Solutions to ethical situations are seldom black or white issues. More often, they are shades of grey with no single right or wrong answer.
(Jim Watson, Ethics for engineers falls in an unstructured grey zone; IEEE Potentials, 2006.)
The Fundamental Principles

Engineers should uphold and advance the integrity, honor and dignity of the engineering profession by:
I. Using their knowledge and skill for the enhancement of human welfare;
ASME’s Guide to Ethics

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II. Being honest and impartial, and serving with fidelity the public, their employers and clients; and

III. Striving to increase the competence and prestige of the engineering profession.
Uncertainty in Research Ethics

Data management:
• which data are relevant, what should be reported?

Authorship and plagiarism:
• who qualifies to be author?
• what material can be copied in a publication?

Social responsibility:
• how certain are we about consequences on others, society?

Reporting misconduct:
• is it worth the trouble?
What is Research Data Management?
Accuracy and Reliability of Data

Case 1

Questions:
1. Should the PI have published the outlying data with an explanation of the limited generality of its correlation?
2. Should the PI have repeated the experiments for these data and ignored them only once they constituted less than five percent of the total data?
Data management examples of ethical issues

Case 1: Treatment of outliers

R.A. Millikan (Nobel prize in physics, 1923)
• data not supported by theory are bad data, not to be reported (W. Broad, N. Wade, “Deceit in History,” in Betrayers of the Truth, Simon and Schuster, 1982, NY)

G. Mendel
• all data perfectly follow theoretical predictions, impossible to reproduce the perfect data (W. Broad, N. Wade, “Deceit in History,” in Betrayers of the Truth, Simon and Schuster, 1982, NY)
Accuracy and Reliability of Data

Comment: The National Society of Professional Engineers Code of Ethics for Engineers states:

Section II.3.a: “Engineers shall be objective and truthful in professional reports, statements, or testimony. They shall include all relevant and pertinent information in such reports, statements, or testimony...”

Section III.3.1: “Engineers shall avoid the use of statements containing a material misrepresentation of fact or omitting a material fact necessary to keep statements from being misleading; statements intended or likely to create an unjustified expectation; statements containing prediction of future success; statements containing an opinion as to the quality of the engineers’ services; or statements intended or likely to attract clients by the use of showmanship, puffery, or self-laudation, including the use of slogans, jingles, or sensational language or format.”
Accuracy and Reliability of Data

Case 2

- request to student: experimental verification of hypothesis
Accuracy and Reliability of Data

Case 2

- selected data points verify hypothesis, but not all data
Accuracy and Reliability of Data

Case 2

Is satisfaction of advisor/supervisor or sponsor more important than “complete scientific truthfulness?”

- different cultures provide different answers
IEEE definition: “Plagiarism is the re-use of someone else’s prior ideas, processes, results or words without explicitly acknowledging the original author and source.”

Note: definition does not include self plagiarism/copy right violation

most severe:
“uncredited verbatim copying of more than half of an article”

least severe:
“credited verbatim copying of a major portion of a paper without clear delineation (quotes or indents)”
Issues in Plagiarism

Plagiarism made easy through internet
- is detection software adequate?

Detected cases in IEEE journals increasing
  14 cases in 2004
  26 in 2005
  50 in 2006
  86 in 2007
  >100 in 2008

Has this always been an issue, and we are now only more sensitive to it?
Is plagiarism always a clear-cut issue?
“US authorities crack down on plagiarism
Aggressive stance prompted by technology bringing more cases to light.”

“For students in internet age, no shame in copy and paste.”
“...many students simply do not grasp that using words they did not write is a serious misdeed.”

- Harper speech writer had to resign for plagiarized speech
- German Secretary of Defense had to resign because of plagiarized dissertation
- Ohio University graduate students were penalized for plagiarism in their theses

Plagiarism detection software is becoming more sophisticated
- now widely used
Social responsibility of engineers

Issues:

How certain can one be of the consequences of a certain action or non-action?
What is the probability that a dangerous situation is encountered?
What is the value of a human life or injury?

How is it possible that a person willing to donate $1000 to save a fisherman on an ice floe, but decides to forego a safety feature in a company product that affects thousands of people?

Are the ethical standards of your employer compatible with your own?
Social responsibility: Case study 1
(from The Institute, IEEE, 15 February 2007)

A solid propellant rocket exploded when it was removed from packing case due to a spark to a grounded antenna, killing several troops. One of the engineers who years earlier worked on the design of this rocket recognized that this could happen, he told his supervisor, and both told the procurement officer. They all agreed that this accident was possible but extremely unlikely. Further investigations on how such an accident could be avoided would delay the deployment and add to a cost overrun.

Who is to blame?
Could something be done at an acceptable cost?
Social responsibility: Case study 2
Responsibility for 35W bridge collapse

Minneapolis Star Tribune, November 11, 2007:
“MNDOT doubted a plan to bolster bridge –
A zero-probability event may still happen”

“The consultant that had urged new steel plates to strengthen the I-35W bridge backed off the solution after the agency questioned it.”

A $2 million bridge strengthening option was rejected in favor of more frequent inspections

Is satisfaction of sponsor/customer more important than the welfare of the public?
Social responsibility: Case study 3

The BART Misfire


Three engineers working on the design of the Bay Area Rapid Transit (BART) system in the early 1970ies questioned the lack of systematic safety testing. After being consistently ignored by management, they went around management to the Board. The Board in a split decision sided with management, and the engineers were fired.

The California Society of Professional Engineers Code of Obligations requires that Engineers “hold the public welfare paramount and notify the proper authorities of any observed conditions which endanger public safety and health.”

After inauguration of the BART system, a failure of the questioned controls led to injury of four passengers and an attendant.
Social responsibility: Case study 4
Challenger Disaster

On January 28, 1986, seven astronauts were killed when the space shuttle Challenger exploded just over a minute into the flight. The failure of the solid rocket booster O-rings to seal properly allowed hot combustion gases to leak from the side of the booster and burn through the external fuel tank.

The potential for failure was identified in the Failure Mode and Effects Analysis (FMEA) process, but NASA management pushed for launch. What is the chance that freezing temperatures occur in Florida at a night before a shuttle launch?

The night before shuttle launch, Morton Thiokol engineers unanimously were in favor of postponement, however, on pressure of NASA management, Morton Thiokol management agreed to a launch.

What is the chance that freezing temperatures will be encountered that specific night, and what is the chance that the O-ring will fail? What could the engineers have done prior to the launch to assure higher reliability of the design?
Social responsibility: Case study 5
Ford Pinto… 1970’s

The Ford Pinto was Ford Motor Company's first domestic North American subcompact automobile marketed beginning on September 11, 1970.

The model became a focus of a major scandal when it was alleged that the car's design allowed its fuel tank to be easily damaged in the event of a rear-end collision which sometimes resulted in deadly fires and explosions. Critics argued that the vehicle's lack of a true rear bumper as well as any reinforcing structure between the rear panel and the tank meant that in certain collisions, the tank would be thrust forward into the differential, which had a number of protruding bolts that could puncture the tank. This, and the fact that the doors could potentially jam during an accident (due to poor reinforcing) allegedly made the car less safe than its contemporaries.
Ford knows there’s a problem. What should they do?

Discussion Items

1. Who are the stakeholders?
2. Propose as many different alternative solutions as you can think of. Do not assign any value or determine the implications of this proposed solution for now.
3. Now try to predict each option's impact on stakeholders.
4. Determine the best possible course of action and explain the reasons for your choice.
5. Are your answers to the above questions the same regardless of whom you represent? In other words, does one's response change depending on one's stake in the solution?
Ford’s Action Plan

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Ford’s Action Plan

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- Eventually, Ford provided a dealer installable "safety kit" that included plastic protective material that went over the offending sharp objects, thus lowering the risk of tank puncture.
Reporting Misconduct

Reporting required by law
Unsubstantiated reporting can be punished

What do you do when you see your friend cheating?
What do you do when you see a fellow engineer falsifying a design?
What do you do when your boss asks you to falsify records?

If you report misconduct, everybody involved suffers, but society gains when misconduct is eliminated

Do not judge or conclude from what you are observing: report only facts, keep a record
Ethical Dilemmas Specific to Engineers

• To what degree can your personal gain result in damage to others?
  - plagiarism, acquisition and reporting of data
  - satisfaction of sponsor vs. reduced wellness of public

• To what degree is loyalty to your employer/supervisor more important than the benefit to society or the adherence to your own ethical values?

• What potential damage to society can be justified by benefits to a company?
  - Safety vs. company financial interest

• How certain do you have to be to initiate an action? How does the possible consequence of inaction influence your decision?
  - Human life vs. minor injury, size of financial loss

• What sacrifice can be brought for the benefit of a majority?
  - Safe several lives by sacrificing one?
Approach for ethical dilemmas

Identify the ethical question
- Consider employer code of conduct, professional society code of conduct, personal code of conduct

Consider options
- Who will be affected by your decision?
- What are the uncertainties involved?

Develop an action plan
- Timeliness may be an issue

Most major employers have an Ombudsman or similar person who can be approached and be helpful