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# SOFTWARE ENGINEERING CODE OF ETHICS IS APPROVED

*The exhaustive efforts of the ACM and IEEE-CS has resulted in the adoption of a code of professional practices for software engineers to consider—and use.*

SOFTWARE ENGINEERING NOW HAS ITS OWN CODE OF ETHICS. THE CODE HAS BEEN ADOPTED by both the ACM and the IEEE–Computer Society, having gone through an extensive review process that culminated in the official unanimous approval by the leadership of both professional organizations. Here, we discuss the major changes that took place between version 3.0 (distributed widely via *Communications of the ACM* and IEEE’s *Computer* magazine) and the currently approved version 5.2.

There were many changes made in the Code between these two versions. The original eight Principles were reordered to reflect the order in which software professionals should consider their ethical obligations—version 3.0’s first Principle was the Product while version 5.2’s first Principle is the Public. A shortened version of the Code was added to the front of the full version of the Code to facilitate a quick review of the Principles of the Code (see box). However, this shortened version must not be viewed as a standalone abbreviated code since this would detract from the detailed breadth and depth of the full version. The details are necessary to provide clear guidance for the practical application of these ethical principals.

The Preamble to the Code was significantly revised. It includes specific ethical standards to help the professional make ethical decisions.

The Code emphasizes the professional’s obligations to the public at large. This obligation is the final arbiter in all decisions. “In all these judgements, concern for the health, safety, and welfare of the public is primary; that is, the ‘Public Interest’ is central to this Code.” The primacy of well being and quality of life of the public, in all decisions related to software engineering, is emphasized throughout the Code. For example, the whistle-blowing clauses (6.11–6.13) describe obligations for protecting the public when their well being is threatened by defective software development and describe steps to meet those obligations.

The Code contains a clause (8.07) against using prejudices or bias in any decision making. The intent of this clause is to be open ended, thus enabling it to include consideration of new social concerns.

The Code includes specific language about the importance of ethical behavior during the maintenance phase of software development. The Code reflects the amount of time a computer professional spends modifying and improving existing software. It also makes clear that we need to treat maintenance with the same professionalism as new development. The quality of maintenance depends upon the professionalism of the software engineer because maintenance is more likely only to be scrutinized locally whereas new development is generally reviewed at a broader corporate level.

by a multinational taskforce with additional inputs from other practicing professionals, and other representatives from industry, governments, military, and education.

The ACM and the IEEE Computer Society are continuing to support the professionalism of software engineering by establishing the software engineering Professional Ethics Project. The focus of this project will be to help make the Code an effective practical instrument. This will include publishing case studies, supporting further corporate adoption of the Code, developing curriculum material, running workshops,

## CODE OF ETHICS AT A GLANCE

The short version of the Code summarizes aspirations at a high level of abstraction. The clauses that are included in the full version give examples and detail of how these aspirations change the way we act as software engineering professionals. Without the aspirations, the details can become legalistic and tedious; without the details, the aspirations can become high sounding but empty; together, the aspirations and the details form a cohesive Code.

Software engineers shall commit themselves to making the analysis, specification, design, development, testing, and maintenance of software a beneficial and respected profession. In accordance with their commitment to the health, safety, and welfare of the public, software engineers shall adhere to the following Principles:

1. **Public:** Software engineers shall act consistently with the public interest.
2. **Client and Employer:** Software engineers shall act in a manner that is in the best interests of their client and employer consistent with the public interest.
3. **Product:** Software engineers shall ensure their products and related modifications meet the highest professional standards possible.
4. **Judgment:** Software engineers shall maintain integrity and independence in their professional judgment.
5. **Management:** Software engineering managers and leaders shall subscribe to and promote an ethical approach to the management of software development and maintenance.
6. **Profession:** Software engineers shall advance the integrity and reputation of the profession consistent with the public interest.
7. **Colleagues:** Software engineers shall be fair to and supportive of their colleagues.
8. **Self:** Software engineers shall participate in lifelong learning regarding the practice of their profession and shall promote an ethical approach to the practice of the profession.

The purpose of developing a Software Engineering Code of Ethics is to document the ethical and professional responsibilities and obligations of software engineers. This Code is intended to educate and inspire software engineers; it also informs the public about the responsibilities that are important to this profession. The Code instructs practitioners about the standards that society expects them to meet, and what their peers strive for and expect of each other.

The Code is unique in that it, unlike other codes, is intended as the Code for a profession and is distinctive in that it has been adopted by two international computing societies. The Code was developed

and collaborating with licensing bodies and professional societies.

## Software Engineering Code of Ethics and Professional Practices

### Preamble

Computers have a central and growing role in commerce, industry, government, medicine, education, entertainment, and society at large. Software engineers are those who contribute by direct participation or by teaching, to the analysis, specification, design, development, certification, maintenance, and testing of software systems. Because of their

roles in developing software systems, software engineers have significant opportunities to do good or cause harm, to enable others to do good or cause harm, or to influence others to do good or cause harm. To ensure, as much as possible, that their efforts will be used for good, software engineers must commit themselves to making software engineering a beneficial and respected profession. In accordance with that commitment, software engineers shall adhere to the following Code of Ethics and Professional Practice.

The Code contains eight Principles related to the behavior of and decisions made by professional software engineers, including practitioners, educators, managers, supervisors and policy makers, as well as trainees and students of the profession. The Principles identify the ethically responsible relationships in

than blind reliance on detailed regulations. These Principles should influence software engineers to consider broadly who is affected by their work; to examine if they and their colleagues are treating other human beings with due respect; to consider how the public, if reasonably well informed, would view their decisions; to analyze how the least empowered will be affected by their decisions; and to consider whether their acts would be judged worthy of the ideal professional working as a software engineer. In all these judgments concern for the health, safety, and welfare of the public is primary; that is, the *public interest* is central to this Code.

The dynamic and demanding context of software engineering requires a code that is adaptable and relevant to new situations as they occur. However, even in this generality, the Code provides support for software

## **T**HE CODE INSTRUCTS PRACTITIONERS ABOUT THE STANDARDS THAT SOCIETY EXPECTS THEM TO MEET, AND WHAT THEIR PEERS STRIVE FOR AND EXPECT OF EACH OTHER.

which individuals, groups, and organizations participate and the primary obligations within these relationships. The clauses of each Principle are illustrations of some of the obligations included in these relationships. These obligations are founded in the software engineer's humanity, in special care owed to people affected by the work of software engineers, and in the unique elements of the practice of software engineering. The Code prescribes these as obligations of anyone claiming to be or aspiring to be a software engineer.

It is not intended that the individual parts of the Code be used in isolation to justify errors of omission or commission. The list of Principles and Clauses is not exhaustive. The clauses should not be read as separating the acceptable from the unacceptable in professional conduct in all practical situations. The Code is not a simple ethical algorithm that generates ethical decisions. In some situations, standards may be in tension with each other or with standards from other sources. These situations require the software engineer to use ethical judgment to act in a manner which is most consistent with the spirit of the Code of Ethics and Professional Practice, given the circumstances.

Ethical tensions can best be addressed by thoughtful consideration of fundamental Principles, rather

engineers and managers of software engineers who need to take positive action in a specific case by documenting the ethical stance of the profession. The Code provides an ethical foundation to which individuals within teams and the team as a whole can appeal. The Code helps to define those actions that are ethically improper to request of a software engineer or teams of software engineers.

The Code is not simply for adjudicating the nature of questionable acts; it also has an important educational function. As this Code expresses the consensus of the profession on ethical issues, it is a means to educate both the public and aspiring professionals about the ethical obligations of all software engineers.

### **Principle I. Public**

Software engineers shall act consistently with the public interest. In particular, software engineers shall, as appropriate:

- 1.01. Accept full responsibility for their own work.
- 1.02. Moderate the interests of the software engineer, the employer, the client, and the users with the public good.
- 1.03. Approve software only if they have a well-founded belief that it is safe, meets specifications,

passes appropriate tests, and does not diminish quality of life, diminish privacy or harm the environment. The ultimate effect of the work should be to the public good.

1.04. Disclose to appropriate persons or authorities any actual or potential danger to the user, the public, or the environment, that they reasonably believe to be associated with software or related documents.

1.05. Cooperate in efforts to address matters of grave public concern caused by software, its installation, maintenance, support, or documentation.

1.06. Be fair and avoid deception in all statements, particularly public ones, concerning software or related documents, methods, and tools.

1.07. Consider issues of physical disabilities, allocation of resources, economic disadvantage, and other factors that can diminish access to the benefits of software.

1.08. Be encouraged to volunteer professional skills to good causes and to contribute to public education concerning the discipline.

## **Principle 2. Client and Employer**

Software engineers shall act in a manner that is in the best interests of their client and employer, consistent with the public interest. In particular, software engineers shall, as appropriate:

2.01. Provide service in their areas of competence, being honest and forthright about any limitations of their experience and education.

2.02. Not knowingly use software that is obtained or retained either illegally or unethically.

2.03. Use the property of a client or employer only in ways properly authorized, and with the client's or employer's knowledge and consent.

2.04. Ensure that any document upon which they rely has been approved, when required, by someone authorized to approve it.

2.05. Keep private any confidential information gained in their professional work, where such confidentiality is consistent with the public interest and consistent with the law.

2.06. Identify, document, collect evidence, and report to the client or the employer promptly if, in their opinion, a project is likely to fail, to prove too expensive, to violate intellectual property law, or otherwise to be problematic.

2.07. Identify, document, and report significant issues of social concern, of which they are aware, in software or related documents, to the employer or the client.

2.08. Accept no outside work detrimental to the work they perform for their primary employer.

2.09. Promote no interest adverse to their employer or client, unless a higher ethical concern is being compromised; in that case, inform the employer or another appropriate authority of the ethical concern.

## **Principle 3. Product**

Software engineers shall ensure their products and related modifications meet the highest professional standards possible. In particular, software engineers shall, as appropriate:

3.01. Strive for high quality, acceptable cost, and a reasonable schedule, ensuring significant tradeoffs are clear to and accepted by the employer and the client, and are available for consideration by the user and the public.

3.02. Ensure proper and achievable goals and objectives for any project on which they work or propose.

3.03. Identify, define, and address ethical, economic, cultural, legal and environmental issues related to work projects.

3.04. Ensure they are qualified for any project on which they work or propose to work, by an appropriate combination of education, training, and experience,.

3.05. Ensure an appropriate method is used for any project on which they work or propose to work.

3.06. Work to follow professional standards, when available, that are most appropriate for the task at hand, departing from these only when ethically or technically justified.

3.07. Strive to fully understand the specifications for software on which they work.

3.08. Ensure that specifications for software on which they work have been well documented, satisfy the user's requirements, and have the appropriate approvals.

3.09. Ensure realistic quantitative estimates of cost, scheduling, personnel, quality, and outcomes on any project on which they work or propose to work and provide an uncertainty assessment of these estimates.

3.10. Ensure adequate testing, debugging, and review of software and related documents on which they work.

3.11. Ensure adequate documentation, including significant problems discovered and solutions adopted, for any project on which they work.

3.12. Work to develop software and related documents that respect the privacy of those who will be affected by that software.

3.13. Be careful to use only accurate data derived by ethical and lawful means, and use it only in ways properly authorized.

3.14. Maintain the integrity of data, being sensitive

to outdated or flawed occurrences.

3.15 Treat all forms of software maintenance with the same professionalism as new development.

#### **Principle 4. Judgment**

Software engineers shall maintain integrity and independence in their professional judgment. In particular, software engineers shall, as appropriate:

4.01. Temper all technical judgments by the need to support and maintain human values.

4.02. Only endorse documents either prepared under their supervision or within their areas of competence and with which they are in agreement.

4.03. Maintain professional objectivity with respect to any software or related documents they are asked to evaluate.

4.04. Not engage in deceptive financial practices such as bribery, double billing, or other improper financial practices.

4.05. Disclose to all concerned parties those conflicts of interest that cannot reasonably be avoided or escaped.

4.06. Refuse to participate, as members or advisors, in a private, governmental, or professional body concerned with software-related issues, in which they, their employers, or their clients have undisclosed potential conflicts of interest.

#### **Principle 5. Management**

Software engineering managers and leaders shall subscribe to and promote an ethical approach to the management of software development and maintenance. In particular, those managing or leading software engineers shall, as appropriate:

5.01. Ensure good management for any project on which they work, including effective procedures for promotion of quality and reduction of risk.

5.02. Ensure that software engineers are informed of standards before being held to them.

5.03. Ensure that software engineers know the employer's policies and procedures for protecting passwords, files, and information that is confidential to the employer or confidential to others.

5.04. Assign work only after taking into account appropriate contributions of education and experience tempered with a desire to further that education and experience.

5.05. Ensure realistic quantitative estimates of cost, scheduling, personnel, quality, and outcomes on any project on which they work or propose to work, and provide an uncertainty assessment of these estimates.

5.06. Attract potential software engineers only by full and accurate description of the conditions of employment.

5.07. Offer fair and just remuneration.

5.08. Not unjustly prevent someone from taking a position for which that person is suitably qualified.

5.09. Ensure there is a fair agreement concerning ownership of any software, processes, research, writing, or other intellectual property to which a software engineer has contributed.

5.10. Provide for due process in hearing charges of violation of an employer's policy or of this Code.

5.11. Not ask a software engineer to do anything inconsistent with this Code.

5.12. Not punish anyone for expressing ethical concerns about a project.

#### **Principle 6. Profession**

Software engineers shall advance the integrity and reputation of the profession consistent with the public interest. In particular, software engineers shall, as appropriate:

6.01. Help develop an organizational environment favorable to acting ethically.

6.02. Promote public knowledge of software engineering.

6.03. Extend software engineering knowledge by appropriate participation in professional organizations, meetings, and publications.

6.04. Support, as members of a profession, other software engineers striving to follow this Code.

6.05. Not promote their own interest at the expense of the profession, client, or employer.

6.06. Obey all laws governing their work, unless, in exceptional circumstances, such compliance is inconsistent with the public interest.

6.07. Be accurate in stating the characteristics of software on which they work, avoiding not only false claims but also claims that might reasonably be speculative, vacuous, deceptive, misleading, or doubtful.

6.08. Take responsibility for detecting, correcting, and reporting errors in software and associated documents on which they work.

6.09. Ensure that clients, employers, and supervisors know of the software engineer's commitment to this Code of Ethics, and the subsequent ramifications of such commitment.

6.10. Avoid associations with businesses and organizations which are in conflict with this Code.

6.11. Recognize that violations of this Code are inconsistent with being a professional software engineer.

6.12. Express concerns to the people involved when significant violations of this Code are detected unless this is impossible, counter-productive, or dangerous.  
6.13. Report significant violations of this Code to appropriate authorities when it is clear that consultation with people involved in these significant violations is impossible, counter-productive, or dangerous.

### Principle 7. Colleagues

Software engineers shall be fair to and supportive of their colleagues. In particular, software engineers shall, as appropriate:

- 7.01. Encourage colleagues to adhere to this Code.
- 7.02. Assist colleagues in professional development.
- 7.03. Credit fully the work of others and refrain from taking undue credit.
- 7.04. Review the work of others in an objective, candid, and properly documented way.
- 7.05. Give a fair hearing to the opinions, concerns, or complaints of a colleague.
- 7.06. Assist colleagues in being fully aware of current standard work practices including policies and procedures for protecting passwords, files, and other confidential information, and security measures in general.
- 7.07. Not unfairly intervene in the career of any colleague; however, concern for the employer, the client, or public interest may compel software engineers, in good faith, to question the competence of a colleague.
- 7.08. In situations outside of their own areas of competence, call upon the opinions of other professionals who have competence in that area.

### Principle 8. Self

Software engineers shall participate in lifelong learning regarding the practice of their profession and shall promote an ethical approach to the practice of the profession. In particular, software engineers shall continually endeavor to:

- 8.01. Further their knowledge of developments in the analysis, specification, design, development, maintenance, and testing of software and related documents, together with the management of the development process.
- 8.02. Improve their ability to create safe, reliable, and useful quality soft-

- ware at reasonable cost and within a reasonable time.
- 8.03. Improve their ability to produce accurate, informative, and well-written documentation.
- 8.04. Improve their understanding of the software and related documents on which they work and of the environment in which they will be used.
- 8.05. Improve their knowledge of relevant standards and the law governing the software and related documents on which they work.
- 8.06. Improve their knowledge of this Code, its interpretation, and its application to their work.
- 8.07. Not give unfair treatment to anyone because of any irrelevant prejudices.
- 8.08. Not influence others to undertake any action that involves a breach of this Code.
- 8.09. Recognize that personal violations of this Code are inconsistent with being a professional software engineer. **C**

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THIS CODE WAS DEVELOPED BY THE IEEE-CS/ACM JOINT TASK FORCE ON SOFTWARE ENGINEERING ETHICS AND PROFESSIONAL PRACTICES (SEEPP); EXECUTIVE COMMITTEE: DONALD GOTTERBARN (CHAIR), KEITH MILLER AND SIMON ROGERSON; MEMBERS: STEVE BARBER, PETER BARNES, ILENE BURNSTEIN, MICHAEL DAVIS, AMR EL-KADI, N. BEN FAIRWEATHER, MILTON FULGHUM, N. JAYARAM, TOM JEWETT, MARK KANKO, ERNIE KALLMAN, DUNCAN LANGFORD, JOYCE CURRIE LITTLE, ED MECHLER, MANUEL J. NORMAN, DOUGLAS PHILLIPS, PETER RON PRINZIVALLI, PATRICK SULLIVAN, JOHN WECKERT, VIVIAN WEIL, S. WEISBAND, AND LAURIE HONOUR WERTH. ©1999 ACM AND IEEE.

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