



Introduction to Computer Engineering

ECE/CS 252, Fall 2008
Prof. Mikko Lipasti
Department of Electrical and Computer Engineering
University of Wisconsin – Madison

Engineering Ethics

Ethics

- Issues of right and wrong; morality
- Very broad, complex, and personal topic
- This not the time or the place; happy to discuss this off-line

Engineering Ethics

- Right and wrong *with respect to engineering practice*
- Consider effects of your professional decisions and actions
- Direct effects, e.g.
 - Safety and well-being of others
 - Legal/judicial consequences
- Indirect effects, e.g.
 - Profitability of your employer; stockholders' rights
 - Your financial security



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Why Study Engineering Ethics? [M. Pritchard 1992]

1. **Stimulate the Moral Imagination**
What if, role reversal, empathy
2. **Recognizing Ethical Situations**
Know when to tread carefully and deliberately
3. **Developing Analytical Skills**
Some tools to help you work through gray areas
4. **Eliciting a Sense of Responsibility**
Don't pass the buck
5. **Tolerating Disagreement and Ambiguity**
Reasonable people can differ; not everything is black and white

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Key Concepts [source: <http://ethics.tamu.edu>]

Example scenario

Employee moves from Company A to Company B, but has signed a contract to not disclose *proprietary information*. At B, she finds a new way to apply a technique she learned of at company A. This will lead to a better, safer product for B, and will not affect A, since they are in a different line of business. Should she disclose the technique to B?

What issues are factual? Clear true and false

- better, safer product

What issues are conceptual? A matter of definition

- What does *proprietary information* mean?

What issues are moral or ethical? A matter of principles

- Which moral principles are *relevant*?
- If more than one *conflict*, does one outweigh the other(s)?

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Example: IEEE Code of Ethics

IEEE: Institute of Electrical and Electronics Engineers
• Professional organization for EEs, CMPEs, CS professionals

Code of ethics established in Feb. 2006

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:

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

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Example: IEEE Code of Ethics

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;
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;

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Example: IEEE Code of Ethics

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.

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Some Useful Rules and Tools

Principle of informed consent

- Assume that people will act in their own best interest
- Ultimately an individual is responsible for his/her own welfare
- Ethical rule: Full disclosure to enable informed decisions

Golden rule

- Do unto others as you would have them do to you
- Pitfalls (don't rat out a bad engineer since you don't want to get ratted out)

The "New York Times" test

- Would you want to read about what you did on the front page?

Utilitarianism

- Analyze to find "best net outcome"

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Utilitarian Analysis

Procedure

- Identify all those affected by an ethical decision
- Weight effects on all players for each outcome
- Consider sum of weights; choose the best outcome

Problems

- How do you weight intangibles?
- How do you weight effects on others vs. effects on you?
- Can lead to bad conclusions
- Must be applied carefully and judiciously

Nevertheless can be a useful tool for analysis

- Can help you find a "third way" (alternative solution/outcome)

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Example Scenario 1

You are developing a device driver for a USB webcam. While testing it you find that it crashes Windows unpredictably about once a week.

Should you release it?

With what, if any warnings?

Who is affected and how?

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Example 2: Therac-25

Radiation therapy machine in use from 1982-

- Software (computer) controlled, few hardware safety interlocks

Multiple design errors and safety mechanism failures

- One related to arithmetic overflow, which disabled safety interlock

Led to at least 6 radiation overdoses, 3 patients died

Conclusions

- Insufficient resources to develop software (1 engineer)
- Insufficient testing
- Initial denial, slow reaction to reports of problems

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Example 3: Google Image Search

Tiananmen Square massacre in Beijing in 1987

Google image search (images.google.com)



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Example 3: Google Image Search

Google image search (images.google.cn in 2006)



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Example 3: Google Image Search

Imagine you worked at Google and your manager ordered you to implement this feature (censorship).

What would you do?

1. Resign in protest?
2. Just do it?
3. Do it, but leak info to the press?
4. ???

Who is affected by your decision?

How are they affected?

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Engineering Ethics: Summary

Engineering Ethics

- Right and wrong *with respect to engineering practice*

Factual, Conceptual, and Moral

Moral Principles

- Help detect when something smells
- Guide ethical decision-making

Analysis of Conflicting Principles

- Identify those affected
- Consider direct and indirect effects of your professional decisions and actions

Bottom line: sometimes there are no easy answers

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