
II. GENERAL KNOWLEDGE

**IT IS EASY TO BE TOLERANT OF THE
PRINCIPLES OF OTHER PEOPLE, IF YOU
HAVE NONE OF YOUR OWN.**

SIR HERBERT SAMUEL

Introduction

General Knowledge is presented in the following topic areas:

- Benefits of Software Quality Engineering
- Ethical and Legal Compliance
- Standards and Models
- Leadership Skills
- Team Skills

Benefits of Software Quality Engineering

There are two principal categories of software quality measurement: functional and nonfunctional. Example definitions from industry and government standards are as follows:

Software quality: The conformance to explicitly stated functional and performance requirements, explicitly documented development standards, and implicit characteristics, such as maintainability and modularity.

The simplest definition is a generalization given by Crosby (1979)¹⁷: “Quality is conformance to requirements.”

It is important to note that both definitions cover products and the processes that create them. They also cover the functional and the nonfunctional categories of quality measures.

First, quality is defined, and hopefully measured, according to some standard.

Second, there are different aspects or types of quality, including the functional and the nonfunctional aspects of a software system.

Third, the nonfunctional aspects can include standards applicable to all, or a subset, of the software products produced by an organization.

Benefits of Software Quality Engineering (Continued)

Product defects (functional discrepancies), such as a preliminary design, detailed design, or the actual code are always noted. For example, defects in the detailed design, as outlined in the preliminary design or the requirements statement are noted, both of which are higher level or more abstract representations of the software product (the code) actually employed by the user.

Defects are noted according to general standards that apply to all software products developed by the organization. Such a standard design requirement might be an explicit standard to facilitate the achievement of product “adaptability.”

Two other definitions of quality are:

- The degree to which a system, component, or process meets specified requirements.
- The degree to which a system, component, or process meets customer or user needs or expectations. (ANSI/IEEE 828, 2012)³¹

The first definition is preferred over the second. One should develop a system to satisfy stated requirements. If a user has a need or expectation not stated in the requirements, or documented in such a manner that it can be verified, then it should not be viewed as a requirement.

Unfortunately, there is a difference between what a customer needs or wants and what the customer actually gets, even if the product or system meets the specification imposed on it. Software is a “component” of a system, as defined above. A system consists of hardware, software, and the procedures for operating it.

Quality software plays a significant role in our daily lives, from the software used in controlling aircraft to the software embedded in medical devices. Since the 1990s, quality has been integrated into the software development process. To software suppliers, quality is no longer an afterthought that provides an advantage in the marketplace; quality has become the benchmark for providing superior products and services in an extremely competitive global market.

Benefits of Software Quality Engineering (Continued)

The benefits realized from software quality are numerous.

The benefits of software quality from a customer's perspective are:

- **Customer satisfaction**
- **Improved software reliability**
- **Reduced errors during software operation**
- **Meeting the customer's requirements**

The benefits of software quality from an organization's perspective are:

- **The customer's requirements are met**
- **Requirements are stable**
- **Feature requirements have been implemented and verified**
- **Processes are applied in a consistent manner**
- **The process improves over time**

Quality Philosophies

In the field of software quality engineering, it's helpful to develop a basic understanding of the philosophies of the leading quality professionals. A number of these gurus are listed in Table 2.1 along with their major contributions to both the business and technical foundations of quality. This list is far from inclusive.

Guru	Contribution
Philip B. Crosby	Senior manager involvement 4 absolutes of quality management Zero defects Quality cost measurements
W. Edwards Deming	Plan-do-study-act (wide usage) Top management involvement Concentration on system improvement Constancy of purpose
Armand V. Feigenbaum	Total quality control/management Top management involvement
Kaoru Ishikawa	4M or cause and effect (fishbone) diagram Companywide quality control Treat the next operation as a customer
Joseph M. Juran	Top management involvement Quality Trilogy (project improvement) Quality cost measurement Pareto analysis
Walter A. Shewhart	Assignable causes versus chance causes Control charts Plan-do-check-act (design usage) Use of statistics for improvement
Genichi Taguchi	Loss function concepts Signal to noise ratio Experimental design methods Concept of design robustness

Table 2.1 Major Contributors to the Quality Profession

Ethical and Legal Compliance

Ethical and Legal Compliance is presented in the following topic areas:

- **Professional Codes of Ethics**
- **Legal and Regulatory Issues**

Professional Codes of Ethics

A system of ethics exists that guides individuals toward actions that produce the greatest good for all. A profession is an occupation that society somehow recognizes as being in a class apart from other occupations. (Bowyer, 1996)⁹. Examples include the medical, engineering, and legal fields of endeavor.

Professional ethics take into account:

- **Relations between practicing professionals and their clients**
- **Relations between the profession and society in general**
- **Relations among professionals**
- **Relations between employee and employer**
- **Specialized technical details of the profession**

Organizations that represent the membership of a profession may undertake to set down a code of ethics specifically for their members. Since software quality engineering is a profession representing several disciplines, its members are often familiar with one or more of the major professional organizations, each with its own published code of ethics. A representative sample may include ACM (Association for Computing Machinery), IEEE (Institute of Electrical and Electronic Engineers), and ASQ (American Society for Quality).

Professional Codes of Ethics (Continued)

A successful software quality engineer undertakes many of the following activities:

- Being sensitive to changes in the attitudes of others
- Accepting responsibility for personal mistakes
- Exhibiting a positive outlook and seeking value in achievement
- Protecting the employer's confidential information

The software quality engineer, like many other professionals, must possess high standards of ethical conduct. ASQ's code of ethics is presented as a guide to achieving this objective.

ASQ Code of Ethics for Professional Conduct*

Fundamental Principles

ASQ requires its members and certification holders to conduct themselves ethically by:

- I. Being honest and impartial in serving the public, their employers, customers and clients.
- II. Striving to increase the competence and prestige of the quality profession, and
- III. Using their knowledge and skill for the enhancement of human welfare.

Relations with the Public

Article 1 - Hold paramount the safety, health, and welfare of the public in the performance of their professional duties.

* The ASQ Code of Ethics comes from ASQ, P.O. Box 3005, Milwaukee, WI 53201.

(ASQ, 2016)³

ASQ Code of Ethics for Professional Conduct (Cont'd)

Relations With Employers and Clients

Article 2 - Perform services only in their areas of competence.

Article 3 - Continue their professional development throughout their careers and provide opportunities for the professional and ethical development of others.

Article 4 - Act in a professional manner in dealings with ASQ staff and each employer, customer, or client.

Article 5 - Act as faithful agents or trustees and avoid conflicts of interest and the appearance of conflicts of interest.

Relations With Peers

Article 6 - Build their professional reputation on the merit of their services and not compete unfairly with others.

Article 7 - Assure that credit for the work of others is given to those to whom it is due.

Professional Conduct and Competence

In comparison with the ACM code and the IEEE code, the ASQ code of ethics includes similar references to the advancement of human welfare and society and to being honest and fair in dealings with others. The ACM code, like the IEEE code, includes two specific items that are of interest to software quality engineers:

- **Maintaining professional competency**
- **Providing and accepting peer reviews**

Professional Conduct and Competence (Continued)

Maintaining Professional Competence

The ASQ code states that members should maintain their own professional development. The code also includes references to increasing the competence and prestige of the profession (the second fundamental principle) and to aid the professional development of others (the third principle). The ASQ certification programs are established to upgrade technical knowledge and competence of professionals through an examination process and through recertification of competence every three years.

Providing and Accepting Peer Reviews

The ASQ code is not very specific in the area of peer review. Whenever appropriate, individual members should seek and utilize peer review and provide critical review of the work of others.

General Comments

Maintaining professional competence and providing and accepting peer reviews are clearly two things that one should plan on being a regular part of their professional life. One cannot expect any professional codes of ethics to be complete, consistent, and correct for all situations. They are mostly voluntary, in the sense that there is no formal monitoring for compliance and little penalty that can be assessed against violators. One must be able to use an internal sense of ethics to resolve the conflicts that inevitably occur while following any code of ethics.

(Bowyer, 1996)⁹

Blanchard (1988)⁶ has developed a three question test for determining what is an ethical choice in a given situation:

1. Is it legal? If an action is not legal, no further consideration should be given.
2. Is it balanced? This means that the action would be fair to all involved.
3. How will it make me feel about myself?

Professional Conduct - Terms and Definitions

Conflict of Interest	A conflict between the private interests and the official responsibilities of a person in a position of trust.
Ethical	Conforming to accepted standards of conduct or practice, especially the standards of a profession.
Ethics	A set of moral principles; a theory or system of moral values; the principles of conduct governing an individual or group.
Legal	Conforming to or permitted by law or established rules; deriving authority from or founded on law.
Malpractice	A dereliction of professional duty or a failure to exercise an ordinary degree of professional skill or learning by one rendering professional services which results in injury, loss, or damage; and injurious, negligent, or improper practice.
Negligence	The failure to exercise the degree of care that the law requires for the protection of other persons, or those interests of other persons that may be injuriously affected by the want of such care.
Notification	A formal act or instance of informing or making known.
Recall	A summons by a manufacturer or other agency for the return of goods or a product already shipped to market or sold to consumers but discovered to be defective, contaminated, unsafe, or the like.
Regulation	An authoritative rule dealing with details or procedure; a rule or order issued by an executive authority or regulatory agency of a government and having the force of law.

(Random House, 1987)⁸⁰