Engineering Ethics II
- Resolving Ethical Dilemmas

7 Steps for resolving ethical dilemma

Previously (Ethics I class)

- Engineers impact people.
- Responsibility of the power impacting society: work for the public's best interest.
- **Engineer's role:** represent society and ensure their safety and well-being.
- **The rules** of engineers' roles for public good: established as ethical codes.

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Academic Code of Student Conduct

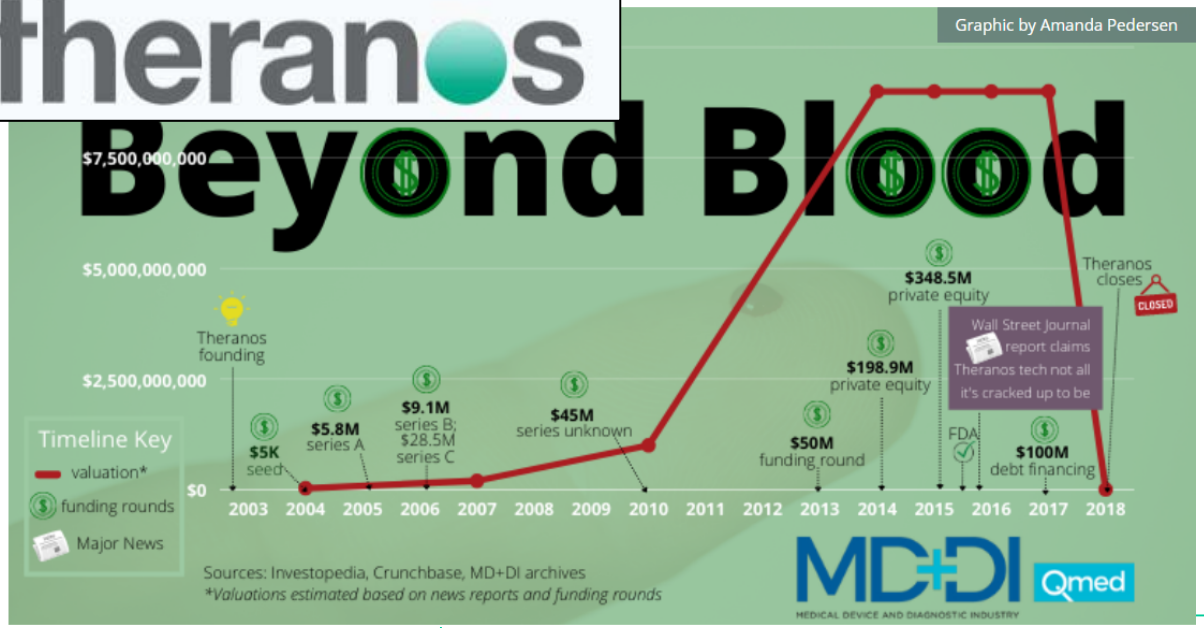
IEEE

Advancing Technology for Humanity

We wrote a technical Essay on Ethics

- Consequences of unethical behavior in **Theranos** Scandal

theranos

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BBC NEWS

Theranos scandal: Who is Elizabeth Holmes and why was she on trial?

19 November 2022

The rise and fall of Theranos: A timeline

By Sara Ashley O'Brien, CNN Business

Published 3:27 PM EDT, Thu July 7, 2022

Technical Essay on Ethics

- **Technical Essay Subject**: “Consequences of unethical behavior –Theranos Fraud/Scandal”
- Essay should answer the following questions
  1. What in essence is this scandal?
  2. What was the root cause of the scandal?
  3. What specific NSPE codes of ethics (of fundamental canons) were violated?
  4. What were the consequences of the unethical behavior?
  5. What would you do if you were working for the company as an bio-medical engineer? [The answer to this question is desired to write in 1st person voice]

Details

- "Consequences of unethical behavior - Theranos scandal"
- Link: **How to write technical essay well (mandatory)**
  - First paragraph [50] (F) – Should answer all the questions summarily.
  - Main body [50] (M) – Expanded description on the questions and answers. [Main Body] > 4 * [First Paragraph]
  - Similarity Score [0 - 100] (S) – Write your own words. Do not quote.
  - Final Essay Score[100] = F + M – (S – 5)

- Surprise Award
  - One essay, from those with perfect score, which has fewest words in the 1st paragraph
  - Award: a surprise

The focus of Ethics II class

- Some ethical situations: clear courses of action for their resolution.

	Action to take is CLEAR
1	If engineers know that a contact lens she designs will harm the user's eyes
2	If a software engineer is asked to design a bridge and he has no experience or education qualifying him to do so.
3	If engineers know that a company is going to sell the personal data it collects from a website, then engineer cannot put "We well not sell your personal information" on the website.
4	An engineer is offered 10% of the profits from a contractor if the contractor is awarded the project.

The focus of Ethics II class

- However, most ethical situations: difficult to resolve – ethical dilemma

	Action to take is UNCLEAR
1	A software engineer used weak security techniques to protect customer information at a bank in order to reduce cost and meet budget. **What would/should s/he do?**
2	Your company got the big contract but, in order to close the deal, the management had to claim you could perform certain analysis that you don't have the expertise to do. At the same time, the future of your company and its 40 employees ride on this one contract. **What would/should you do?**
3	An engineer runs some "extra" tests that go beyond those specified by the design requirements of the software she has designed. In doing so, she finds a major flaw that she would never find using only the agreed-upon tests. **What would/should she do?**
4	A salesperson offers to take you, an engineer, to lunch. **What would/should you do?** (In most cases, going to a reasonable lunch is not considered something that can influence or appear to influence a decision, but an engineer needs to be careful in making such decisions).

Ethical Dilemmas – Why difficult to resolve?

- Multiple courses of actions to take when faced with an ethical dilemma.
- Some are ethical, others not
- Selection of the best ethical course of action using multiple values (such as facts, ethical codes, impact to society) in evaluation the courses of actions.
- Ambiguity in the fact, relevant ethical codes, and stakeholders' interests

How to resolve ethical dilemma - process

- Situation with unclear ethical course of action → need of a reliable process to guide decisions → find the action that best meets the responsibilities.
- 7 Steps for Resolving Ethical Dilemmas
  - step 1: Identify the ethical dilemma
  - step 2: Determine the facts (removing as much bias as possible)
  - step 3: Determine (a) the stakeholders, (b) their interest, and (c) the level of impact the stakeholders would be affected by the selected course of action
  - step 4: Identify the relevant parts of ethical codes
  - step 5: Generate several solutions (actions to take) to the dilemmas
  - step 6: Analyze the proposed solutions
  - step 7: Select the most preferred course of action

The focus of Ethics II class

- Help for Resolving Ethical Dilemmas
  - Seek additional assistance if the framework does not help
  - Consult with appropriate people to help determine the best course of action
    - Supervisor
    - mentor
    - someone with experience with the type of situation being encountered
  - Most professional organizations have a board that deals with ethical issues, from which advice can be sought
  - Online Ethics Center – a help line at **www.onlineethics.com**

Step 1: Identify the Ethical Dilemma

- If you find yourself saying or thinking one of the following, you're probably facing an ethical dilemma:
  - "Well, maybe just this one ..."
  - "No one will ever know ..."
  - "It doesn't matter how it gets done as long as it gets done."
  - "Everyone does it."
  - "No one will get hurt."
  - "It's legal, so who cares?"
- A sample Case

Step 1: Identify the Ethical Dilemma

- A sample Case
  - An engineer was working on a team designing a new glucose-level monitor for diabetics. The new monitor was similar to previous models in that a user pricks his finger, puts a drop of blood on a test strip, and then inserts the test strip into the monitor for results. The advantage of the new monitor is that it uses a specially coated test strip to significantly speed up the process. The product had been designed, prototypes had been built and tested, and a manufacturing facility had been prepared. With 10,000 monitors ready to be shipped, the design team finished their final set of testing, which involves having test subjects use the monitor in the field (not i a lab setting). This final test was not required by the FDA, but it was performed because the company took pride in the quality of its products. Going beyond minimum standards was expected by this company.
  - During the final field test, some test subjects somehow used old test strips and used them in the new monitor. When the old test strips were used, the resulting glucose level shown on the new monitor was consistently lower than the new strips were used. Upon further testing, the engineers found that a person could have dangerously high glucose levels when the monitor would indicate that the results were only moderately high (when old test strips were used). Moderately high glucose levels showed as normal levels.
  - "We don't have to report this – it already passed FDA approval." Such a thought is a beacon calling out "This is an ethical dilemma !!!"

Step 2: Determine the Facts

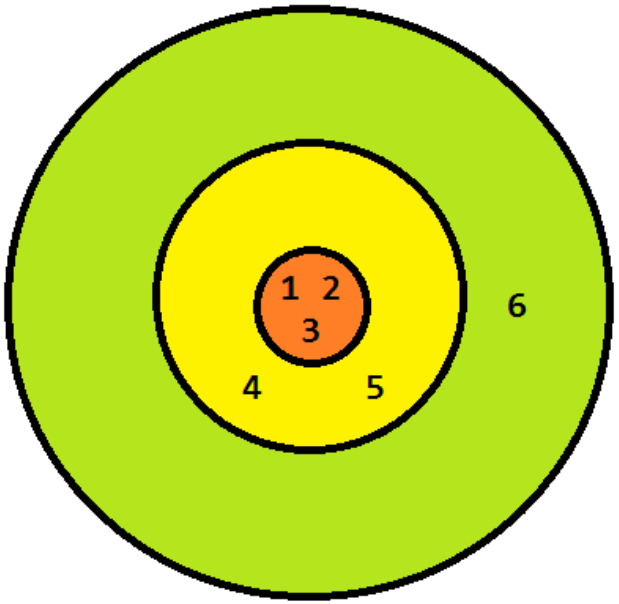
- Distill the facts from the complex reality
- Some of the facts (from the example case)
  - The monitor passed FDA standards
  - The additional tests showed that, when old test strips are used in the new monitor, glucose measurements are lower than actual glucose levels
  - The error in the glucose measurement could cause people to think they are fine when in fact their levels are too high
  - 10,000 monitors have already been produced and are ready for shipping

step 3: Stakeholders

- (a) Stakeholders: Customers, Engineering Team, Supervisor of Team, Employees of the Company, Stockholders of the Company, and FDA
- (b) Stakeholders' interests:
  - Engineering Team:
    - Develop a product that meets all the design requirements
    - Make device useful for customers and reliable and easy to use
    - Generate income for the company
  - Supervisor
    - Develop a product under budget and on time
  - Customers
    - Measure their glucose level accurately, quickly, inexpensively, and with little interruption in their lives
  - Employees of the Company
    - Make profit for the company
    - Receive reliable income/salary from the company
  - Stockholders of the Company
    - Increase the value of the company
    - Keep the reputation high
    - Increase stock price
  - FDA
    - Keep customers healthy and safe
    - make sure approval process is strict and accurate
    - Make sure the approved device keeps and maintains its standard

step 3: Stakeholders

- (c) Impact:
  - Engineering Team:
    - Failed and wrong device would imp entire team's failure
    - Do not put the customer's safety fir
  - Supervisor
    - Failed Product development manag
  - Customers
    - Wrong self-diagnosis of diabetes
    - Great health impact
  - Employees of the Company
    - Some profit or reputation loss may benefit from the company
  - Stockholders of the Company
    - Stock price may be impacted
  - FDA
    - Its regulatory process may be slightly changed.



1. customers
2. Engineering Team
3. Supervisor
4. Employees of the company
5. Stockholders of the company
6. FDA

High Impact

Moderate Impact

Low Impact

step 4: Identify specific ethical codes which are relevant to the dilemma

- What parts of ethical codes are involved
  - (a) "the health and the safety of the public" is clearly involved
  - (b) "acting as a faithful agent to your employer" and
  - (c) "reporting objectively and truthfully" are also involved
  - (d) "keep accurate and complete records" is also involved

Step 5: Generate Several Actions to take (Solutions) to the Dilemma

- Generate a wide range of solutions to the dilemma
  - Record the data internally, but never tell your supervisor, customers, or the FDA
  - Inform your supervisor and report the results, but don't present any suggestions as to what to do
  - Inform your supervisor and include several option about how to resolve the dilemma
  - Propose a design change to the monitor that will resolve the issue such as (A) putting a warning label that only certain test strips should be used or (b) Change the monitor so that only new test strips can fit in the monitor or (c) rewriting the software in the monitor to detect which type of strip is inserted thereby allowing the correct results to be displayed
  - Go straight to the local media and tell them what is happening
  - Destroy all data from the extra tests

Step 6:Analyze the proposed actions

- **(1) How well is each alternative with behaving <u>according to ethical codes</u>?**
- **Analysis Example (Addresses the relevant ethical codes?)**
- Option 1: Record the data internally, but never tell your supervisor, customers, or the FDA
- Option 2: Putting a warning label that only certain test strips should be used
- Option 3: Change the monitor so that only new test strips can fit in the monitor
- Option 4: Destroy all data from the extra tests

	Option 1	Option 2	Option 3	Option 4
the health and the safety of the public	No	Yes	Yes	No
acting as a faithful agent to your employer	No	Yes	Yes	No
reporting objectively and truthfully	No	Yes	Yes	No
keep accurate and complete records	Yes	Yes	Yes	No

Step 6:Analyze the proposal solutions

- **(2) What are the <u>consequences</u> on all of the stakeholders of taking each action?**
  - **Option 1: Record the data internally, but never tell your supervisor, customers, or the FDA**
  - **Option 2: Putting a warning label that only certain test strips should be used**
  - **Option 3: Change the monitor so that only new test strips can fit in the monitor**
  - **Option 4: Destroy all data from the extra tests**

Consequence	Option 1	Option 2	Option 3	Option 4
Customers will use old test strips with the new monitor	Very High	High	Very Low	Very High
Customers will be injured as a result of the flaw	High	High	Very Low	High
Company will lose money in the short term	Very Low	Low	Very High	Very Low
Engineers involved will lose their jobs	High	Low	Very Low	Very High
Company's reputation will be hurt in the long term	High	High	Very Low	Very High

Step 7: Select the most preferred Course of Action

- A decision must be made
- The involved engineers should
  - review the information they have collected,
  - weigh the trade-offs of selecting each option, and
  - choose an option that best meets their needs and interests.
- Documentation of why one alternative is selected over another is critical – such documentation can prove that they did their best to make an ethical decision under uncertain conditions even if the end result is not ideal.

Step 7: Select the most preferred Course of Action

- A final check before taking the selected course of action – consider the following questions
  - Are my actions legal?
  - Am I being fair and honest?
  - Will my action stand the test of time?
  - How will I feel about myself afterward?
  - How would it look in the newspaper?
  - Will I sleep soundly tonight?
  - How would I feel if my family, friends, and neighbors knew what I was doing?

Assignment – Individual

- Ethical Dilemma Resolution – following the 7 step framework
- For the following scenario, fill out the report form
- The scenario is adapted from *Engineering Design Process* (by Y. Haik and T. M. Shamin), end edition, Cenage Learning publication.
- Ethical Dilemma Report Form:
  - Check the webpage
- Submission Due
  - Check the webpage

Assignment (Scenario)

- High Concept Manufacturing (HCM) has an engineering plant in a small town that employs 10% of the community. It provides approximately $10 million of salaries to its workers and pays $2 million in taxes. The HCM plant releases, as a consequence of its manufacturing procedures, bad smelling fumes, annoying residential neighbors and hurting the local tourism trade. The fumes have been linked (although not conclusively) to a raise in asthma in the area. The town is considering an ultimatum to HCM: “Clean up your plant, or we will fine you $1 million.” HCM had previously made it known that the business will close down and go somewhere else if it is fined by the town. There will be a town meeting where all concerned parties have agreed to attend and discuss the matters given. You are an engineer living in the town who has been recently offered an excellent job opportunity at HCM. You have signed a contract with HCM, and you are officially one of the new employees. However, this is as of yet not public knowledge. HCM asks you to try to convince the town to drop the case and that the town is better off with HCM’s presence. What are you going to do?