes laws;
- the judiciary, that is, the judges and other legal officials, which applies and enforces these laws in particular cases; and
- the executive, that is, the President and the other members of the government, which carries on the actual business of government.

The separation of these functions is recognised in many other countries. Historically, they have not been separated in the UK but recent reforms, embodied in the Constitutional Reform Act 2005, have moved the UK much further in this direction by establishing a Supreme Court.

The legislative situation in the US is made more complicated by the fact that the country is a federation of 50 states. Each state has its own legislature, most of them modelled on the federal legislature, and its own government. On some topics each state can make its own laws but in other areas the law is made at federal level. For example, as we shall see in the next chapter, each state has its own laws regarding who can call themselves an engineer. The issue of states' rights, that is, the extent to which federal law can override laws made by individual states, has been a live political issue throughout the existence of the US and remains so today. Most recently, this has led the Federal Supreme Court to declare unconstitutional laws passed by individual states to regulate use of the internet. This issue of states' rights also arises in other countries with a federal constitution, such as India or Australia.

Smaller countries such as Singapore, Sri Lanka and Mauritius often have a **unicameral** legislature, that is, a parliament that consists of a single chamber. Where there is a historical connection with Britain, much of the legislation may be based on British legislation, as a way of avoiding the expense of law-making on a large scale.

1.6 THE LAW ACROSS BORDERS

What are the geographical limits of the jurisdiction of a country's courts? The immediate reaction is likely to be that a country's courts can only deal with crimes committed within the country's boundaries. This is not in fact true. Most countries would claim that their courts have the power, for example, to deal with a spy who passed on secrets to an enemy country, even though the passing on of the secrets took place on foreign soil. And many countries, including the UK, have legislation intended to combat sex tourism, that is, legislation that enables criminal charges to be brought in their courts against their citizens who have engaged in sexual activity with underage partners in foreign countries.

The development of the web and other innovations in the field of telecommunications has, however, created further problems. The very notion of the place where a crime is committed has ceased to be well defined. If a hacker sitting in an apartment in New York hacks into a European air traffic control computer located in the Netherlands so as to cause a mid-air collision over Denmark, where was the crime committed and which country's laws and legal procedures should be used in prosecuting the crime? What happens about an action that is criminal in some of the countries it affects but not in others – publishing obscene material over the internet is a case in point?

Closely related to these questions is the issue of extradition. Under what circumstances can a person be extradited, that is, sent from one country to another in order to face trial for an alleged offence?

Some recent cases have turned these questions into very live issues and we shall have more to say about them in later chapters. However, they are immensely complex questions and anything like a complete answer is well beyond the scope of this book.

Jurisdiction in civil cases that cross borders is in some ways a much simpler matter in that it is up to the claimant to decide in which country to initiate action. That decision will depend very much on the circumstances of the case but may well also be influenced by the reputation of a country's courts and how favourable its laws will be to the claimant's case.

FURTHER READING

Twenty years ago, it was difficult to get information about the legislative process in countries other than the one in which you were living. It meant going to specialist libraries or to the embassies of the countries concerned. The development of the web has changed all this and it is now very easy to obtain this material from websites.

The following pages explain how the legislative process works in the UK and in the US.

United Kingdom
www.parliament.uk

United States of America
www.house.gov/content/learn
www.senate.gov
http://bensguide.gpo.gov/9-12/lawmaking/index.html

Copies of acts of Parliament and acts of Congress for the past 30 years or so are available on the web.

In the US, most of the individual states have similar sites describing the legislative process in the state and, in many cases, most of the statutes of the state are available on the web.

Most other countries have similar sites, although the quality is variable.

2 THE COMPUTING PROFESSION

After studying this chapter, you should:

- *understand what is meant by the terms profession and professional, and be aware of the main professional bodies in the field of information technology;*
- *be familiar with BCS Code of Conduct and understand the obligations that it imposes on members;*
- *understand the concepts of reservation of title and reservation of function in the context of professional responsibility for public safety.*

2.1 THE CONCEPT OF A PROFESSION

Words like **profession** and **professional** are used in many different ways. Professional footballers are footballers who make their living from the game. Professional employees are employees of a certain status, who are expected, within limits, to put the interests of the organisation they work for above their own convenience. To describe someone as a real professional implies that they can be relied on to carry out their work competently and conscientiously regardless of the circumstances. A professional piece of work means a piece of work that meets established standards of quality. However, the terms can also have negative overtones – professional fouls are fouls committed deliberately by professional footballers who calculate that, on the balance of probabilities, the outcome will be in their favour.

There is no single definition of a profession. The meaning of the word depends on who is using it and what the context is. However, if we look at a range of occupations that would commonly be described as professions – lawyers, doctors, dentists, accountants, veterinary surgeons, architects and so on – we see that there are a number of characteristics that most of them have in common:

- Substantial education and training are required in order to practise the profession.
- The members of the profession themselves decide the nature of this training and, more generally, control entry to the profession.
- The profession is organised into one or more professional bodies.
- Members of the profession are expected to conduct their professional activities in accordance with codes of conduct laid down by the professional bodies and enforced by them.

Many, but by no means all, professions also enjoy a sort of monopoly: either the use of a certain title, such as architect, or the carrying out of certain functions, dentistry for example, or both, may be restricted by Act of Parliament to members of certain professional bodies. We shall discuss this in more detail later in this chapter.

A professional body usually starts by a group of people coming together because of a shared interest in a particular type of activity. There are many professional bodies in Britain and they cover a very wide range of professions, including the law, medicine, many different branches of science and engineering, accountancy, architecture, surveying and many others. BCS, The Chartered Institute for IT (BCS) was set up in 1957 as the British Computer Society by a group of people working in the new and expanding field of computers, who wanted the opportunity to exchange ideas. It currently has about 70,000 members. The Institution of Engineering and Technology (IET) is the other main body in the UK that includes information technologists among its members. It was formed in 2006 by a merger of the Institution of Electrical Engineers, which was set up in 1871 by people with an interest in the developing field of electrical engineering, and the Institution of Incorporated Engineers. It covers electrical engineering, electronic engineering and a number of other fields in addition to IT, and has a membership of around 150,000.

Although the role of professional bodies in the USA is somewhat different from their role in the UK, there are two professional computing bodies based in the USA whose importance is worldwide and immense. The Institute of Electrical and Electronic Engineers (IEEE) is a professional engineering society based in the USA but with members and activities spread worldwide. It was under the aegis of the IEEE that the first professional society in the field of computing was founded in 1946. This was the IEEE Computer Society (IEEE-CS); today it has over 100,000 members. It was closely followed by the **Association for Computing Machinery**, universally known as the ACM. This was founded in 1947 and now has over 75,000 members. Like the IEEE-CS, it is primarily an American organisation, but it has members and activities in many countries.

2.2 ROYAL CHARTERS

In the UK, any organisation that believes its main objectives are in the public interest can enter into discussions with the Privy Council with a view to being awarded a *royal charter*. A royal charter is a formal document, written in rather quaint language and signed by the monarch, which establishes the organisation and lays down its purpose and rules of operation. As they grow into mature organisations, most professional bodies seek and obtain a royal charter.

BCS was awarded its royal charter in 1984. The Institution of Electrical Engineers was awarded its first charter in 1921 and the IET received its charter in 2008, shortly after the merger.

The charter of BCS sets out very clearly the purposes of the institution:

> to promote the study and practice of Computing and to advance knowledge and education therein for the benefit of the public.

There follows a lengthy list of things that the institution is authorised to do in order to fulfil these purposes. The most important of these can be summarised as follows:

- establishing a code of conduct to regulate the way members of the body behave in their professional lives and a disciplinary procedure to discipline members who breach this code;
- promoting education in the field of computing;
- setting standards of education and experience that must be met by people wishing to become members of the body;
- establishing mechanisms for disseminating knowledge of good practice and new developments to its members, typically through publications and conferences but also through the use of the internet;
- to promote and support standards and codes of practice;
- to advise government and regulatory bodies about matters within its area of expertise.

In the following sections we shall look at the way that BCS addresses some of these functions.

2.3 PROFESSIONAL CONDUCT

The BCS charter specifically requires BCS to 'establish and maintain a sound ethical foundation for the use of computers...'. All professional bodies are under a similar obligation; this, indeed, is one of the most important characteristics of a professional body. It is normally done by laying down a code of conduct to which their members are required to adhere. A **code of conduct** sets out the standards of behaviour that members of the body are expected to follow in their professional life. Sometimes the code is called a code of ethics. It looks outwards, in the sense that it is concerned with the relationship between members and society as a whole. Although all codes of conduct have much in common, they also have significant differences, if only because the nature of the activities of different professions places different temptations in the path of their practitioners.

Codes of conduct should not be confused with codes of **practice**, which are concerned with the way in which the professional activities should be carried out.

BCS's Code of Conduct is currently divided into the following sections (please consult the BCS website for the latest version at www.bcs.org/codeofconduct):

1. The Public Interest
2. Professional Competence and Integrity
3. Duty to the Relevant Authority
4. Duty to the Profession.

2.3.1 The public interest

This section requires members to be aware of and comply with aspects of the law and regulations that govern acting in the public interest. For example, members need to safeguard public health, protect the environment, have due regard for privacy and human rights and avoid discrimination.

Some of these elements can cause problems for members working for clients or companies in countries whose governments practice or encourage systematic discrimination on, for example, grounds of race, religion or sexual orientation. Information systems developed in such countries often have such discrimination embedded in their design – this was certainly the case, for example, in some government information systems developed in South Africa during the era of apartheid. The effect of this clause is to forbid members of BCS from working on such systems.

The section is also concerned with the rights of third parties as well as copyright and intellectual property (which will be discussed in detail in Chapter 11).

Finally, the section invites members to take any opportunity to address the so-called digital divide, that is, the inequality that exists, for whatever reason, among different groups with respect to their ability to benefit from information and communication technologies. It includes, on the one hand, the lack of appropriate skills amongst many elderly people, which means they cannot take advantage of technologies that could very much improve the quality of their lives. On the other hand, it includes the gap between the way that middle-class children in Britain can use these technologies and the lack of facilities for children in rural Africa to do the same.

2.3.2 Professional competence and integrity

This section addresses what has been, and to some extent continues to be, a serious problem for the IT industry. Only too often, individuals and companies claim to be able to undertake work that they are not competent to carry out, and this leads to system failures. One of the most serious system failures, that of the London Ambulance Service's Computer Aided Despatch System, in 1994 (see Further Reading section), was caused, at least in part, by a small software company claiming expertise that it did not have. It was not deliberate deception: the company in question had so little expertise that it failed to recognise that the system required expertise that it did not have.

Under this section members are also required to keep their professional skills up to date and be familiar with the legislation that is relevant to their professional activities. Thus, web developers building an ecommerce site for a retail company are required to be conversant with legislation such as the Consumer Protection (Distance Selling) Regulations 2000 (see Chapter 14). A software engineer working on a railway signalling system would not be expected to be familiar with those regulations but should be familiar with the regulations laid down by the Rail Safety and Standards Board.

2.3.3 Duty to the relevant authority

This section starts by saying that members should carry out their professional duties with 'due care and diligence', that is, with the proper care and attention. This is what society has the right to demand of any professional.

The term 'relevant authority' means the person or organisation that has authority over what you are doing. If you are employed by an organisation, this is likely to be your employer; if you are an independent consultant, it will be your client; and if you are a student, it will be your school, college or university. In some cases, there may be several relevant authorities; for example, if you are a part-time student who is also employed part time, then the relevant authority as far as your work as a student is concerned will be your school or college but the relevant authority in your employment will be your employer.

According to this section, behaving professionally towards relevant authorities means, in particular, avoiding the following:

- *Conflicts of interest*: These are situations in which there are incentives that might encourage you to do things or take decisions that are not in the best interests of your relevant authority. If, for example, you have been asked by your employer to recommend a payroll package for your company and it happens that your sister works in the sales section of a company that supplies such a package, you might well be tempted to recommend that package, whether or not it is the most suitable for your company's needs. In such circumstances, you should explain the situation to your employer and suggest that it might be better to ask someone else to recommend a suitable package.
- *Disclosing confidential information without permission*: Confidential information may include technical information about a company's products, its financial position, sales leads and so on. (The law relating to confidential information is covered in more detail in Chapter 11).
- *Misrepresentation*: This is a failing that occurs only too often in the software industry. In their eagerness to make a sale, sales staff in particular, but also technical staff, will claim that software that they are selling will do things that, in fact, it will not, or they will claim their company is competent to do things that it cannot. Although most people will try to avoid making claims that they know are wrong, in many cases they will be prepared to claim things of which they are uncertain, if the claims seem plausible. The Code forbids such behaviour.

2.3.4 Duty to the profession

Like other professionals, information systems professionals have not always had a good press. System developments have been plagued by delays, budget overruns and complete failures, and these have been well publicised. Too often, the systems themselves do not meet the needs of their users. And information systems professionals have, on occasions, been perceived as behaving in an unprofessional manner. The purpose of this section of the Code is to impress on members what is expected of them in order to uphold the reputation and good standing of BCS in particular, and the profession in general.

2.3.5 Status of professional codes of conduct

Like most professional bodies, BCS has procedures that allow it to take disciplinary action against members who infringe the Code, with expulsion as the ultimate sanction. Where membership of the professional body confers a licence to practise, as in the case of the Law Society for example, this is a very serious punishment, since expulsion deprives expelled members of the right to earn their living in their chosen profession. Even in the case of BCS, expulsion or other sanctions, although not directly affecting a member's ability to earn a living, can certainly affect their professional standing. A member who has been subject to disciplinary action can thus take the matter to the civil courts, which will expect the disciplinary proceedings to have been conducted in accordance with the rules of natural justice. This places limits on the extent to which codes of conduct can be enforced.

Most codes of conduct contain some very precise rules and some rather vague or aspirational ones. Clause (e) in the *Duty to the Profession* section of the BCS Code of Conduct is an example of a very precise rule. It states:

> [You shall] notify BCS if convicted of a criminal offence or upon becoming bankrupt or disqualified as a Company Director and in each case give details of the relevant jurisdiction.

This is quite clear. There is little doubt about what it means and, in any specific case, it should be clear whether a member has complied with this rule. There is no difficulty in taking action against a member who has broken this rule.

The first clause of the *Public Interest* section, on the other hand, is much vaguer:

> [You shall] have due regard for public health, privacy, security and wellbeing of others and the environment.

Although no one can quarrel with this precept, there may not be general agreement as to whether a particular development is or is not consistent with improvement in public health, safety and the environment. Some people would regard any work carried out for the nuclear industry as being detrimental to public health, safety and the environment. Others will argue that the use of nuclear power stations to generate electricity is beneficial to the environment because it avoids carbon dioxide emissions. It would thus be unreasonable for the Institute to take disciplinary action against members working in the nuclear industry, even though many other members might feel passionately that such work was dangerous to health, safety and the environment.

2.4 EDUCATION

BCS promotes education in a number of ways:

- it runs its own system of professional examinations and grants approval to suitable organisations that provide courses to prepare students for them;

- it accredits degree programmes offered by universities and other institutions of higher education;
- it designs and franchises short courses leading to qualifications in specific areas.

2.4.1 Higher education

BCS offers examinations to students in higher education. These consist of three stages, the **Certificate**, the **Diploma** and the **Professional Graduate Diploma**. As well as the normal written examinations, projects are assessed at Diploma and Professional Graduate Diploma levels. The Professional Graduate Diploma with the project is considered to be the equivalent of an honours degree.

A few other computer societies operate examination schemes. The Australian Computer Society has, for a number of years, operated its own system of examinations, somewhat comparable with the BCS Certificate and Diploma examinations but without the project. The IEEE-CS has recently introduced a scheme that allows someone with 9,000 hours of appropriate professional experience to take an examination set by the Society and, if successful, to be registered with the IEEE as a Certified Software Development Professional.

2.4.2 Accreditation and exemption

The term accreditation is used with a confusing variety of related meanings. In the present context, it refers to the process by which a professional body recognises specific academic awards made by specific institutions of higher education as satisfying, wholly or partly, the academic requirements for professional membership. Awards that are recognised in this way are referred to as accredited awards and the courses that lead to them are referred to as accredited courses. It is in this sense that the term is used by a range of professional bodies in such fields as medicine, law, engineering and science.

In deciding whether to accredit an award, BCS takes into consideration:

- the academic content of the programme, to see whether it meets the Institute's requirements, which are based on the computing benchmark statement produced by the UK Quality Assurance Agency for Higher Education;
- the quality of the learning and teaching facilities provided for students, including laboratory facilities and staff qualifications;
- the quality control and assurance procedures of the institution offering the award.

The process involves a written submission and a visit by a BCS panel during which there will be meetings with both staff and students.

2.4.3 Professional certifications

BCS offers a substantial range of qualifications, known as certifications, which are achievable through short courses. The courses are intended as training courses for staff working in the industry. Typically, they last around 40 hours.

Courses are available in a wide range of topics including, for example, business analysis, sustainable IT, IT governance and information security, project management and support, and software testing.

At the level of the computer user rather than the systems developer, BCS manages and promotes the European Computer Driving Licence (ECDL) in the UK on behalf of the ECDL Foundation. This is a European-wide qualification, which enables people to demonstrate their competence in computer skills. It is designed specifically for those who wish to gain a basic qualification in computing to help them with their current job, develop their IT skills, and enhance their career prospects.

2.5 THE ADVANCEMENT OF KNOWLEDGE

The royal charter of BCS states very specifically that one of its objects is to advance knowledge of computing, and many other professional bodies include this among their objects. In practice, however, much of the research that contributes to the advancement of knowledge takes place in universities and in research establishments both public and private. As a result, professional bodies tend to be more concerned with the dissemination of knowledge through their publications, conferences that they organise or sponsor and various other activities.

One of the first actions of BCS when it was formed was to establish *The Computer Journal*. The first issue was published in 1958 and it has been published regularly ever since. The journal carries articles that present the results of research carried out in industry, in research establishments and in universities all over the world. The IET publishes a number of journals covering various topics in IT, including *IET Software*, which concentrates on new developments in software engineering, and *IET Networks*.

Most of the articles in *The Computer Journal* and the IET journals are targeted at specialists. For the information systems professional who is not engaged in research and development, the three most useful publications are probably *Computer* (the flagship publication of the IEEE-CS), *IEEE Software* and the *Communications of the ACM*. These contain authoritative articles on new developments and current issues written at a level that practising professionals can understand.

BCS also supports a considerable number of specialist groups. These groups bring together people with interests in specific areas. They cover a wide range of specialist areas, from artificial intelligence to software testing, from human computer interaction to law. They are particularly effective in spreading knowledge of good practice because they bring together practitioners from different organisations, all working in the same field, who learn from each other. Many specialist groups have gone on to develop an extensive range of resources, from books and reports to special software, to disseminate knowledge about their specialist topic.

2.6 CONTINUING PROFESSIONAL DEVELOPMENT

For many years, little attention was given to how professionals kept their knowledge up to date after qualifying. Thus, it was possible for a doctor, a dentist or a solicitor

to practise for 40 years without any formal requirement to update their knowledge. Of course, most professionals were aware of the need to do this and would take whatever opportunities are available. Nevertheless, these opportunities might not be readily available and the pressures of day-to-day work might make it difficult for busy professionals to take advantage of them.

The increasing rate at which new knowledge was becoming available and existing knowledge was being used in new ways led, in the 1970s, to increasing concern that professionals should keep their qualifications up to date and this process became known as **continuing professional development** (CPD). It can be defined as the systematic maintenance and improvement of professional knowledge and skills throughout an individual's professional working life.

2.6.1 CPD services to individual members

In common with other professional bodies, BCS supports CPD both by providing a formal structure through which it can be recorded and assessed, and by providing some of the means by which it can be achieved. For example, all members of BCS receive a copy of its monthly publication, *ITNOW*, which helps to keep them aware of new developments and current topics of interest to the profession. Additionally, the Institute provides its members with many opportunities for CPD through its branches and specialist groups. These provide an opportunity for members to meet together to share experiences, talk about common problems and listen to talks about new developments both technical and professional.

Although CPD serves to encourage professionals to keep their expertise up to date, there is a real danger that the knowledge and experience that qualified a member for a professional grade within the Institute may atrophy if they are not used. Accordingly, BCS offers a service to allow members to revalidate their skills every five years so that they can demonstrate to employers that these skills have been maintained.

2.6.2 Career development and CPD services to the industry

For many years, managing IT staff presented problems to their employers. The chronic shortage of qualified and experienced staff together with the rapid pace of change made the problems particularly acute for large user organisations. Such organisations were faced with the problem of where to place IT specialists in their staffing structures. Because of their scarcity, such staff could command high salaries but, elsewhere in the organisation, such salaries would be associated with substantial managerial responsibility. IT staff were anomalies who provoked both envy and disdain among their colleagues.

BCS started to tackle this problem in the mid-1980s with the development of the Industry Structure Model (ISM) – now SFIAplus, an enhanced model based on the Skills Framework for the Information Age (SFIA). The SFIA is a common reference model for the identification of IT skills, which has been developed by the SFIA Foundation, a not-for-profit organisation set up and owned by BCS, the IET, the Institute for the Management of Information Systems and e-skills UK, an industry body.

Such a model means that a large employer has a systematic way of structuring IT roles and is therefore in a much better position to address the problems referred to above.

2.7 REPRESENTING THE PROFESSION

Professional bodies are widely regarded as the source of the most authoritative advice on their disciplines. It is normal, therefore, for them to be consulted by the government about changes in the law as it affects the discipline or is affected by it. This consultation may extend over a period of several years, as happened, for example, when BCS was consulted over the EU Directive on Data Protection and the 1998 Data Protection Act. As well as such official consultation, professional bodies are also regularly invited to talk to groups of members of parliament who are interested in their disciplines.

Professional engineering bodies are also routinely asked by standardisation bodies, such as the American National Standards Institute or the British Standards Institute, to nominate members of committees developing standards in the field. Indeed, the IEEE itself runs the standards-making process in the field of local area networks through its Project 802.

Individual BCS members are also able to influence and shape policy by playing an active part in discussions and contributing to consultations from government and other bodies on a wide range of professional, economic and societal issues through joining the BCS 'policy hub'.

2.8 MEMBERSHIP GRADES

BCS has three major membership categories: standard grades, professional grades and chartered professional status. Membership in the professional grades requires degree level qualifications in IT or substantial experience. For chartered professional status, both degree level qualifications and substantial experience are required.

The criteria for membership in the professional and chartered professional grades are flexible but, for that very reason, they are complicated. The BCS website should always be consulted for precise and up-to-date information.

Membership at any level requires a commitment to compliance with the Institute's Code of Conduct. There are two professional grades: Member and Fellow, and members are entitled to use the letters MBCS after their name. Fellow is the most senior professional grade. It is open to applicants who can demonstrate a minimum of five years' IT practitioner experience and hold a senior IT position or who have an established reputation of eminence or authority in the field of IT. Fellows may use the letters FBCS after their names.

To achieve Chartered IT Professional (CITP) status you will be a professional Member or Fellow and will have spent at least three of the last five years working in an IT role carrying significant responsibility, full accountability and presenting a challenging range of complex work activities. Chartered IT Professionals are entitled to use the letters CITP after their names, along with their membership post-nominal (MBCS or FBCS).

In addition to awarding CITP status, the Institute is licensed by the Engineering Council to award Chartered Engineer (CEng) status and Incorporated Engineer (IEng) status, and by the Science Council to award Chartered Scientist (CSci) status.

2.9 RESERVATION OF TITLE AND FUNCTION

As mentioned at the beginning of this chapter, in certain cases, where it is considered to be in the public interest, the members of a profession may be granted some sort of legal monopoly. There are two different ways in which this can be done. First, the use of the name of the profession may be restricted to those people who are appropriately qualified. A restriction of this sort is called **reservation of title**. In the UK, for example, the Architects Act 1997 makes it a criminal offence to call yourself an architect unless you are registered with the Architects Registration Board.

Secondly, the law may state that certain activities are restricted to people with appropriate qualifications or to members of particular specified professional bodies. This is called **reservation of function**. For example, in England and Wales, only members of the Institute of Chartered Accountants in England and Wales and the Association of Certified Accountants are allowed to audit the accounts of public companies. Auditing accounts is an example of reservation of function where there is no corresponding reservation of title. Anyone can call himself or herself an accountant, provided this is not done for fraudulent purposes.

An example where both reservation of title and reservation of function apply is veterinary surgery. Under the Veterinary Surgeons Act 1966, you are not allowed to call yourself a veterinary surgeon unless you are registered with the Royal College of Veterinary Surgeons (RCVS); in order to be registered you must have the proper qualifications. And, subject to certain limitations, it is a criminal offence to carry out surgical procedures on animals unless you are registered with the RCVS.

In the US, title and function are usually reserved not to members of professional bodies but to people whose names are on a register maintained by a state government. In the UK, a somewhat similar provision has been in operation for many years for doctors and dentists. Recent developments have shown a tendency for the UK to move further in the same direction. For example, until the passage of the Architects Act 1997, it was an offence to 'practise or carry on business under any name, style or title containing the word "architect"', unless you were a member of the Royal Institute of British Architects (RIBA). The 1997 Act established the Architects Registration Board, registration with which now replaces membership of the RIBA as the requirement for calling yourself an architect. The reason for this change is that professional bodies are often seen as white-collar trade unions, which use their monopoly power to limit competition and maintain high charges for their services, while doing little to enforce the codes of conduct that they publish.

Whatever the mechanism adopted, there are strong arguments for protecting the public by ensuring that only suitably qualified people are allowed to practise professions in which unqualified people can do serious damage, be it physical or economic. It was a series of civil engineering disasters that led to the introduction of a licensing scheme for engineers in the USA in the 1920s and 1930s. A number of disasters can be traced directly to lack of professional competence on the part of the software engineers who developed the systems. Therac 25 (see the Further Reading section) in the US and the London Ambulance System in the UK are only two of many examples that show how the professional incompetence of software developers can lead to avoidable deaths. In both these examples, the developers lacked any professional qualifications in software engineering and were ignorant of such elementary topics as the risks of concurrent access to shared memory and the dangers of dynamic memory allocation, as well

as many more advanced topics. Although the immediate cause of the failure of these systems was programming error arising from ignorance of elementary topics, these errors occurred in a context that showed a much broader lack of professionalism. It is not surprising, therefore, that there have been calls for the compulsory registration of software engineers and for legislation to ensure that software engineering activities are carried out under the supervision of registered software engineers.

Some members of the profession have advocated a legal requirement that all software must be written by registered software engineers, or at least under their supervision. Such a regulation would be impossible to enforce. The number of people qualified to be registered as software engineers is vastly fewer than the number of people developing software. If such a regulation were introduced, the amount of new software that could be developed would be enormously reduced or, more likely, software development would go underground. Furthermore, there would be considerable opposition to the regulation. Many software developers would see it as an attempt to establish a monopoly by a small number of people with specific qualifications, with the intention of pushing up their own earnings. The public would share this view and see the move as unnecessary, because most software is not critical.

It would be more realistic and more defensible to require that the design and implementation of all 'critical' systems should be under the control of a registered software engineer; in the UK, this would probably mean a chartered engineer or a CITP whose experience and qualifications are in software engineering. By a critical system we mean a system whose failure to operate correctly could result in physical injury or loss of life, or catastrophic economic damage. Society is justified in demanding that such systems are designed and implemented by properly qualified and experienced engineers.

One difficulty is that the boundary between critical and non-critical systems is not always well defined. Although it is clear that an air traffic control system should be considered critical, because a failure can result directly in loss of life, should we consider a medical records system to be critical, because the loss of information concerning, say, a patient's allergy to penicillin could in some circumstances lead to the death of the patient? A second difficulty is that many software engineers have not studied the rather specialised techniques needed for working on critical systems. Nor, for the jobs they are doing, is it necessary that they should.

In the UK context, compulsory reservation of function for software engineers, even for critical systems work, is unlikely to be realistic except as part of a move towards reservation of function for engineers more generally. The UK has shown no inclination to follow the US in making registration of engineers compulsory and there is little likelihood of this happening. If anything, it is indirect pressures from the Health and Safety Executive or from insurers providing professional indemnity insurance that is likely to increase the emphasis on registration as CEng or CITP.

In the US, the certification and registration of software engineers remains a contentious issue, although there has been some progress towards integrating software engineering into the more general schemes for registration of engineers. However, since such registration is carried out at the level of the individual state, progress is extremely slow.

A large number of vendor or product specific qualifications are now available and serve further to confuse the situation. Although such qualifications are useful for demonstrating

that individuals have specific expertise, they are of little relevance when it comes to ensuring that critical systems are built by people who know what they are doing.

FURTHER READING

The websites of the main professional bodies referred to in this chapter are as follows:

- BCS, The Chartered Institute for IT
  www.bcs.org
- Institution of Engineering and Technology
  www.theiet.org
- IEEE – Computer Society
  www.computer.org/portal/web/guest/home
- Association for Computing Machinery
  www.acm.org

All four websites include the organisation's code of conduct/ethics, as well as much information about the organisations and the way they function. The websites of BCS and the IET also include the full text of their royal charters.

Websites of the two international bodies connected to BCS:

- International Federation for Information Processing
  www.ifip.or.at
- Council of European Professional Informatics Societies
  www.cepis.org

Website of the SFIA foundation:
www.sfia-online.org

The authoritative description of the London Ambulance Service disaster was published as follows:

Thames Regional Health Authority. (1993) *Report of the Inquiry into The London Ambulance Service*. Communications Directorate, South West Thames Regional Health Authority.

This report and some related material are also available on the web:
www0.cs.ucl.ac.uk/staff/A.Finkelstein/las/lascase0.9.pdf

The Therac 25 disaster is described in a number of books and articles, such as the following readily available source:

Leveson, N. and Turner, C. S. (1993) 'An Investigation of the Therac-25 Accidents'. *IEEE Computer*, 25, No. 7, 18–41.

An updated version of the paper is also available on the web:
http://sunnyday.mit.edu/therac-25.html

INDEX

ability tests 92
accountability 32–3
accounting
  financial 55–69
  management 70–8
accounting rate of return 85
accreditation 14
ACM (Association for Computing Machinery) 9
administration 38
age discrimination 112
All-Party Parliamentary Internet Group 177–8
annual report 55
anti-discrimination legislation 94, 104–13
appraisal schemes 96–8
aptitude tests 92
Architects Act (1997) 18
articles of association 25
assets 57–61
Association for Computing Machinery 9

balance sheet 55
  commercial 57–61
  for a student 56–7
balancing item 57
BCS (British Computer Society) 9
BCS Code of Conduct 10, 17, 93
  and the public interest 11
  duty to the profession 12
  duty to the relevant authority 12
  health and safety issues 144
  professional competence and integrity 11
  status of 13
bespoke software company, organisational structure 43–4
bespoke software contracts 136–7
  acceptance procedure 138–9
  intellectual property rights 137
  management of 138
  termination of 139
bicameral legislature 3
bill of Parliament 4
budgets 70–3
burden of proof 2
bureaucratic organisational model 35–6
business angels 52
business plans 49–50

CAN SPAM Act (2004), USA 171–2
Cantor Fitzgerald v. Tradition (UK) 120–1, 123
capital, cost of 83
capital for start-ups 48–9
career development 16
cash flow forecasts 76–8
cash flow statements 64–8
cash flows
  financial 84
  timing of 83
  see also discounted cash flow
cash requirement 77
CEng (Chartered Engineer) 17, 19
centralisation 43
certifications 14–15
chartered professional status 17
charters 9–10, 24, 33
CITP (Chartered IT Professional) 17, 19
civil law 2, 3, 161
claimant 2
cloud computing 136
CMA *see* Computer Misuse Act
code of conduct 10, 13, 17, 93, 144
commercial balance sheets
  assets 57–61
  liabilities and owners' equity 61
commercial organisations 21–3
  limited companies 23–5
common law 3
Companies Act (1948) 25
Companies Act (2006) 24, 25, 26
company limited by guarantee 33
company setup 24–5
competence 11
computer fraud 180–1
Computer Misuse Act (1990) 175–7
  amendments to 177–8
  operation of 178–80
computing profession 8–20
conduct *see* BCS Code of Conduct
confidential information 115, 122–5
conflicts of interest 12
Congress 5
constitution of a limited company 25
Constitutional Reform Act (2005), USA 6
constructive dismissal 100
consultancy contracts 139–40
Consumer Protection (Distance Selling) Regulations (2000) 173

continuing professional development (CPD) 15–16, 93
contract hire 139
contracts
  bespoke software 136–9
  for consultancy and contract hire 139–41
  of employment 101–2, 182–4
cooperatives 23
copyright 115, 116
  allowable actions 118
  and intellectual property rights 137
  databases 118
  infringement 118–19
  legislation 119
  licensing and assignment 119
  rights of copyright owner 117
  software case examples 119–22
Copyright, Designs and Patents Act (1988) 5, 116, 119, 125–6, 128
core business 37
corporate bonds 52
cost of capital 83
cost of labour 73–4
'cost plus' contract 140
Council of Europe 160, 161
CPD (continuing professional development) 15–16, 93
Criminal Justice and Immigration Act (2008) 166
criminal law 2, 160
cronyism 92
cross-border legislation 6–7, 160–1
cumulative present value 84
cyber squatting 131
cybercrime, international convention on 160–1

Data Protection Act (1984) 145, 150
Data Protection Act (1988) 17, 136
  background to 145–6
  operation of 152–3
  principles 147–50
  rights of data subjects 150
  scope of 151
  terminology 146–7
data subjects, rights of 150
databases, copyright in 118
DCF *see* discounted cash flow
defamation 161–4
Defamation Act (1996) 162
defective software liability 141–3
denial of service attacks 177, 178–9
depreciation 57, 59, 60, 63, 65, 66
direct costs 71, 73, 74, 75
direct discrimination 105–6
directors 25–6
disability discrimination 109–12
Disability Discrimination Act (1995) 109–10
disclosure requirements 55
discount factor 80
discounted cash flow (DCF) 79–80
discrimination 105–6
  avoidance of 112–13
  legislation against 104–5
  on grounds of age 110
  on grounds of disability 109–12
  on grounds of race 109
  on grounds of sex 106–8
dismissal
  and redundancy 99–100
  constructive 100
  unfair 98–9
  wrongful 101
domain names 130–1
DPA *see* Data Protection Act

ECDL (European Computer Driving Licence) 15
ecommerce regulations 173–4
education 13–14
  accreditation 14
  and sex discrimination 108
  higher education 14
  professional certifications 14–15
EHRC (Equality and Human Rights Commission) 104, 108, 109, 111
Electronic Commerce (EC Directive) Regulations (2002) 158, 167–8, 174
employment contract 101–2, 182–4
employment legislation, sex discrimination 107
Employment Rights Act (1996) 89, 124
empowerment 97
Enterprise and Regulatory Reform Bill/Act (2013) 89, 98, 124–5
Equality Act (2010) 90, 104, 105–6, 109, 112
Equality and Human Rights Commission (EHRC) 104, 108, 109, 111
equity capital 52
European Community Directive on Privacy and Electronic Communications (2002) 171
European Computer Driving Licence (ECDL) 15
European Patent Convention 125–6, 128
European Union (EU) 5
extradition 7, 180
extradition treaty 160
extraterritorial jurisdiction 160

finance for start-up companies 48–53
finance sources 49–52
financial accounting
  balance sheet 55–61
  cash flow statement 64–7
  disclosure requirements 55
  overall picture 67–8
  profit and loss account 61–4
flexible centralisation 43
FoI *see* Freedom of Information Act
fraud 180–1
Fraud Act (2006) 180
free software 134–5
freedom of information 151, 154–5
Freedom of Information Act (1967), USA 155
Freedom of Information Act (2000), UK 146, 154–5
function-based organisational structure 37–8
function, reservation of 18–20

gearing 53
General Agreement on Tariffs and Trade (GATT) 130

geographically-based organisational structure 39
goodwill 60
grants 50–1
green paper 4
grievance procedures 100, 184

hacking 152, 175, 178–9, 180
health and safety 143–4
Health and Safety at Work Act (1974) 27, 143, 144
higher education 14
House of Commons 3–4
House of Lords 3–4
House of Representatives 5
human resources 88
  appraisal schemes 96–8
  contracts of employment 101–2
  HR planning 102–3
  job evaluation 94–6
  legal context 88–91
  recruitment & selection 91–3
  redundancy and dismissal 98–101
  remuneration 93–4
  staff training & development 93

ICANN (Internet Corporation for Assigned Names and Numbers) 130–1
ICRA (Internet Content Rating Association) 168–9
IEE (Institution of Electrical Engineers) 9
IEEE-CS (IEEE Computer Society) 9, 14, 15
IEEE (Institute of Electrical and Electronic Engineers) 9, 14, 17
IET (Institution of Engineering and Technology) 9, 15, 16
income and expenditure accounts 61–2, 65
incorporation 2
indirect discrimination 106
individual privacy 146
industrial relations 89
Industrial Relations Act (1971) 90
Industry Structure Model (ISM) 16
inflation 83–4
Information Commissioner's Office (ICO) 152–3, 155
Institute of Electrical and Electronic Engineers (IEEE) 9, 14, 17
integrity 11
intellectual property rights 114, 137
  confidential information 122–5
  copyright 116–22
  intellectual property 114–16
internal rate of return (IRR) 85–6
international convention on cybercrime 160–1
Internet Content Rating Association (ICRA) 168–9
Internet Corporation for Assigned Names and Numbers (ICANN) 130–1
internet service providers (ISPs)
  and CAN SPAM Act, USA 172
  and defamation law 162–3
  and pornographic material 167–8
  and RIPA 154
  civil law case study 161
  family friendly filter 169–70
  role of 148–9
interviews 91
investment appraisal
  example of simple DCF analysis 81–4
  investment proposals 79–80
  pitfalls of DCF analysis 86
  software product proposal 84–6
  time value of money 80–1
investment proposals 79–80
IRR (internal rate of return) 85–6
ISM (Industry Structure Model) 16
ISP *see* internet service providers
IWF (Internet Watch Foundation) 167–8, 169

job descriptions 91
job design 44–6
job enrichment 46
job evaluation 94–6
job rotation 45–6
jurisdiction 1

knowledge advancement 15

labour costs 73–4
law 1
  across borders 6–7, 160–1
  criminal and civil 2
  sources of 3
Leahy-Smith America Invents Act (2011) 129
legal person 2
legislation 3
legislative process
  in other countries 5–6
  in the UK 3–5
leverage 53
liabilities 55, 56, 57, 58, 61, 77
liability for defective software 141–3
libel 162
licences/licensing 119, 125, 137
  licence agreements 134–5
limited companies 23–4
  constitution of 25
Limited Liability Partnership Act (2000) 22–3
LLP (limited liability partnership) 22–3
loans 51–2
Local Government Act (1992) 32
long-term loans 51

management accounting 70
  allocation of overheads 74–5
  budgets and overheads 70–3
  cash flow forecast 76–8
  cost of labour 73–4
management buyouts 30
management by objectives (MBO) 96–7
market sector-based organisational structure 40
marketing licences 135
matrix management 37
MBO (management by objectives) 96–7
membership grades, BCS 17–18
memorandum of association 25
mergers 29–30
misrepresentation 12
mixed organisational structure 40
model article 25

National Insurance contribution 73
natural person 2
Navitaire Inc. v. easyJet and Bulletproof Technologies Inc 121–2
nepotism 92
non-commercial bodies
  non-profit-making bodies 33
  statutory bodies 31–3
non-profit-making bodies 33
NPV (net present value) 81, 82, 83, 84, 85, 86

obligation of confidence 122
Obscene Publications Acts (1959 and 1964) 165–6
off-shoring 31
open-source software licences 134–5
operational organisational structure 41–2
operations 37
opportunity cost 83
Oracle Corp versus SAP AG 122
organic organisational model 36–7
organisational models 35–7
organisational structures
  by market sector 40
  depth of structure 42–3
  function-based 37–8
  geographically-based 39
  operational 41–2
  product line 39–40
  setting up 43–4
  technology-based 41
organisations
  commercial 21–4
  constitution of limited company 25
  directors 25–7
  limited companies 23–4
  mergers 29–30
  non-commercial 31–3
  outsourcing 30–1
  role of 21
  setting up a company 24–5
  takeovers 27–9
outsourcing 30–1
  contracts for 135
  HR issues 100–1
overdrafts 51
overheads 70–3
  allocation of 74–5

parliament 3
Partnership Act (1890) 22
partnerships 22
patents 115, 125–7
  enforcing 127
  obtaining 127
  software 128–9
Patents Act (1977) 125–6
pay-back period 84
payroll cost 73
Perreira and Oroyan v. US Federal Government 119–20
personality tests 92
PIDA (Public Interest Disclosure Act) 101, 124
PJA (Police and Justice Act) 175, 178
plaintiff 2
PLC/plc (public limited company) 23
Police and Justice Act (2006) 175, 178
pornography 164–5
  future developments 169–70
  Internet Content Rating Association (ICRA) 168–9
  Internet Watch Foundation (IWF) 167–8
  legislation in UK 165–6
  regulation in other countries 166–7
precedents 3
primary legislation 4
privacy 146, 153–4
product line organisational structure 39–40
production-based structures 41–2
profession, concept of 8–9
professional certifications 14–15
professional competence and integrity 11
professional conduct 10–13
profiled budget 72
profit and loss account 61–4
project-based structures 41–2
proof 2
Protection of Children Act (1978) 166
provision of goods and services, sexual discrimination 108
psychometric tests 92
public interest disclosure 101, 124–5
Public Interest Disclosure Act 1998 (PIDA) 101, 124
public sector 31–3

quality assurance (QA) 14

Race Relations Act (1965) 109
racial discrimination 109
ratification 160
recruitment 91–3, 107
redundancy 99–100
references, assessment of 92
registration
  domain name 131
  of telephone numbers 172–3
  with professional body 18–20
Regulation of Investigatory Powers Act 2000 (RIPA) 153–4
remuneration policies 93–4
representation of profession, professional bodies 17
research and development (R&D) 38
reservation of title and function 18–20
RIPA (Regulation of Investigatory Powers Act) 153–4
royal assent 4
royal charters 9–10, 24, 33

Safe Harbour Privacy Principles 150
Sale of Goods Act (1979) 142
sales forecasts 102
sales & marketing 38
secondary legislation 4–5
selection techniques 91–2
Senate 5
service level agreement 135
sexual discrimination 106–8
SFIA (Skills Framework for the Information Age) 16
shareholders' agreement 25
simple pay-back period 84
simple return on investment 85
situational assessment 92
Skills Framework for the Information Age (SFIA) 16
slander 162

social security contributions 73
soft loans 52
software contracts 133
  for bespoke systems 136–9
  for consultancy and contract hire 139–41
  health & safety issues 143–4
  liability clauses 141–3
  licence agreements 134–5
  outsourcing 135–6
software licence agreements 134–5
software patents 128–9
sole traders 22
sovereignty of Parliament 5
SPAM 170–1
  European legislation 171
  registration 172–3
  US legislation 171–2
span of control 42, 45
Special Educational Needs and Disability Act (2001) 109
'spoofing' 172–3
staff training 93
staffing forecasts 103
standard of proof 2
start-up company finance 48–53
statute law 3
statutory bodies 31–3
structure of organisations *see* organisational structures
Supply of Goods and Services Act (1982) 142

takeovers 27–9, 100–1
task assessment 92
technology-based organisational structure 41
the public interest 11
time and materials contract 140–1
time value of money 80–1
title, reservation of 18–20
trade marks 115, 129–30
Trade Marks Act (1994) 129, 130
trade secrets 123
trade unions 89–90, 94, 100
training, staff 16, 93
Transfer of Undertakings (Protection of Employment) (TUPE) Regulations 101
Trustee Board, BCS 33
TUPE regulations 101

UK Commission for Employment and Skills (UKCES) 93
UML (Unified Modelling Language) 124
unauthorised access offence 175, 176, 177–8
Unfair Contract Terms Act (1977) 134, 141, 142
unfair dismissal 98–9
unicameral legislature 6
Uniform Domain Name Dispute Resolution Policy (UDRP) 131
unsolicited email *see* SPAM

venture capitalists 52

W3C (World Wide Web Consortium) 110–11
Web Accessibility Initiative (WAI) 110–11
Web Content Accessibility Guidelines (WCAG) 110–11
whistle blowers 101, 124
white paper 4
WIPO (World Intellectual Property Organization) 127, 129, 131
working capital 61
write down, asset value 59
wrongful dismissal 101

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