EECS 581/582

Computer Science Design I/II

Ethics

KU THE UNIVERSITY OF KANSAS

Ethics

Topics

Moral Theories

- Moral Theory
- Utilitarianism
- Utilitarianism Tests
- The Ethics of Respect-for-Persons
- Respect-for-Persons Tests

Ethics

Reference

Harris, Charles E., Pritchard, Michael S., and Rabins, Michael J. (1995). *Engineering Ethics: Concepts and Cases*. Wadsworth Publishing Company, ISBN: 0-534-23964-1.

Ethics

Topics

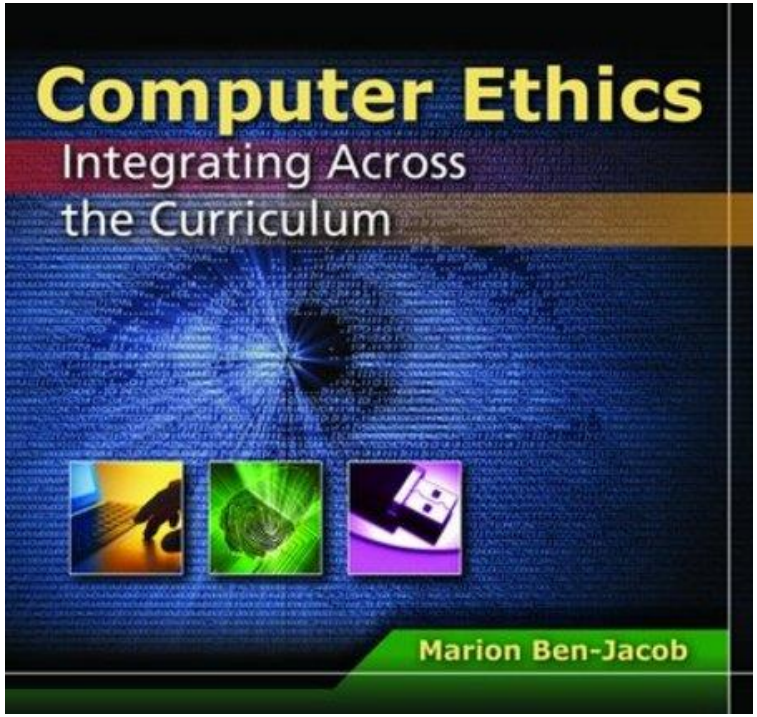
Computer Ethics

- Plagiarism
- Computer Crimes
- Licensing of Software Engineers
- Responsible Conduct of Research
- Intellectual Property
- Professionalism

Ethics

Reference

Ben-Jacob, Marion. (2009). *Computer Ethics: Integrating Across the Curriculum* [CD-ROM]. Jones & Bartlett Publishers, ISBN: 978-0763778095.



Ethics

Topics

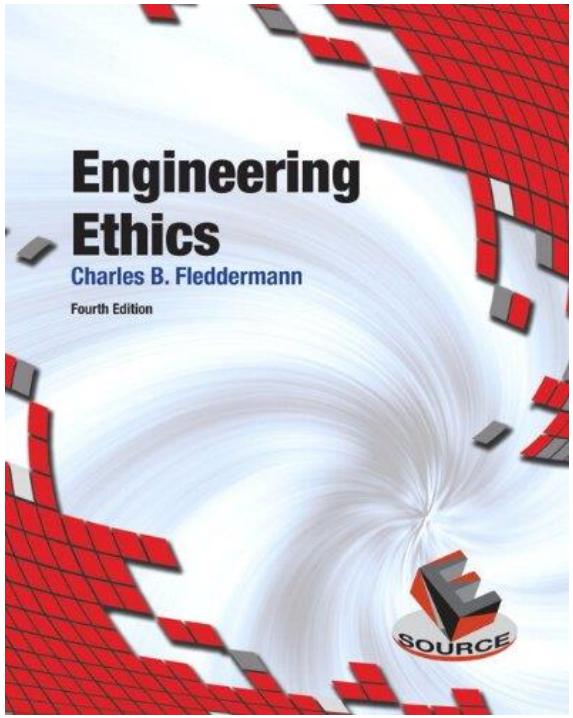
Ethics in Practice

- Environmental Ethics
- Computer Ethics
  - Computers as a Tool for Unethical Behavior
  - Computers as an Engineering Tool
  - Autonomous Computers
  - Computer Codes of Ethics
- Ethics and Research

Ethics

Reference

Fleddermann, Charles B. (2012). *Engineering Ethics*, Fourth Edition. Pearson Education, Inc., ISBN: 978-0-13-214521-3.



Ethics

Topics

Codes of Ethics

- ACM Code of Ethics and Professional Conduct
- IEEE Code of Ethics
- Software Engineering Code of Ethics and Professional Practice

Ethics

References

- Association for Computing Machinery, Inc. (ACM). acm.org.
- Institute of Electrical and Electronics Engineers, Inc. (IEEE). ieee.org.

Moral Theories

Moral Theory

- A set of concepts and principles that organizes and in some sense explains or provides a foundation for common morality, or some portion of it
- Organizes our moral thinking
- Justifies many of the precepts of common morality
- Criticizes and reforms common morality
- Assists in moral problem solving by supplying tests for the moral acceptability of actions
- Moral theories
  - Utilitarian and respect for persons
  - Convergence — Both models lead to the same conclusion
  - Divergence — Models lead to different conclusions (difficult problems)

Utilitarianism

- Moral standard — Those individual actions or rules that produce the greatest total amount of utility to those affected are right
- One definition of utility: Welfare
- Another definition of utility: Happiness
- Necessary conditions for happiness: Freedom and well-being
- Freedom — The ability to make unforced choices in following ones preferences
- Well-being — The set of necessary conditions to make effective use of freedom, including factors as health, food, shelter, education, etc.

Utilitarianism

- Utilitarians maintain that the precepts of common morality
  - Insofar as they are morally valid
  - Can be derived from the utilitarian standard
  - In the sense that they maximize utility
- Audience — The population over which the good is maximized

Utilitarianism

- Problem 1
  - It may be difficult to come up with a directive for action
  - At times it may be impossible to obtain knowledge about the utilities associated with courses of action
- Problem 2
  - Determining the scope of the audience
  - The company, the community, the country, all human beings, etc.
- Problem 3
  - It can sometimes justify perpetrating injustice on individuals
  - E.g. pollutants that adversely affect only a small population

Utilitarianism Tests

The Act Utilitarian Test

- Raises the question: "Will this course of action produce more utility than any other course of action that I could take?"

1. Enumerate the available options or courses of action open to you
2. Determine the audience for the options, keeping in mind the problems in determining the audience
3. Decide which action will produce the greatest total amount of utility

Utilitarianism Tests

The Cost/Benefit Test

- A version of act utilitarianism, in which the negative and positive utilities are translated into monetary terms.

1. Assess the options open to you
2. Assess the costs (in monetary terms) and the benefits (in monetary terms) of each of the options, for the entire audience of the action and for all those affected by the action
3. Choose the course of action that produces the greatest benefit relative to cost

Utilitarianism Tests

The Rule Utilitarian Test

- Raises the question: "Would utility be maximized if everyone did the same thing in the same circumstances?"

1. Analyze the case in order to determine the alternative rules that are at issue
2. Determine the proper audience for the rule
3. Decide which rule produces the most utility for the relevant audience
4. Make a decision in a particular situation on the basis of the rule that produces the most utility

- Based on the practical perspective that things we do will often be emulated by others

The Ethics of Respect-for-Persons

- Moral standard: Those rules or actions are right which, if followed, would accord equal respect to each person as a moral agent.
- Moral agents are autonomous beings capable of formulating or pursuing goals and purposes of their own
- Its precepts protect the moral agency of individual human beings
- Maximizing the welfare of the majority takes second place

The Ethics of Respect-for-Persons

- Problem 1
  - It is sometimes difficult to apply
  - In some cases, any alternative open to one individual involves interference with the moral agency of someone else
  - E.g., not being able to deliver a product or delivering an inferior one
- Problem 2
  - Sometimes it seems justifiable to limit the moral agency of individuals for the sake of greater overall utility
  - E.g., company facing difficulty to institute a compulsory early retirement program, infringing on the moral agency of those forced to retire in order to help the entire company

Respect-for-Persons Tests

The Golden Rule Test

- Raises the questions: "What if everyone did that?" and "Why should you make an exception for yourself?"

1. Analyze the situation to determine the alternative actions available
2. Determine the consequences of the alternative actions
3. Place yourself in the position of the one who would be affected by the consequences of each alternative and ask whether you would be willing to accept those consequences

Respect-for-Persons Tests

- Based on the universalizability criterion: In order to be ethically valid, the resolution of a moral issue must be one that would be universally acceptable if others resolved similar issues in a similar way
- Requires us to evaluate the effects of our actions on others by asking whether we (the actors) would be wiling to exchange places with those affected by our actions (the recipients)
- A variant of the rule appears in the religious and ethical writings of most cultures

Respect-for-Persons Tests

The Self-Defeating Test

- Raises the question: "If everyone else did what I am doing, would this undermine my own ability to do the same thing?"

1. Analyze the situation and determine the options
2. Determine the consequences of the options
3. Determine whether the options, if universally adopted, are self-defeating
   - If they are, then the action is impermissible
   - If they are not, then the action is permissible

- E.g., if one borrows money on the promise to return it and does not keep the promise, it would be a self-defeating action if universalized; since if everyone borrowed money and did not return it, no one would loan money.

Respect-for-Persons Tests

The Rights Test

- Uses a three-tiered hierarchy for distinguishing more basic from less basic rights, where a more basic right cannot be sacrificed for a less basic right.
- First tier — Most basic rights, essential preconditions of action
  - Life
  - Physical integrity
  - Mental health

Respect-for-Persons Tests

- Second tier — Rights to maintaining the level of purpose fulfillment an individual has already achieved
  - Not to be deceived or cheated
  - Not to have possessions stolen
  - Not to be defamed
  - Not to suffer broken promises
- Third tier — Rights necessary to increase one's level of purpose fulfillment
  - Property
  - Self-respect
  - Non-discrimination

Respect-for-Persons Tests

1. Analyze the action to determine what options are available and what rights are at stake
2. Determine the audience of the action
3. Evaluate the seriousness of the rights infringements that would occur with a given action and compare the infringements with those of the alternative action
4. Choose the principle or course of action that produces the least serious rights infringement

Respect-for-Persons Tests

- E.g., a chemical company produces toxic pollutants
- Resulting in the contrast between
  - The public's right to health (first tier right)
  - The firm's right to not have its present level of well-being interfered with (second tier right)
- A second tier right should be infringed before a first tier right

Computer Ethics

Plagiarism

- Plagiarism — Use of another's results, thoughts, ideas, or writings without giving credit to the owner
- Wrongdoing with professional, social, and possible legal implications
- Integration of technology: Increased opportunities for plagiarism
- Massive amounts of information easily available
- Citations must be provided
- Use of standard formats

Computer Crimes

- Computer Crime — Also known as e-crime and cyber crime
- Spam — Junk, unsolicited email
- Virus — A program that can cause the computer to not work properly
  - E.g., move files, erase files, fill up memory
- Worm — A type of virus that replicates itself
- Logic Bomb — A program that interferes with standard operating procedures when a specific condition occurs
  - E.g., date, program execution
- Trojan Horse — A program that appears to be ordinary, but it does damage to computer
- Identity theft — Acquiring personal information to represent oneself as another person

Computer Crimes

- Hacking — Using computers to obtain unauthorized access to data
  - Alternative positive definition: Working with computers in a clever manner to discover information
- Denial of service attack — Prevents an organization from doing business on the Internet
- Phishing — An attempt to get personal information about an individual
- Sniffing — A program or device that monitors data
- Piracy — Distribution or downloading of copyrighted materials
  - E.g., music recordings or licensed software

Licensing of Software Engineers

- License — The permission to engage in an activity or profession
  - Granted by an authoritative organization
  - Or government
- Exams administered by NCEES
  - National Council of Examiners for Engineering and Surveying
  - A national nonprofit organization
- Steps in becoming a licensed Professional Engineer (P.E.)

Licensing of Software Engineers

Licensing of Professional Engineers

1. Degree from an accredited university
   - Accreditation Board for Engineering (ABET)
2. Four years of professional experience
3. Fundamentals of Engineering (FE) exam
4. Principles and Practice in Engineering (PE) exam

Licensing of Software Engineers

Fundamentals of Engineering (FE) Exam

- Typically the first step in becoming a P.E.
- 8 hours
- Morning
  - Same for everyone
  - General exam
  - E.g., mathematics, ethics
- Afternoon
  - Discipline-specific exam
  - E.g., civil, electrical engineering
- Closed-book exam

Licensing of Software Engineers

Principles and Practice in Engineering (PE) Exam

- Typically the last step in becoming a P.E.
- Tests ability to practice competently in a particular engineering discipline
- At least four years of post-college work experience
- E.g., chemical, mechanical, software (Starting 2013)
- 8 hours
- Open-book exam

Responsible Conduct of Research

- Responsible conduct of research — Adhering to ethical and moral conduct when engaging in research
- Ramifications for research misconduct
  - Social
  - Professional
  - Legal
- Computers are involved directly and indirectly in responsible conduct of research
- Computer ethics is an integral component of responsible conduct of research

Responsible Conduct of Research

From multiple perspectives

- Finances and funding categories
- Treatment of animal and human subjects
- Collaborations
- Sharing of results and responsible authorship
- Peer review of manuscripts and grant applications
- Truthful representation of data
- Data management
- Credit given to others for their contributions
- Safety measures
- Confidentiality and proprietary information
- Conflict of interest
- Responsibility to society
- Mentor/trainee relationships and responsibilities

Intellectual Property

- Intellectual property — Ownership of non-physical items, such as literary works, ideas, icons, and programs
  - Ideas and laws vary in different cultures and societies
- Legal rights for protection of intellectual property
  - Patent Law: Protects inventions and processes
  - Trademark Law: Protects words and symbols
  - Copyright Law: Protects original authored works
  - Trade Secret Law: Protects business information that is not generally known

Intellectual Property

- Patent — Government-issued right to inventor
  - Giving exclusive rights to invention
  - For limited period of time (usually 20 years)
- Trademark — Unique words and symbols
  - Associated with a product, service, or firm
  - Associations has been legally registered
- Copyright — Rights that protect the use and sale of
  - An idea or expression, or a literary or creative work
  - According to an international law or a specific law of a country
- Trade Secret — Information used by a business or corporation
  - Not generally known
  - And wished to be kept secret

Intellectual Property

Patent

- Getting a patent
  - Apply at Patent and Trademark Office
  - Describe invention in detail
  - If more than one: First with idea, not first to file
- No abstract concepts
- Satisfies qualities of
  - Novelty
  - Utility
  - Originality
  - Non-obviousness

Intellectual Property

- Patent Pending — Period of time after application filed and waiting for patent
  - No legal rights at this time
- Infringement — Unlawful use of patented invention without permission
- Patent holder can grant rights of use to others
- Patented invention needs to be marked
- After patent expires: Invention enters the public domain
- Public Domain — Collection of works that are available and are not under protection
- Violation of a patent
  - Communicate with persons and ask them to desist
  - Can file suit in federal district court

Intellectual Property

Trademark

- Having a trademark
  - Legal right to use mark to identify a source
  - Use as a marketing tool for public identification
- Also called mark or service mark
- Getting a trademark
  - Apply at the US Patent and Trademark Office
  - Get registration certificate
  - Marks appear in the Official Gazette
- Intensive search to guarantee mark does not belong to another

Intellectual Property

Copyright

- Having a copyright
  - Gives complete rights for specific time period
  - Cannot copy without permission
  - Copyright holder must be credited for work
  - Who can adapt work
  - Who can gain financially from it
- Work must be original, not necessarily unique
- Getting a copyright
  - Not necessary
  - Good idea to obtain one through the US Copyright Office

Intellectual Property

- Poor Man's Copyright — Send work to oneself via registered mail in sealed envelope
  - Postmark establishes the date
  - Not substitution for actual registration
- Do It Yourself Copyright — Write ©, year of publication, and name on work
- Concept of Fair Use

Intellectual Property

Fair Use

- Fair Use — A legal concept that allows the use of another's results without explicit permission of the original author
- Copyright Act of 1976
- Permits some copying and distribution
- Does not define fair use: Provides considerations to use
  - Reason for use (e.g., education)
  - Nature of the work (e.g., factual or artistic work)
  - Amount of work used
  - Effect of the use upon market

Intellectual Property

Trade Secret

- Information, algorithm, formula, etc.
  - Not generally known
  - Provides advantage over competition
- Maintenance of secrecy
- Employee leaving company
  - Takes skills and information
  - Asked to not to work in industry for specific time period
- Reverse engineering
  - Take something apart to learn how it works
  - Is this an infringement on a trade secret?
  - Usually considered legal

Intellectual Property

Software Issues

- Requires interpretation: Copyright laws do not specifically address software
- Software similarity
  - Code
  - Interface
  - Performance
  - Algorithm
- Cases are going to court: Precedents are being set
  - Numerous cases
  - Appeals
  - Reversing decisions (i.e., difficult cases)

Professionalism

- One needs to act with integrity in all aspects of life
  - Living with oneself (personal reflection)
  - Acting appropriately toward peers
  - Acting appropriately toward employers and superiors
  - Acting appropriately toward subordinates
- The place of employment needs to set guidelines
- Professions have codes of ethics

Ethics in Practice

Introduction

- Many ethical issues arise in engineering practice
- Three important areas

1. Environmental ethics
2. Computer ethics
3. Ethics and research

Environmental Ethics

- Environmental movement to protect the environment
- Increased awareness among engineers to use knowledge and skills to protect the environment
- Incorporated into some engineering codes of ethics
- Phrases such as
  - Sustainable design
  - Green engineering
- Ensuring designs do not harm the environment
  - Product has minimal environmental impact during use
  - Manufactured without harming the environment
  - Disposed without harming the environment

Computer Ethics

- Computers a ubiquitous tool in engineering
- Engineers role in ethical use of computers
- Ethical issues associated with computers variations on other ethical issues
  - E.g., unauthorized use of information stored on computer databases related to issues of confidentiality
- Two broad categories of computer ethic problems

1. Computer is used to commit an unethical act
2. Computer is used as an engineering tool, but improperly

Computers as a Tool for Unethical Behavior

- Use of computer makes the crime impersonal
  - E.g., computers used to steal money from a bank
- Computers make privacy more difficult to protect
  - Large amounts of data centrally stored on computers
- Issuance of computer viruses is unethical
  - Destroy data
  - Could lead to deaths in case of hospital records or equipment
- Hacking is unethical
  - Often not malicious: Trying to push the envelope
- Copyright infringement another concern
  - Easy to share music, movies, software
  - Protection of copyright increasing difficult
  - Illegal and unethical

Computers as an Engineering Tool

- Computers essential tool for all engineers
- Two uses of computers unique to engineering

1. Computers as design tools
2. Computers as integrated components in engineering systems

Computers as an Engineering Tool

Computers as Design Tools

- Numerous software packages for design
- E.g., CAD/CAM, circuit analysis, structural analysis
- Software to aid in testing devices
- Ethical issue: Flaw in software used to deign a product
- Software not a substitute for good engineering judgment
- Engineer who uses software responsible for the design
  - Be careful to make sure software is appropriate
  - Knowledgeable about limitations and applicability
  - Keep up to date on discovered flaws
  - Ensure most recent version is being used
  - Verify the results of computer-generated design or analysis

Computers as an Engineering Tool

Computers as Integrated Components

- Computers as components in many engineering systems
- E.g., computers in cars to control emissions and braking
- Ability of computers to control aspects: Removes humans from the control loop
- Software engineers must ensure that when designing systems with embedded computers
  - Software is adequately tested
  - Humans can intervene when necessary
  - Safety systems have enough hardware redundancy without relying solely on software

Autonomous Computers

- Ethical concerns because of increasingly autonomous nature of computers
- Applications for which autonomy is valuable
  - E.g., monitoring of manufacturing processes at frequent intervals
- Some autonomy not so benign
  - E.g., automatic trading of stocks, selling under certain conditions, prices drop, more selling
- Autonomous computers can greatly increase productivity and efficiency in many areas
- There must be some human control to prevent disasters

Computer Codes of Ethics

- To aid with decision making regarding computer-ethics: Many organizations have developed codes of ethics for use of computers
- Provide guidance in proper use of computer equipment
- Should not be used as a substitute for sound moral judgment

Ethics and Research

Two major ethical issues related to research

1. Honesty in approaching the research problem
   - Avoiding preconceived notions about results
   - Being open to changing the hypothesis
   - Maintaining an objective frame of mind
2. Honesty in reporting the results
   - Accurately reporting the results
   - Not overstating the results
   - Distinction between intentional deception and incorrect interpretations
   - Ensure proper credit is given to all participants

Codes of Ethics

ACM Code of Ethics and Professional Conduct

- 1992
- Copyright ACM
- 4 sections
- 24 imperatives
- Commitment to ethical professional conduct is expected of every member of ACM
  - Voting members
  - Associate members
  - Student members

ACM Code of Ethics and Professional Conduct

1. GENERAL MORAL IMPERATIVES.

As an ACM member I will ....

1.1 Contribute to society and human well-being.
1.2 Avoid harm to others.
1.3 Be honest and trustworthy.
1.4 Be fair and take action not to discriminate.
1.5 Honor property rights including copyrights and patent.
1.6 Give proper credit for intellectual property.
1.7 Respect the privacy of others.
1.8 Honor confidentiality.

ACM Code of Ethics and Professional Conduct

2. MORE SPECIFIC PROFESSIONAL RESPONSIBILITIES.

As an ACM computing professional I will ....

2.1 Strive to achieve the highest quality, effectiveness and dignity in both the process and products of professional work.

2.2 Acquire and maintain professional competence.

2.3 Know and respect existing laws pertaining to professional work.

2.4 Accept and provide appropriate professional review.

2.5 Give comprehensive and thorough evaluations of computer systems and their impacts, including analysis of possible risks.

ACM Code of Ethics and Professional Conduct

2.6 Honor contracts, agreements, and assigned responsibilities.

2.7 Improve public understanding of computing and its consequences.

2.8 Access computing and communication resources only when authorized to do so.

ACM Code of Ethics and Professional Conduct

3. ORGANIZATIONAL LEADERSHIP IMPERATIVES.

As an ACM member and an organizational leader, I will ....

3.1 Articulate social responsibilities of members of an organizational unit and encourage full acceptance of those responsibilities.

3.2 Manage personnel and resources to design and build information systems that enhance the quality of working life.

3.3 Acknowledge and support proper and authorized uses of an organization's computing and communication resources.

ACM Code of Ethics and Professional Conduct

3.4 Ensure that users and those who will be affected by a system have their needs clearly articulated during the assessment and design of requirements; later the system must be validated to meet requirements.

3.5 Articulate and support policies that protect the dignity of users and others affected by a computing system.

3.6 Create opportunities for members of the organization to learn the principles and limitations of computer systems.

ACM Code of Ethics and Professional Conduct

4. COMPLIANCE WITH THE CODE.

As an ACM member I will ....

4.1 Uphold and promote the principles of this Code.

4.2 Treat violations of this code as inconsistent with membership in the ACM.

IEEE Code of Ethics

- As per IEEE Bylaw I-104.14
- Membership in IEEE in any grade shall carry the obligation to abide by the IEEE Code of Ethics (IEEE Policy 7.8)
- 2006
- Copyright IEEE
- We, the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree:

IEEE Code of Ethics

1. To accept responsibility in making decisions consistent with the safety, health, and welfare of the public, and to disclose promptly factors that might endanger the public or the environment;
2. To avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist;
3. To be honest and realistic in stating claims or estimates based on available data;
4. To reject bribery in all its forms;
5. To improve the understanding of technology; its appropriate application, and potential consequences;

IEEE Code of Ethics

6. To maintain and improve our technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations;
7. To seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others;
8. To treat fairly all persons regardless of such factors as race, religion, gender, disability, age, or national origin;
9. To avoid injuring others, their property, reputation, or employment by false or malicious action;
10. To assist colleagues and co-workers in their professional development and to support them in following this code of ethics;

Software Engineering Code of Ethics and Professional Practice

- Recommended by the ACM/IEEE-CS Joint Task Force on Software Engineering Ethics and Professional Practices (SEEPP)
- Jointly approved by the ACM and the IEEE-CS as the standard for teaching and practicing software engineering
- Version 5.2
- Two versions
  - Short Version: Overall summary
  - Full Version: Examples and details
- 1999
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Software Engineering Code of Ethics and Professional Practice

- 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.

Software Engineering Code of Ethics and Professional Practice

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.

Software Engineering Code of Ethics and Professional Practice

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.