



Computer Society and ACM Approve Software Engineering Code of Ethics

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Executive Committee, IEEE-CS/ACM Joint Task Force
on Software Engineering Ethics and Professional Practices

Software engineering has evolved over the past several years from an activity of computer engineering to a discipline in its own right. With an eye toward formalizing the field, the IEEE Computer Society has engaged in several activities to advance the professionalism of software engineering, such as establishing certification requirements for software developers. To complement this work, a joint task force of the Computer Society and the ACM has recently established another linchpin of professionalism for software engineering: a code of ethics.

After an extensive review process, version 5.2 of the Software Engineering Code of Ethics and Professional Practice, recommended last year by the IEEE-CS/ACM Joint Task Force on Software Engineering Ethics and Professional Practices, was adopted by both the IEEE Computer Society and the ACM.

PURPOSE

The Software Engineering Code of Ethics and Professional Practice, intended as a standard for teaching and practicing software engineering, documents the ethical and professional obligations of software engineers. The code should instruct practitioners about the standards society

expects them to meet, about what their peers strive for, and about what to expect of one another. In addition, the code should inform the public about the responsibilities that are important to the profession.

Adopted by the Computer Society and the ACM—two leading international computing societies—the code of ethics is intended as a guide for members of the evolving software engineering profession. The code was developed by a multinational task force with additional input from other professionals from industry, government posts, military installations, and educational profes-

CHANGES TO THE CODE

Major revisions were made between version 3.0—widely distributed through *Computer* (Don Gotterbarn, Keith Miller, and Simon Rogerson, “Software Engineering Code of Ethics, Version 3.0,” November 1997, pp. 88-92) and *Communications of the ACM*—and version 5.2, the recently approved version. The preamble was significantly revised to include specific standards that can help professionals make ethical decisions. To facilitate a quick review of the principles, a shortened version of the code was added to the front of the full version. This shortened version is not intended to be a stand-alone abbreviated code. The details of the full version are necessary to provide clear guidance for the practical application of these ethical principles.

In addition to these changes, the eight principles were reordered to reflect the order in which software professionals should consider their ethical obligations: Version 3.0’s first principle concerned the product, while version 5.2 begins with the public. The primacy of well-being and quality of life of the public in all decisions related to software engineering is emphasized throughout the code. This obligation is the final arbiter in all decisions: “In all these judgements concern for the health, safety and welfare of the

About the Joint Task Force

This Code of Ethics was developed by the IEEE-CS/ACM Joint Task Force on Software Engineering Ethics and Professional Practices. Members are

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public is primary; that is, the 'Public Interest' is central to this Code." For example, the whistle-blowing clauses (6.11-6.13) describe a software engineer's obligations when public safety is threatened by defective software development and describe steps to meet those obligations.

The code now contains an open-ended clause (8.07) against using prejudices or bias in any decision making, written broadly enough to include consideration of new social concerns.

Finally, the code includes specific language about the importance of ethical behavior during the maintenance phase of software development. The new text reflects the amount of time a computer professional spends modifying and improving existing software and also makes clear that we need to treat main-

The primacy of well-being and quality of life of the public is emphasized throughout the code.

tenance with the same professionalism as new development. The quality of maintenance depends upon the professionalism of the software engineer, because maintenance is more likely to be scrutinized only locally, whereas new development is generally reviewed at a broader corporate level.

In the same spirit that created the code of ethics, the Computer Society and the ACM continue to support the software engineering profession through the Software Engineering Professionalism and Ethics Project (<http://computer.org/tab/swecc/Sepec.htm>). This project will help make the code an effective practical tool by publishing case studies, supporting further corporate adoption of the code, developing curriculum material, running workshops, and collaborating with licensing bodies and professional societies.

Software Engineering Code of Ethics and Professional Practice

SHORT VERSION: PREAMBLE

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 details 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 eight 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 that 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.

FULL VERSION: 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 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 soft-

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ware 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 that 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 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 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 adjudicat-

ing 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.

PRINCIPLES

Principle 1: 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 that 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 that 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 that 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 that 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 supposed to 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, counterproductive, 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, counterproductive, 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 those areas.

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

software 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.

Renew Your Membership Online

Renewing your Computer Society membership just got easier. As an IEEE Computer Society member or an affiliate member, you can renew your membership for 2000 on the Web. Starting 1 October, members can access a secure online application form and submit renewal payments via credit card. The service is open to anyone with an IEEE Web account, which full and affiliate members can create online with their member numbers. IEEE Web accounts also allow access to members-only products and services.

To ensure a continuation of services, members in the US and Canada must renew by the end of February. Members in other regions must renew by late April. For complete instructions on renewing online, visit <http://iee.orgmembership/index.html>.

Opportunities Available for Professional and Student Chapters

Any Computer Society member can take advantage of the Society's publications, conference discounts, and international technical committees. But members in areas with strong Society chapters can also enjoy the benefits of local professional communities. To recognize and reward chapters with exemplary programs for their local communities, the Computer Society presents annual Outstanding Chapter Awards to the best professional and student chapters. Nominees for Outstanding Chapter for 1999 are being accepted until 31 October.

Professional chapters sponsor conferences and offer the opportunity for members to participate in activities for professional development. Student chapters both provide resources to students in computing majors and host outreach activities to interest the entire student body in the discipline. Organized under the IEEE, Computer Society chapters often host speakers from the Distinguished Visitors Program and the Chapter Tutorials Program, two Computer Society invited lecture series that feature expert speakers in areas of interest to computing professionals and students.

To enter the competition, chapters must submit essays summarizing the chapter's service to local members. Outstanding Chapter Awards are given based on success in technical activities, society activities, membership advancement, and enlistment of new Computer Society members. Winning chapters receive an all-expense-paid visit by a speaker from our Distinguished Visitors Program.

The Computer Society has more than 200 chapters, located in regions around the world. For information

Computer Society to Unveil New Web Home

Looking for easier access to Computer Society information and services? In the coming weeks, you'll find a new interface and new features when you visit the Society online. Already replete with membership links, program information, conference listings, and a Digital Library 18 titles strong, the new computer.org will provide a welcoming crossing point to members and newcomers alike.

The redesigned site will feature a new look, more intuitive navigation, and tremendously enhanced search capabilities. The new site will also group Society publications, conferences, standards, and committees according to several fields of interest. Whether your specialty is software engineering, computer graphics and visualization, design and test, information technology, or the Internet, you'll be able to access the information you need with just a few mouse clicks.

With the redesign, your Society Web Account will become even more valuable, enabling you to customize the computer.org home page with links to your favorite areas. New pages on the site will highlight opportunities to get involved with the Society and explain the support services available to our valued volunteers. Online forms for joining Technical Committees, subscribing to new publications, or accessing other services will streamline your interactions with the Society.

Members who choose not to subscribe to online periodicals will be able to access individual articles at low member prices. *Computer* will remain free online to members, with improved navigation and links, enhanced membership resources, and interactive forums. *IEEE Internet Computing Online* will continue to provide Web-exclusive articles, extensive links, and the popular site review column, "The Arachnoid Tourist." The Society's 11 other magazines and six transactions will be available to Digital Library subscribers for the same low price of \$99 a year.

Whether you're looking for an article, planning to attend a symposium, or browsing for information on standards, you'll find the Computer Society resources you need quickly at the new computer.org.

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on how to nominate your chapter for the award, see <http://computer.org/chapter/ocashort.htm>. To find the chapter nearest you, establish a chapter in your area, or learn more about inviting a Computer Society lecturer to your chapter, see <http://computer.org/chapter/chapter.htm>.

For consistently offering high-quality technical conferences, the IEEE Hong Kong Section Computer Chapter earned the title of Outstanding Chapter for 1998. For providing its members with professional events, contests, and mentoring opportunities, the IEEE Student Branch Computer Chapter at Thadomal Shahani Engineering College won the equivalent honor for student chapters. For more on last year's winners, see "Conferences, Contests Make These Chapters Successful" (*Computer*, May 1999, p. 85; <http://dlib.computer.org/books/co1999/pdf/r5084.pdf>). ❖

Student Awards Programs Seek Entrants by 31 October

In recognition of leadership in student chapters, each year the Computer Society presents the Richard E. Merwin Student Scholarship. To honor individual achievements of student members, the Society presents the Lance Stafford Larson Student Scholarship for student papers and participates in presenting the Upsilon Pi Epsilon Student Award for Academic Excellence. Both individual prize programs are seeking nominees by 31 October for the 1999 awards.

LARSON SCHOLARSHIP

Established in 1983, the Lance Stafford Larson Student Scholarship rec-

ognizes the best computer-related paper submitted. Designed to encourage communication skills among future computer science professionals, the contest judges papers on technical content, writing talent, and overall presentation. Any undergraduate student Computer Society member with a minimum GPA of 3.0 is eligible to compete. The first-place winner receives \$500.

UPSILON PI EPSILON AWARD

The Upsilon Pi Epsilon Student Award for Academic Excellence is presented by the Computer Society in conjunction with Upsilon Pi Epsilon. An honor society that recognizes undergraduate and graduate student achievement in the computing discipline, UPE has chapters at colleges and universities around the world. Supported in part by funds from Microsoft and IBM, UPE offers scholarships and other recognitions to exemplary students. The UPE fosters partnerships to help promote computer science education and is the only computing honor society recognized by both the Computer Society and the ACM. UPE members must be pursuing a major in a computing science and have a GPA of 3.0.

The Upsilon Pi Epsilon/Computer Society Student Award for Academic Excellence is awarded based on a student's academic record, computer-related extracurricular involvement, and letters of recommendation. Any Computer Society member who is a full-time undergraduate or graduate student with a minimum GPA of 3.0 may apply. Up to four awards of \$500 each are given each year to competition winners. Winners also receive their choice of either one Computer Society book or a one-year subscription to an optional periodical.

To apply for any Computer Society student competition, visit <http://computer.org/student/schlrshp.htm> or call (202) 371-1013 for a Student Scholarships and Awards brochure. ❖



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Polls close 4 October