

G52GRP: Lecture 5

Professionalism

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G52GRP: Lecture 5 – p.1/32

What is a Profession? (1)

Wikipedia:

“A profession is an occupation that requires extensive training and the study and mastery of specialized knowledge, and usually has a professional association, ethical code and process of certification or licensing.”

G52GRP: Lecture 5 – p.3/32

This Lecture

- The nature of profession
- Professional bodies
- Reservation of Title and Function
- Software Development and Engineering
- Discussion: Should Software Engineering be Regulated?

Main reference:

Frank Bott. *Professional Issues in Information Technology*. Chapters 2–3.

G52GRP: Lecture 5 – p.2/32

What is a Profession? (2)

Some occupations that usually would be described as “professions”:

- lawyer
- doctor
- dentist
- accountant
- architect
- teacher

G52GRP: Lecture 5 – p.4/32

What is a Profession? (3)

Characteristics common to many:

- **substantial education and training** required
- the **members** of the profession themselves decide the nature of the training and **control entry** to the profession
- the profession is organised into one or more **professional bodies**
- the profession lays down **standards of conduct** with which its members must comply.

(But rules do vary from country to country.)

G52GRP: Lecture 5 – p.5/32

Functions of Professional Bodies (1)

Typical functions developed by professional bodies:

- **setting standards of education and experience** that must be met by its members
- **accreditation** of e.g. university courses that are judged to meet these standards to facilitate entry
- establishing a **code of conduct** to regulate how members behave in their professional lives

G52GRP: Lecture 5 – p.6/32

Functions of Professional Bodies (2)

- establishing mechanisms for **disseminating knowledge** of good practice to its members
- **advising government and regulatory bodies** about matters within its area of expertise.

G52GRP: Lecture 5 – p.7/32

Some Professional Bodies: IEE

- **IEE**: The Institution of Electrical Engineers
 - British-based engineering society
 - Founded 1871
 - 130 000 members worldwide, many in IT.

G52GRP: Lecture 5 – p.8/32

Some Professional Bodies: IEEE

- **IEEE**: The Institute of Electrical and Electronic Engineers
 - USA-based engineering society
 - Activities and members across the world
- **IEEE-CS**: IEEE Computer Society
 - Founded 1946
 - First professional society in computing
 - 100 000 members worldwide

G52GRP: Lecture 5 – p.9/32

Some Professional Bodies: ACM

- **ACM**: Association for Computing Machinery
 - Founded 1947
 - **Learned society**:
 - “The Association for Computing Machinery is an international scientific and educational organisation dedicated to advancing the arts, sciences, and applications of information technology.”
 - 80 000 members worldwide
 - Conferences
 - Publications
 - The Turing Award

G52GRP: Lecture 5 – p.10/32

Some Turing Award Winners

- **2005** Peter Naur: Algol 60, Backus-Naur Form (BNF)
- **2004** Vinton G. Cerf, Robert E. Kahn: Pioneering work on the Internet (TCP/IP)
- **2002** Leonard M. Adleman, Ronald L. Rivest, Adi Shamir: Public-key cryptography.
- **1991** Robin Milner: LCF, ML, CCS
- **1983** Dennis M. Ritchie, Ken Thompson: UNIX
- **1972** Edsger W. Dijkstra: profound impact on programming practice

G52GRP: Lecture 5 – p.11/32

Some Professional Bodies: BCS

- **BCS**: British Computer Society
 - Founded 1957
 - Initially a learned society, the British equivalent of the ACM
 - Increasingly a professional, qualifications-awarding body:
 - “Our vision is to see the IT profession recognised as being a profession of the highest integrity and competence.”
 - Royal Charter in 1984
 - Accreditation of University Courses

G52GRP: Lecture 5 – p.12/32

Codes of Conduct and Practice

All professional bodies have codes of conduct and/or practice that their members must obey:

- **Code of Conduct:** Outwards looking, governs relationship between members and society as a whole. Example:
“In your professional role you shall have regard for the public health, safety, and environment.”
- **Code of Practice:** Inwards looking, governs how to practice the profession. Example:
“Every statement in the code must be executed at least once during testing.”

G52GRP: Lecture 5 – p.13/32

BCS Code of Conduct (1)

- **The Public Interest**
 - Professional duties should be carried out with “due care and diligence”.
 - Members are required to be aware of and comply with relevant laws and regulations.
- **Duty to the Relevant Authority** (employers, client, university, . . .)
 - Avoid conflicts of interest.
 - Avoid misrepresentation.
 - Don't pass on confidential information.

G52GRP: Lecture 5 – p.14/32

BCS Code of Conduct (2)

- **Duty to the Profession:** how to behave to uphold the good reputation of BCS and the profession in general.
- **Professional Competence and Integrity**
 - Keep up professional skills.
 - Follow code of practice.
 - Commitment to continuing professional development.

G52GRP: Lecture 5 – p.15/32

Reservation of Title and Function (1)

Parliament may grant a professional body a legal monopoly if judged to be in the public interest.

- **Reservation of Title:** **name** of profession restricted to those who are qualified.
- **Reservation of Function:** certain **activities** restricted to those who are qualified.

In the USA, and increasingly in the UK, title/function reserved to those on a government-maintained register.

G52GRP: Lecture 5 – p.16/32

Reservation of Title and Function (2)

Examples:

- **Architect:** In the UK, since 1997, anyone calling themselves “architect” must be registered with the Architects Registration Board. (Previously member of RIBA.)
- **Accounting:**
 - In England and Wales, *auditing of accounts* of public companies can only be performed by members of two professional bodies.
 - But no reservation of title: anyone can call themselves an “accountant”.

G52GRP: Lecture 5 – p.17/32

Reservation of Title and Function (3)

- **Veterinary Surgery:** Both title and function reserved.

G52GRP: Lecture 5 – p.18/32

Software Development as Engineering

Characteristics of Engineering:

- engineering involves constructing artifacts that must work properly; i.e., meet predetermined requirements regarding functionality, performance, reliability
- the construction process must be completed on time and budget.

Software development are today usually recognised as engineering. The practitioners are considered (software) engineers.

G52GRP: Lecture 5 – p.19/32

The Status of Engineers (1)

In many countries, including the USA, the profession of “engineering” is strictly regulated:

- you must be registered to call yourself an engineer
- any company using the word “engineering” in its name must employ at least one registered engineer
- illegal to carry out engineering work unless supervised by registered engineer

G52GRP: Lecture 5 – p.20/32

The Status of Engineers (2)

- academic engineering programmes must be taught mostly by registered engineers

Example: Rice university, Texas, had to change the title of a course from “Software Engineering” to “Software Construction”.

G52GRP: Lecture 5 – p.21/32

Why the Engineering Regulations?

- The legislation in the USA was introduced in the early 20th century in the wake of disasters related to the failure of large civil engineering works.
- Bad Software Engineering has caused and increasingly has the potential to cause a lot of damage too!
 - The London Ambulance Service
 - The Therac-25

G52GRP: Lecture 5 – p.22/32

The London Ambulance Service (1)

Background:

- The LAS Dispatch system is responsible for:
 - receiving calls
 - dispatching ambulances based on nature of call and availability of resources
 - monitoring progress of the response to the call.
- In October 1992, the manual dispatch system was to be replaced by a computer aided, highly automated system to better manage the available resources.

G52GRP: Lecture 5 – p.23/32

The London Ambulance Service (2)

What happened?

- Under load, the system could not keep track of vehicles and their status.
- Scarce resources thus employed suboptimally.
- Overall failure to meet demand, leading to a huge backlog.
- System effectively collapsed:
 - Ambulance arrived to find that patient was dead and had been taken away by undertakers.
 - Ambulance answered stroke call after 11 hours: patient already in hospital since 5 hours.

G52GRP: Lecture 5 – p.24/32

The London Ambulance Service (3)

Why?

- Problems at many levels, including the broad political context . . .
- but bad project management and bad software engineering at the core, including:
 - incomplete and effectively untested software
 - “high-risk” implementation approach
 - inappropriate and unjustified assumptions in the specification
 - lack of consultation with users and clients.

G52GRP: Lecture 5 – p.25/32

The Therac-25 (2)

What happened?

- Between June 1985 and January 1987, six patients **massively** overdosed (in some cases by a factor of 100).
- All were seriously injured or died: one within three weeks of the accident.
- Have been described as “the worst accidents in the history of medical accelerators”.

G52GRP: Lecture 5 – p.27/32

The Therac-25 (1)

Background:

- Therac-25: Computer-**controlled** radiation therapy machine.
 - In particular, all safety interlock features in software.
- Developed from 1976 to 1982.
- Dual mode X-ray and electron beam therapy.
- Follow on from earlier computer-**assisted** machines Therac-6 and Therac-20.
 - In particular, industry-standard hardware safety interlock mechanisms.

G52GRP: Lecture 5 – p.26/32

The Therac-25 (3)

Why?

- Decision not to “duplicate” software safety mechanisms in hardware.
- Reuse of faulty software modules from the earlier machines, where the fact that they were faulty was not critical (even unknown?) because of the hardware safety features.
- Deeply flawed concurrent programming practice: concurrent access to shared memory without proper synchronization.

G52GRP: Lecture 5 – p.28/32

The Therac-25 (4)

- This leads to **race conditions** and bugs that are extremely hard to reproduce. Testing very difficult.

One might argue that the code implies that the responsible people were not properly qualified. Had they known and applied basic concurrent programming principles, the failure would at least have been much less likely.

G52GRP: Lecture 5 – p.29/32

Should SE Be a Profession?

Should regulations be put in place governing the title and function of software development?

Discuss pros and cons!

G52GRP: Lecture 5 – p.31/32

Is Software Engineering a Profession?

- Is substantial education and training **required** to develop software?
- Do the **members** of the profession decide who can develop software?
- Is the profession organised into professional bodies to which **all** developers belong?
- Does the profession lay down standards of conduct and practice with which all developers **must** comply?

G52GRP: Lecture 5 – p.30/32

Should SE Be a Profession?

- Realistic? (Say for professional development.)
- Fair?
- Necessary?
- Right way? Would it work at all? Or is SE just very different from, say, Civil Engineering?
- All kinds of software?
- One kind certification or area-specific certification?
- Impact on Innovation?
- Impact on University Teaching?

G52GRP: Lecture 5 – p.32/32