

## 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](http://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 SFIPlus, 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](http://www.bcs.org)
- Institution of Engineering and Technology  
[www.theiet.org](http://www.theiet.org)
- IEEE – Computer Society  
[www.computer.org/portal/web/guest/home](http://www.computer.org/portal/web/guest/home)
- Association for Computing Machinery  
[www.acm.org](http://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](http://www.ifip.or.at)
- Council of European Professional Informatics Societies  
[www.cepis.org](http://www.cepis.org)

Website of the SFIA foundation:

[www.sfia-online.org](http://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:

[wwwO.cs.ucl.ac.uk/staff/A.Finkelstein/las/lascase0.9.pdf](http://wwwO.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>