Professional Ethics: Unit 2 - Part 1 of 3

Engineering Ethics and Computer-Related Codes of Ethics

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Profession

Profession

Profession is defined as any occupation/job/vocation that requires advanced expertise (skills and knowledge), self-regulation, and concerted service to the public good. It brings a high status, socially, and economically.

Characteristics of a Profession

Characteristics of a Profession

1. **Advanced expertise:** Many profession require sophisticated skills (do-how) and theoretical knowledge (know-how and why). Formal education, training, continuing education, updating are needed.
2. **Self-Regulation:** Professional societies play important role in setting standards for admission to profession, drafting codes of ethics, enforcing standards of conduct, and representing the profession before the public and the government.

Characteristics of a Profession

Characteristics of a Profession Cont'd

3. **Public good:** The occupation provides some important public good, by concerted efforts to maintain ethical standards. For example, a physician promotes health, a lawyer protects the legal rights, an engineer provides a product or a project for use by the public towards their health, welfare, and safety. Teaching is also claimed as a profession as it helps shaping and traing the minds of the students, young as well as old.

Professional and Professionalism

Professional

Professional relates to person or any work that a person does on profession, and which requires expertise (skills and knowledge), self-regulation and results in public good. The term professional means a 'person' as well as a 'status'.

Professionalism

It is the status of a professional which implies certain attitudes or typical qualities that are expected of a professional. According to Macintyre, professionalism is defines as the services related to achieving the public good, in addition to the practices of the knowledge of moral ideals.

Engineering Ethics

Engineering Ethics is the activity and discipline aimed at

1. understanding the moral values that ought to guide engineering profession or practice,
2. resolving moral issues in engineering, and
3. justifying the moral judgments in engineering. It deals with set of moral problems and issues connected with engineering.

Engineering Ethics

Engineering Ethics

Engineering ethics is defined by the codes and standards of conduct endorsed by engineering (professional) societies with respect to the particular set of beliefs, attitudes and habits displayed by the individual or group.

Engineering Ethics

- Another important goal of engineering ethics is the discovery of the set of justified moral principles of obligation, rights and ideals that ought to be endorsed by the engineers and apply them to concrete situations.
- Engineering is the largest profession and the decisions and actions of engineers affect all of us in almost all areas of our lives, namely public safety, health, and welfare.

Senses of Engineering Ethics

Senses of Engineering Ethics

There are two different senses (meanings) of engineering ethics, namely the Normative and the Descriptive senses.

Normative sense

- Knowing moral values, finding accurate solutions to moral problems and justifying moral judgments in engineering practices,
- Study of decisions, policies, and values that are morally desirable in the engineering practice and research, and
- Using codes of ethics and standards and applying them in their transactions by engineers.

Descriptive sense

The descriptive sense refers to what specific individual or group of engineers believe and act, without justifying their beliefs or actions.

Variety of Moral Issues

- It would be relevant to know why and how do moral issues (problems) arise in a profession or why do people behave unethically?
- The reasons for people including the employer and employees, behaving unethically may be classified into three categories, namely (i) Resource Crunch, (ii) Opportunity, and (iii) Attitude.

Resource Crunch

- Due to pressure, through time limits, availability of money or budgetary constraints, and technology decay or obsolescence.
- Pressure from the government to complete the project in time (e.g., before the elections), reduction in the budget because of sudden war or natural calamity (e.g., Tsunami) and obsolescence due technology innovation by the competitor lead to manipulation and unsafe and unethical execution of projects.

Involving individuals in the development of goals and values and developing policies that allow for individual diversity, dissent, and input to decision-making will prevent unethical results.

Opportunity

- Double standards or behavior of the employers towards the employees and the public. The unethical behaviors of World Com (in USA), Enron (in USA as well as India) executives in 2002 resulted in bankruptcy for those companies
- Management projecting their own interests more than that of their employees. Some organizations over-emphasize short-term gains and results at the expense of themselves and others,
- Emphasis on results and gains at the expense of the employees, and
- Management by objectives, without focus on empowerment and improvement of the infrastructure

This is best encountered by developing policies that allow 'conscience keepers' and whistle blowers and appointing ombudsman, who can work confidentially with people to solve the unethical problems internally.

Attitude

Poor attitude of the employees set in due to

- Low morale of the employees because of dissatisfaction and downsizing,
- Absence of grievance redressal mechanism,
- Lack of promotion or career development policies or denied promotions,
- Lack of transparency,
- Absence of recognition and reward system, and
- Poor working environments

Giving ethics training for all, recognizing ethical conduct in work place, including ethics in performance appraisal, and encouraging open discussion on ethical issues, are some of the directions to promote positive attitudes among the employees.

Computer Ethics

Computer ethics is defined as

- Study and analysis of nature and social impact of computer technology,
- Formulation and justification of policies, for ethical use of computers.

The use of computers have raised a host of moral concerns such as free speech, privacy, intellectual property right, and physical as well as mental harm.

Computer Ethics

Computer Ethics

- On the question of whether computer ethics is unique as a form of ethics, it is fair to say that computer ethics does not have different principles than do other kinds of ethics.
- However, the nature of the computer does give many dilemmas concerning it a difference in degree that approximates a difference in kind and makes computer ethics a unique field of study.

The Ten Commandments of Computer Ethics

The Ten Commandments of Computer Ethics

1. Thou shalt not use a computer to harm other people.
2. Thou shalt not interfere with other people's computer work.
3. Thou shalt not snoop around in other people's computer files.
4. Thou shalt not use a computer to steal.
5. Thou shalt not use a computer to bear false witness.

The Ten Commandments of Computer Ethics

The Ten Commandments of Computer Ethics

6. Thou shalt not copy or use proprietary software for which you have not paid.
7. Thou shalt not use other people's computer resources without authorization or proper compensation.
8. Thou shalt not appropriate other people's intellectual output.
9. Thou shalt think about the social consequences of the program you are writing or the system you are designing.
10. Thou shalt always use a computer in ways that ensure consideration and respect for your fellow humans.

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General Ethical Principles

- Contribute to society and to human well-being
- Avoid harm
- Be honest and trustworthy
- Be fair and take action not to discriminate
- Respect the work required to produce new ideas, inventions, creative works, and computing artifacts
- Respect privacy
- Honor confidentiality

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Professional Responsibilities

- Strive to achieve high quality in both the processes and products of professional work
- Maintain high standards of professional competence, conduct, and ethical practice
- Know and respect existing rules pertaining to professional work
- Accept and provide appropriate professional review
- Give comprehensive and thorough evaluations of computer systems and their impacts, including analysis of possible risks

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Professional Responsibilities cont'd

- Perform work only in areas of competence
- Foster public awareness and understanding of computing, related technologies, and their consequences
- Access computing and communication resources only when authorized or when compelled by the public good
- Design and implement systems that are robustly and usably secure

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Professional Leadership Principles

- Ensure that the public good is the central concern during all professional computing work
- Articulate, encourage acceptance of, and evaluate fulfillment of social responsibilities by members of the organization or group
- Manage personnel and resources to enhance the quality of working life
- Articulate, apply, and support policies and processes that reflect the principles of the Code

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Professional Leadership Principles Cont'd

- Create opportunities for members of the organization or group to grow as professionals
- Use care when modifying or retiring systems
- Recognize and take special care of systems that become integrated into the infrastructure of society

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Case Study

The case is presented to illustrate how computing professionals can apply the Code as a framework for analyzing ethical dilemmas.

- Questions that establish a general approach to assist computing professionals in ethical decision-making.
  - **Consider:** Who are the relevant actors and stakeholders? What were the anticipated and/or observable effects of the actions or decisions for those stakeholders? What additional details would provide a greater understanding of the situational context?
  - **Analyze:** What stakeholder rights (legal, natural, or social) were impacted and to what extent? What technical facts are most relevant to the actors' decision? What principles of the Code were most relevant? What personal, institutional, or legal values should be considered?

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Case Study Cont'd

- Questions that establish a general approach to assist computing professionals in ethical decision-making.
  - **Review:** What responsibilities, authority, practices, or policies shaped the actors' choices? What potential actions could have changed the outcomes?
  - **Evaluate:** How might the decision in this case be used as a foundation for similar future cases? What actions (or lack of action) supported or violated the Code? Are the actions taken in this case justified, particularly when considering the rights of and impact on all stakeholders?

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Case Study 1

Rogue Services advertised its web hosting services as "cheap, guaranteed uptime, no matter what." While some of Rogue's clients were independent web-based retailers, the majority were focused on malware and spam. Several botnets used Rogue's reliability guarantees to protect their command-and-control servers from take-down attempts. Spam and other fraudulent services leveraged Rogue for continuous delivery. Corrupted advertisements often linked to code hosted on Rogue exploiting browser vulnerabilities to infect machines with ransomware.

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Case Study 1 Cont'd

Despite repeated requests from other ISPs and security organizations, Rogue refused to intervene with these services, citing their "no matter what" pledge to their customers. International pressure from other governments failed to induce national-level intervention, as Rogue was based in a country whose laws did not adequately proscribe such hosting activities. Given Rogue's non-compliance with these requests, a response team consisting of security vendors and government organizations created a prototype worm designed specifically to target Rogue's network and destroy the malicious services.

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Case Study 1 Cont'd

- **Consider:** In deciding whether to proceed with the attack, the security response team needs to consider the impact on stakeholders that include Rogue's clients, those affected by the malware hosted on Rogue's systems, and others who rely on the services of Rogue's non-malicious clients. While the worm is intended to disrupt the malware hosting, it could disrupt the operation of non-malicious clients or escape Rogue's network, spreading to other ISPs. The worm could also prove to be ineffective and fail to achieve its aim, though alerting Rogue's malicious clients in the process. More information about Rogue's non-malicious clients would be beneficial, particularly whether they understood the nature of and risks caused by Rogue's malicious clients.

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Case Study 1 Cont'd

- **Analyze:** Allowing Rogue's malicious clients' service to continue impacts the rights of individuals they harm, whereas Rogue's retailer clients have rights relating to the integrity and preservation of their data and business. Furthermore, Rogue's clients should have had transparent information of the risks associated with their business model. The most relevant portions of the Code are Principles "Avoid harm" and "Access computing and communication resources only when authorized or when compelled by the public good.", as the worm authors must consider whether the intentional harm to Rogue's systems is justified to support the public good.

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Case Study 1 Cont'd

- **Review:** Rogue's policy of non-interference with their clients, coupled with their refusal to cooperate with takedown requests, shaped the choices of the security response team. Cooperation by Rogue or a more robust legal framework by their host country would have provided more options for a resolution that did not risk such harm.

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Case Study 1 Cont'd

- **Evaluate:** This case highlights a key nuance of Principle "Avoid harm". Given that the worm was designed with the specific intent of causing harm to Rogue's systems, the authors are obligated to ensure the harm is ethically justified. As the worm aims to shut down web services that are clearly harmful and malicious, the intent of the worm is consistent with the moral obligations identified in Principle "Contribute to society and to human well-being, acknowledging that all people are stakeholders in computing." Additionally, the Code obligates the authors to minimize unintended harm by limiting the worm's effects solely to Rogue's systems. Rogue's other (non-malicious) clients could rightfully object if their data is harmed, so the worm should include additional precautions to avoid this unintentional harm.

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Case Study 1 Cont'd

- The worm also highlights the guidance in Principle "Access computing and communication resources only when authorized or when compelled by the public good.". The worm will clearly access Rogue's systems in ways that are not authorized—destroying data in the process—but targeting known malicious software demonstrates a compelling belief that the service disruption was consistent with the public good. While there is a legitimate concern that such a worm could be manipulated as a precedent for someone seeking vigilante action, this case suggests how a computing professional should approach this work, by resorting to malicious actions only when other approaches are unsuccessful.

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Case Study 1 Cont'd

- This scenario is like a real incident that occurred in November 2008. McColo, a web hosting provider, had been responsible for a significant source of spam and malware. In contrast to the destructive worm described above, McColo's upstream provider severed their connection to the Internet. This action disrupted the operation of several of the world's largest botnets, as they had hosted their master servers on McColo.

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Case Study 2

Quinn is a member of a medical research team studying the role of genetic factors in psychological disorders, particularly focusing on how different variants influence social behavior. To facilitate this work, Quinn built a tool that linked three anonymized data sets: an anonymized set of genetic test results accessible only by medical researchers, a publicly available anonymized database of clinical diagnoses, and a custom database of public social networking posts. To preserve anonymity, the tool replaced all personally identifiable information in the social networking posts with quasi-identifiers. Quinn's team was granted approval for a study by their ethics review board (ERB), on the grounds that all data was anonymous and/or public, and all users had opted in to the data collection.

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Case Study 2 Cont'd

While testing the tool, Quinn discovered a bug that incorrectly linked some records of multiple individuals as a single person. Given that the data sets were all anonymized, the team had accepted that such erroneous matches were likely to occur. The bug increased the expected number of such matches, but only slightly; as such, the bug was classified as low priority. Quinn raised concerns that there may be other such bugs and suggested that the source code be released under an open source license to facilitate peer review of both the tool and the overall research.

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Case Study 2 Cont'd

- **Consider:** Before releasing the code, Quinn and the team need to consider the impact on relevant stakeholders, particularly individuals whose records are contained in the data sets. When data sets are linked, re-identification of individuals is a common risk, which could lead to harm. Quinn would need to evaluate the merged data according to established anonymization metrics. Even more problematic, Quinn would need to consider how the merged data sets could be linked with other unknown data collections to break the existing anonymity.

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Case Study 2 Cont'd

- **Analyze:** Quinn's team had a moral (and almost certainly a legal) responsibility to protect the human subjects of their research. Although they worked with their ERB as part of this process, making the tool publicly available—even while keeping the existing data private—introduces unpredictable risks of data re-identification. Individuals who opt into such data sets could not be expected to anticipate the risk of using their data in this way. The most relevant portions of the Code are Principles "Avoid harm" and "Respect privacy", though several other principles apply.

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Case Study 2 Cont'd

- **Review:** Prior to releasing the source code in any way, Quinn's team should consult with their ERB regarding the risks. It is possible that the ERB members lack the technical expertise to determine that releasing the code is tantamount to releasing the merged data. Additionally, Quinn should consider alternative ways to do such peer review, such as making the code available only on request and under restricted terms.

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Case Study 2 Cont'd

- **Evaluate:** Principle "Avoid harm" warns against the harms that can be caused by data aggregation; Principle "Respect privacy" re-emphasizes this point by stressing that merging data can strip privacy guarantees in the original sets. Principle "Respect privacy" also suggests that the inaccuracies introduced by the bug must be fixed, and subjects must be adequately informed of the risks. In addition, the tool may facilitate the collection of data (such as metadata associated with the social networking activity) beyond the minimum amount necessary. Principle "Give comprehensive and thorough evaluations of computer systems and their impacts, including analysis of possible risks" also declares that the team must consider possible future risks associated with this tool and data use.

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Case Study 2 Cont'd

- **Evaluate: (cont'd)** In addition, Principles "Strive to achieve high quality in both the processes and products of professional work" and "Accept and provide appropriate professional review" obligate transparent communication with stakeholders, which would obligate informing both the ERB and all subjects of these risks. As such, publicly releasing the source code for this tool could cause harm and would be inadvisable.

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Case Study 2 Cont'd

- The use of social networking posts also raises concerns in regard to Principle "Access computing and communication resources only when authorized or when compelled by the public good". Although these posts were publicly accessible, Quinn's team had no reasonable belief that using the data in this way was authorized. Some individuals' posts may have been made public because they did not understand the system's privacy controls. Even those who knowingly made their posts public would not have considered that these posts would be linked to genetic records.

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Case Study 2 Cont'd

- Quinn's attempt to seek peer review is consistent with the intent of Principles "Maintain high standards of professional competence, conduct, and ethical practice" and "Accept and provide appropriate professional review". In recognizing the potential for bugs in the tool, Quinn sought input from other computing professionals; however, given the risks involved, a more discreet form that did not involve a completely public release would have been recommended. It is not clear whether Quinn had sufficient training in data anonymization techniques; if not, the guidance of Principle "Maintain high standards of professional competence, conduct, and ethical practice" suggests that Quinn should not have developed the tool without acquiring these technical competencies.

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Case Study 3

Corazón is a medical technology startup that builds an implantable heart health monitoring device. The device comes with a smart phone app that monitors and controls the device wirelessly, as well as stores a persistent record that can be shared with medical providers. After being approved by multiple countries' medical device regulation agencies, Corazón quickly gained market share based on the ease of use of the app and the company's vocal commitment to securing patients' information. To further expand their impact, Corazón worked with several charities to provide the device at a reduced price to patients living below the poverty line.

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Case Study 3 Cont'd

As a basic security mechanism, Corazón's implant could only be accessible through short-range wireless connections, requiring the phone and implant to be in close proximity. Data transferred between the app and the device employed standard cryptographic algorithms, and all data stored on the phone was encrypted. To support on-going improvement, Corazón had an open bug bounty program inviting disclosure of potential vulnerabilities in their app.

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Case Study 3 Cont'd

At a recent security conference, an independent researcher claimed to have found a vulnerability in the wireless connectivity. The researcher presented a proof-of-concept demonstration where a second device in close proximity could modify commands sent to the implant to force a device reset. The attack relied on the use of a hard-coded initialization value stored in the implant device that created a predictable pattern in the data exchanges that could be manipulated. In consultation with Corazón's technical leaders, the researcher concluded that the risk of harm with this attack is negligible, given the limited capabilities of the device.

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Case Study 3 Cont'd

- **ANALYSIS SUMMARY:** Corazón's practices embody the goals of several principles in the Code. Corazón's products and their charity work contribute to society and to human well-being, consistent with the aims of Principle "Contribute to society and to human well-being, acknowledging that all people are stakeholders in computing". In addition, their rigorous approach to design, validation, and maintenance exemplifies Principle "Ensure that the public good is the central concern during all professional computing work", holding the public good as the central concern within their processes. By working within governmental regulation agencies, Corazón demonstrated a commitment to Principle "Know and respect existing rules pertaining to professional work". Corazón's use of cryptography and vulnerability disclosure practices adheres to the robust security goals of Principle "Design and implement systems that are robustly and usably secure".

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Case Study 3 Cont'd

- **ANALYSIS SUMMARY cont'd:** Furthermore, Corazón's reliance on standard cryptographic algorithms—rather than attempting to devise an unproven proprietary technique—shows commitment to Principle "Perform work only in areas of competence", restricting their developers' work to areas of competence. Corazón's consultation with the researcher also highlights a key aspect of Principle "Give comprehensive and thorough evaluations of computer systems and their impacts, including analysis of possible risks". The design and implementation of Corazón's products exhibit a commitment to comprehensive and thorough risk analysis. Furthermore, Corazón welcomed independent security evaluation to identify additional issues that their designers overlooked. Once a potential vulnerability was discovered, Corazón acted responsibly and quickly to determine the scope of the flaw with the aim of mitigating the harm.

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Case Study 3 Cont'd

- **ANALYSIS SUMMARY cont'd:** One area of concern regarding Corazón's design is the use of a hard-coded value in the implant. Given the nature of the device, fixing this design choice would be difficult if it proved necessary. However, there is insufficient evidence at this point to determine the scope of the risk induced by this design.

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Case Study 3 Cont'd

- **ANALYSIS SUMMARY cont'd:** Corazón's on-going commitment to security and improvement also exemplifies an important aspect of Principle "Recognize and take special care of systems that become integrated into the infrastructure of society". Corazón's rapid success in this specialized healthcare field is an instance of the integration of technology into the infrastructure of society. Recognizing the increased stewardship required by this Principle, Corazón began working with charities to serve individuals whose poverty may have excluded them from access.

Software Engineering Code of Ethics and Professional Practice

Software Engineering Code of Ethics and Professional Practice

- Recommended by the ACM/IEEE-CS Joint Task Force on Software Engineering Ethics and Professional Practices
- Jointly approved by the ACM and the IEEE-CS as the standard for teaching and practicing software engineering.
- For the welfare of the public, software engineers shall adhere to the following Eight Principles.

Software Engineering Code of Ethics and Professional Practice

Software Engineering Code of Ethics and Professional Practice

- **Product:** Software engineers shall ensure that their products and relatedmodifications meet the highest professional standards possible.
- **Public:** Software engineers shall act consistently with the public interest.
- **Judgment:** Software engineers shall maintain integrity and independence in theirprofessional judgment.
- **Client and Employer:** Software engineers shall act in a manner that is in thebest interests of their client and employer consistent with the public interest.

Software Engineering Code of Ethics and Professional Practice

Software Engineering Code of Ethics and Professional Practice

- **Management:** Software engineering managers and leaders shall subscribe to andpromote an ethical approach to the management of software development andmaintenance.
- **Profession:** Software engineers shall advance the integrity and reputation of theprofession consistent with the public interest.
- **Colleagues:** Software engineers shall be fair to and supportive of theircolleagues.
- **Self:** Software engineers shall participate in lifelong learning regarding the practiceof their profession and shall promote an ethical approach to the practice of the profession.