EECS 541: Computer Systems Design Capstone

Engineering Ethics

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Why Engineering Ethics?

- Engineering disasters
  - affects society; human lives
- Engineers are becoming professionally self-conscious
  - engineers starting to recognizing themselves are engineers first, and employees later

Why do Engineers need Ethics?

- Engineering is a “profession” as opposed to an “occupation”
- Professions Vs. Occupation
  - based on large knowledge base that requires extensive training
  - is important to the well-being of society
  - is self-regulating
  - demands autonomy in the workplace
- Ethics (and technical skill) needed for professionalism.
- Code of ethics forms a contract between professionals and the public.

Engineering Profession

- Licensing of engineers
  - 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.)*
  - degree from an accredited university
    - accreditation Board for Engineering (ABET)
  - four years of professional experience
  - fundamentals of Engineering (FE) exam
    - has an “ethics” section
  - Principles and Practice in Engineering (PE) exam

**Notes by Dr. Arvin Agah*

Application of Ethical Codes

- In many situations, applying ethical codes is straight-forward and non-controversial
- In some cases, applying ethical codes in more challenging
  - facts vs. factual issues
  - when facts are just as controversial as moral issues
  - when different factual assumptions can produce different moral conclusions

Application of Ethical Codes – 2

- Some things are not "defined" in the ethical codes, are murky; called *conceptual issues*
  - valuable consideration
  - adequate knowledge
  - public welfare
  - truthful
  - relevant and pertinent information
  - conflict of interest
  - does something appear to influence professional judgement?
  - does something directly or indirectly influence professional judgement?

Application of Ethical Codes – 3

- Conflict issues / tradeoffs
  - how to balance costs versus benefits?
  - how to balance obligation to employers versus obligation to public?
  - how to balance health/safety versus cost?
  - how to balance fast design when it is needed versus ensuring quality?

Satisfy Different Constraints – Example*

- Ethics disputes may be caused by attempts to satisfy irreconcilable constraints
  - suppose it is impossible to test a product adequately in time to meet a delivery date
  - missing the delivery date constitutes a highly visible failure, with clearly defined penalties
  - there may be no obvious indication that an important set of tests has been omitted, even if this leads to a substantial increase in the probability of a life threatening system failure
- Under such conditions, there is a temptation to meet the deadline by skipping or shortening the tests

** Notes by Dr. Sushma Kotru, University of Alabama*

Morals, Ethics, and the Law

- *Morals* are beliefs on what is right and what is wrong held by sections of society
  - may vary among people and cultures
- *Personal ethics* are based on morals/beliefs held by each individual
- *Professional ethics* is formally adopted and regulated in a code of conduct by a professional group
  - contract on how the members of a profession will interact with society
- All engineers are required to adhere to laws in their work.
- Professional ethics goes beyond adhering to laws.

Engineer's Ethical Obligations

- Foremost obligation and responsibility is to society
  - public life, health, property, and welfare
  - be a guardian of public safety
  - submit complete and truthful reports, statements, testimonies
  - don't abuse credibility
  - don't conduct fraud
  - inform state board of possible ethics violations

Engineer's Ethical Obligations – 2

- Engineer's next obligations are to employer
  - only accept assignments for which you are qualified
  - don't sign reports/documents for projects if you did not prepare or supervise them; or are not competent in them
  - for project segments where you are not competent, a qualified engineer should sign plans and documents for those aspects of the project
  - protect facts, data, and information belonging to your employer or client
  - disclose actual or perceived conflicts of interest
  - don't accept *payment* for anyone other than the employer or client
  - do not accept a contract from a government body on which a principal or officer of your firm serves as a member.

Engineer's Ethical Obligations – 3

- Next obligations are to other licensees
  - don't misrepresent or exaggerate the degree of responsibility or complexity of your prior work
  - do not give or receive valuable consideration in order to secure work – bribes, donations, gifts, payments, etc.
  - do not attempt to "injure, maliciously or falsely, directly or indirectly" the professional reputation or employment opportunities of other licensees

Engineer's Ethical Obligations – 3

- Other obligations
- As an expert witness
  - give complete and objective analysis of the facts in your area of expertise
- As a consultant
  - make sure you are fully qualified as an expert in the area for which you are consulting

Case study – 1*

- 1. What is the direct result of ethical behavior?
  - (A) Your reputation will be enhanced.
  - (B) You will be rewarded economically.
  - (C) You will feel good about yourself.
  - (D) Neither I, II, or III

** Notes by Dr. Sushma Kotru, University of Alabama*

Case study – 2*

- Complete the sentence: “if you check the calculations for a licensed (registered) friend who has gone into a consulting business for himself/herself,
  - (A) “you should be paid for your work.”
  - (B) “your friend’s client should be told of your involvement.”
  - (C) “you do not need to be licensed or registered yourself.”
  - (D) “your friend assumes all the liability for your work.”

** Notes by Dr. Sushma Kotru, University of Alabama*

Case study – 3*

- What does it mean when a design professional accepts a punishment for an unethical act from his technical society "with prejudice?"
  - (A) The professional's race, creed, and national origin were considered in deciding on the punishment.
  - (B) The professional's race, creed, and national origin were not considered in deciding on the punishment.
  - (C) Even after the sentence is served or punishment is completed, there may be further actions taken.
  - (D) The professional is held in bad report for the period of prejudice.

** Notes by Dr. Sushma Kotru, University of Alabama*

Case study – 4*

- While supervising a construction project in a developing country, an Engineer discovers that his client's project manager is treating laborers in an unsafe and inhumane manner (but for that country, legal). When he protests, the Engineer is told by the company executives that the company has no choice if it wishes to remain competitive in the regions, and he should accept this as the way things are. What would Ethics require the Engineer to do?
  - (A) Take no action – the company is acting in a perfectly legal manner.
  - (B) Withdraw from the project, returning any fees he may have already received.
  - (C) Report the company to the proper authorities for its human rights abuses.
  - (D) Assist the laborers in organizing a strike to obtain better working conditions.

** Notes by Dr. Sushma Kotru, University of Alabama*

Case study – 5*

- Two engineers submitted sealed bids to a prospective client for a design project. The client told Engineer A how much Engineer B had bid and invited Engineer A to beat that amount. Engineer A really wants the project and honestly believes he can do a better job than Engineer B. What should he do?
  - (A) He should submit another quote, but only if he can perform the work adequately at the reduced price.
  - (B) He should withdraw from consideration for the project.
  - (C) He should remain in consideration for the project, but not change his bid.
  - (D) He should bargain with the client for the cost of the work.

** Notes by Dr. Sushma Kotru, University of Alabama*

Case study – 6*

- You are a city Engineer in charge of receiving bids on behalf of the city council. A contractor's bid arrives with two tickets to a professional football game. The bid is the lowest received. What should you do?
  - (A) Return the tickets and accept the bid.
  - (B) Return the tickets and reject the bid.
  - (C) Discard the tickets and accept the bid.
  - (D) Discard the tickets and reject the bid.

** Notes by Dr. Sushma Kotru, University of Alabama*

Case Study – 7*

- A registered engineer is being interviewed for television on a matter relating to his expertise that affects the public safety. The interviewer asks a question about the chances for a cure for AIDS. The engineer should
  - (A) express his opinion honestly and completely
  - (B) decline to comment
  - (C) recount what he read in a magazine article on the subject
  - (D) suggest everyone get an AIDS test

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Case Study – 8*

- Under what circumstances can a registered engineer sign and seal plans or documents he/she did not prepare?
  - (A) Registered engineers can coordinate projects that include segments that they are not competent in if a qualified registered engineer signs and seals plans or documents for those segments of the project.
  - (B) Under no circumstances.
  - (C) If the plans or documents were prepared by someone under the registered engineer's direct supervision and the registered engineer is an expert in the subject matter.
  - (D) When practicing in a state different than the one in which the engineer is registered.

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Case Study – 9*

- You and your design group are competing for a multidisciplinary concept project. Your firm is the lead group in the design professional consortium formed to compete for the project. Your consortium has been selected to be the first to enter fee negotiations with the project owner. During negotiations, the amount you have to cut from your fee to be awarded the contract will require dropping one of the consortium members whose staff has special capabilities not found in the staff of the remaining consortium members. Is your consortium response in the negotiations ethical?
  - (A) No, not if the owner is left with the impression that the consortium is still fully qualified to perform all the required tasks.
  - (B) Yes, if your remaining consortium members hire a few new, lower cost employees to do the special work originally intended to be provided by the consortium member dropped.
  - (C) No, because an engineer may not accept a contract to coordinate a project with other professional firms providing capabilities and services not under the engineer's direct control.
  - (D) Yes, if in accepting an assignment to coordinate a project, a single personwill sign and seal all the documents in the entire consortium work.

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Case Study – 10*

- A registered engineer has applied for a promotion at a firm she has been working at for several years. During an interview for the new position, she is asked to contrast her qualifications with other registered engineers at the firm who have applied for the same position. She should
  - (A) withdraw her application for the position.
  - (B) give a full accounting of all the ways her ability and experience are superior to those of the other applicants.
  - (C) demand to speak to the interviewer's supervisor.
  - (D) decline to compare her qualifications but offer to describe them.

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Case Study – 11*

- A professional engineer, originally licensed 30 years ago, is asked to act as a consultant on a newly developed computerized control system for a public transportation system. The engineer may accept this project if
  - (A) he or she is competent in the area of modern control systems.
  - (B) his or her professional engineering license has not lapsed.
  - (C) his or her original area of specialization was in transportation systems.
  - (D) he or she has regularly attended annual meetings of a professional engineering society.

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Case Study – 12*

- A registered engineer is retained as an expert witness by one of the parties in a civil case where the public safety is not involved. In investigating the technical data in the case, the engineer makes findings that are not favorable to the side of the party who retained her. The engineer should
  - (A) inform the party who retained her of the findings.
  - (B) inform the judge of the findings.
  - (C) inform the opposing party of the findings.
  - (D) say nothing about the findings until called to testify.

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Case Study – 13*

- Connie is a licensed professional engineer and professor at a major state university. She is retained to testify as an expert in construction engineering. She will testify that although the construction sequence used in the project in question was outside usual engineering practice, it was acceptable. She can base her testimony on:
  - (A) The fact she holds a Ph.D. in engineering
  - (B) The fact she is a licensed professional engineer
  - (C) Her intuition that the sequence is acceptable
  - (D) Detailed computer simulations that prove the construction sequence used in the project will work

**Washington State University notes on CE 466 FE Exam Review – Ethics and Business Practices, 2013*

Case Study – 14*

- Juan is an EIT working as an electrical engineer for a consulting company that designs switch gears for small substations. His supervisor asks him to duplicate a set of drawings, changing the name of the client. He explains that a new client has a substation with identical specifications to the last project Juan worked on, so the same design will work. When Juan asks how he should bill his time, he is told to enter the same number of hours he billed for the initial design work. Juan's response should be:
  - (A) "It took me two weeks to design the earlier project, so I should wait two weeks before submitting this design to justify the charged hours"
  - (B) "The Code of Ethics requires that a second use of a design be done by a different engineer"
  - (C) "The Code of Ethics prevents me from billing two clients for the same work, without informed consent"
  - (D) "I'll need to do some research to make sure the specifications are really identical"

**Washington State University notes on CE 466 FE Exam Review – Ethics and Business Practices, 2013*

Case Study – 15*

- With respect to an engineer's responsibility to the profession, the NCEES model code prevents engineers from
  - (A) forming partnerships with surveyors without approval of the Surveying board.
  - (B) working under unlicensed engineers.
  - (C) offering a commission to secure an engineering assignment.
  - (D) advertising their services to the public in other than technical journals.

**Washington State University notes on CE 466 FE Exam Review – Ethics and Business Practices, 2013*

Case Study – 16*

- You and your design group are competing for a multi-disciplinary project. Your firm is the lead group of a consortium formed to compete for the contract. Your consortium has been selected as the first to enter fee negotiations with the project owner. During the negotiations, you are asked to reduce your fee which will require dropping one of the consortium members whose staff have special expertise not found among the remaining consortium members. Is your consortium's response to the fee reduction ethical?
  - (A) Not if the owner is left with the impression that the consortium is fully qualified to perform all the required tasks.
  - (B) Yes, if your remaining consortium members hire a few, lower cost employees to do the special work intended to be provided by the firm that was dropped.
  - (C) No, because an engineer may not accept a contract to coordinate a project with other professional firms providing capabilities and services not under the engineer's direct control.
  - (D) Yes, if in accepting an assignment to coordinate a project a single person will stamp all documents in the entire project

**Washington State University notes on CE 466 FE Exam Review – Ethics and Business Practices, 2013*

Case Study – 17*

- Both you and Joe were hired right out of engineering school by XYZ company one year ago. You and Joe work in the same engineering section and have become friends as well as working on the same projects every once and a while. Recently, Joe let it slip that he never actually graduated due to failing a required last-semester senior course. Joe just listed himself as a graduate engineer on his application form. Joe is a nice person. Both of you are registered as EITs with the state registration board. You should:
  - (A) Write a brief report on the situation to the state licensing board asking them to investigate.
  - (B) Ignore the situation since Joe is doing a good job at work.
  - (C) Write an anonymous letter to the firm president stating that "some" engineering employees have misrepresented their educational background.
  - (D) Avoid interacting with Joe because otherwise you might be blamed for condoning his behavior if the truth comes to light.

**Washington State University notes on CE 466 FE Exam Review – Ethics and Business Practices, 2013*

Computer Ethics – 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 provides increased opportunities for plagiarism
- Massive amounts of information easily available
- Citations must be provided
- Use of standard formats

**Notes by Dr. Arvin Agah*

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

**Notes by Dr. Arvin Agah*

Computer Crimes – 2*

- 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

**Notes by Dr. Arvin Agah*

Guidelines for Dissenting on Ethical Grounds*

- Establish a clear technical foundation
- Keep your arguments professional
- Try to catch problems early and work with the lowest managerial level possible
- Make sure that the issue is sufficiently important
- Use organizational dispute resolution mechanisms
- Keep records and collect paper
- Resigning
- Use Outside Resources

**IEEE Ethics Committee 11/11/96, www.onlineethics.org*

Whistleblowing*

- A basic ethical dilemma exists when an Engineer takes a concern to their organization and the concern is not satisfactorily addressed.
- A whistle-blower is a person who takes a concern **outside the organization** in which the abuse is occurring and with which the whistle blower is affiliated.
- Regulatory agencies exist to perform oversight and to which whistle-blowers can go **anonymously**. Going to those charged with oversight is usually seen as much less adversarial than, say, going to the media.

**www.onlineethics.org*

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
- CopyrightIEEE
- 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 – 2

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 – 3

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;

ACM Code Of Ethics

- 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 – 2

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 – 3

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 – 4

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 – 5

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 – 6

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 – 7

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.