Ethics In Engineering

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The Essence of Your Engineering Career

✓Engineering is one of the most important professions in society.

✓Engineers . . .

→**Build products** such as cell phones, home appliances, valves, bridges & cars. In general, they advance society by building new technology.

→**Develop processes**, such as the process to convert salt water into fresh water or the process to recycle bottles. These processes change how we live and what we can accomplish.

→As engineers we don't just build things and develop processes;

→We build things and make processes in order to **better society.**

→In order to make society better we have to **reflect** constantly on the products and processes that we make.

Products and processes have consequences for society:

- ✓ If the bridge has an inadequate support, it will fail.
- ✓ If the gas tank is positioned too close to the bumper, it might explode from a small accident.
- ✓ If a medical instrument isn't accurate, improper doses of medication can be given.
- ✓ If the process for refining gas produces too much toxins, it harms the local community.

Decisions made by engineers usually have serious consequences on people -- often to multitudes of people.

What Is Meant By Ethics?

- A set of moral values and principles which form the standards of the code of conduct of individuals, organizations and professions.
- It is the principles of good and bad behavior governing what is right and wrong conduct.

✓System of moral principles

- Principles of right and wrong
- Principles of conduct governing behavior of an individual or a group.

✓Doing what society expects

- Standards of right and wrong that prescribe what people ought to do in terms of rights, benefits to society, fairness, etc.

Ethics is knowing the difference between what you have a right to do and what is right to do.
Potter Stewart

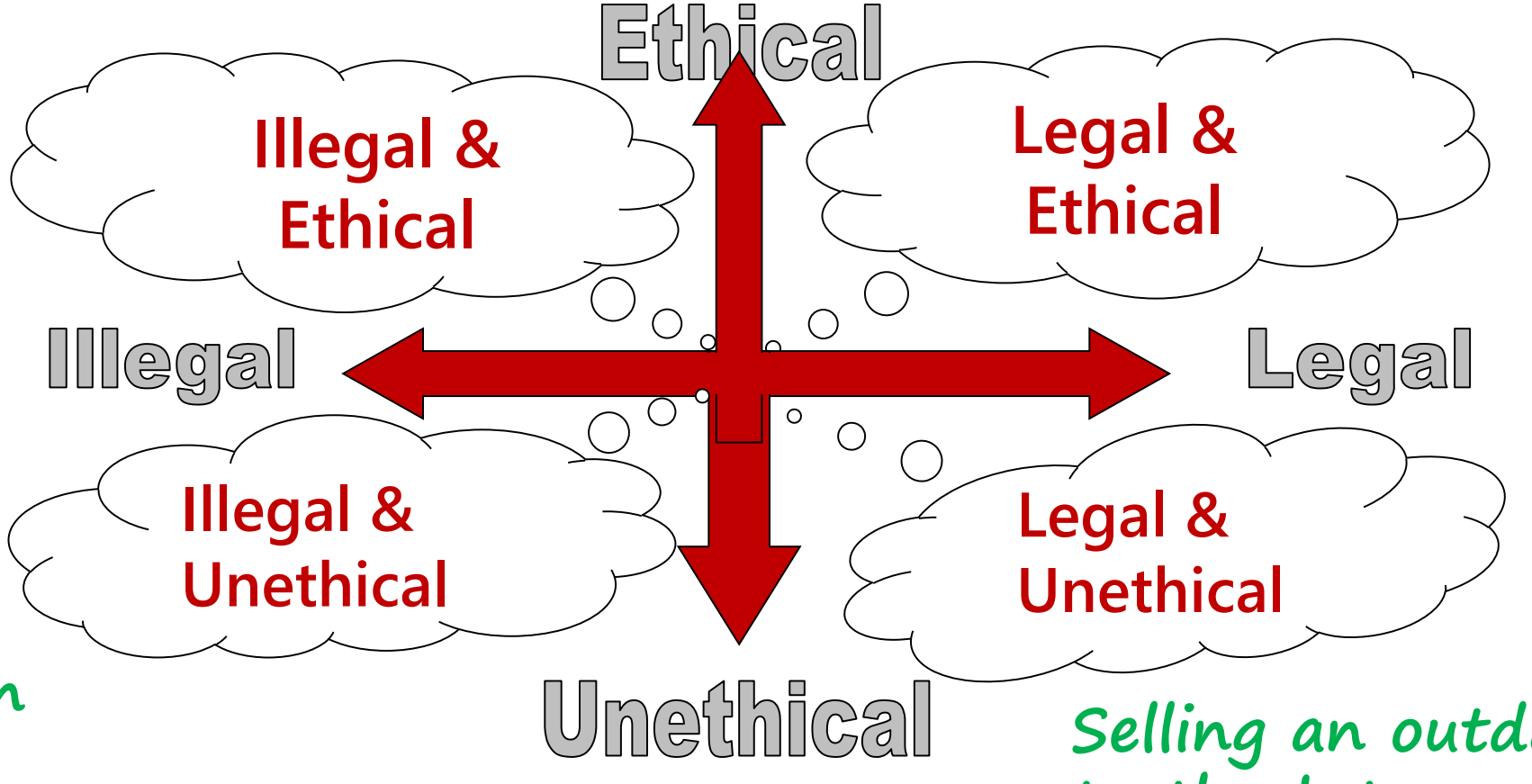
✓Doing what the law requires

- Standards of behavior

How are Ethics and Law Related?

Parking in A space with C sticker while taking roommate to emergency room

Coming to Class

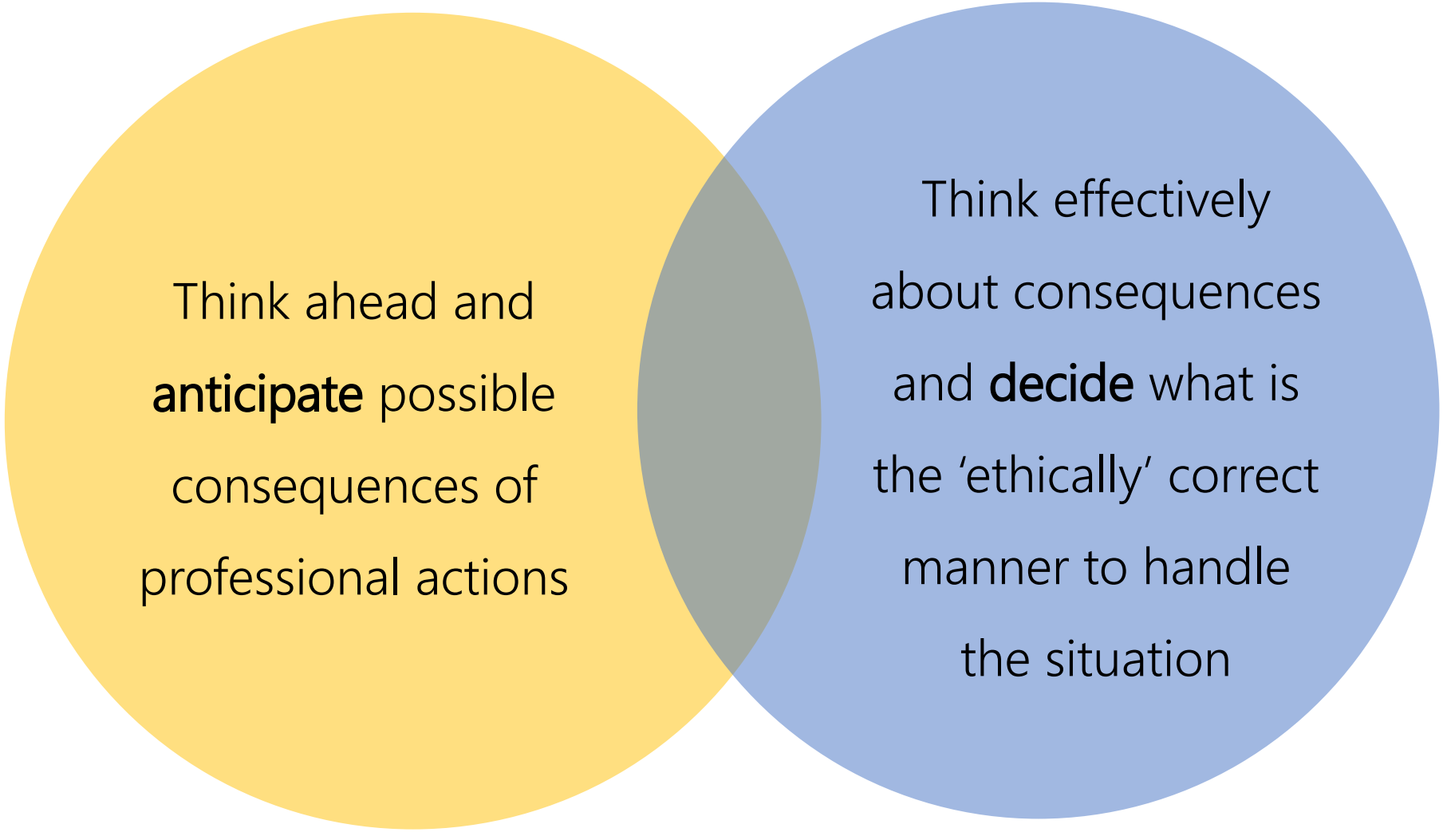


Cheating on an Exam.

Selling an outdated textbook to an unaware student

Engineering Ethics

Engineering is based on "Preventive Ethics" which is based on two dimensions:



Ethics in an Engineering Course????

We will be studying engineering, such as design, analysis, and performance measurement.

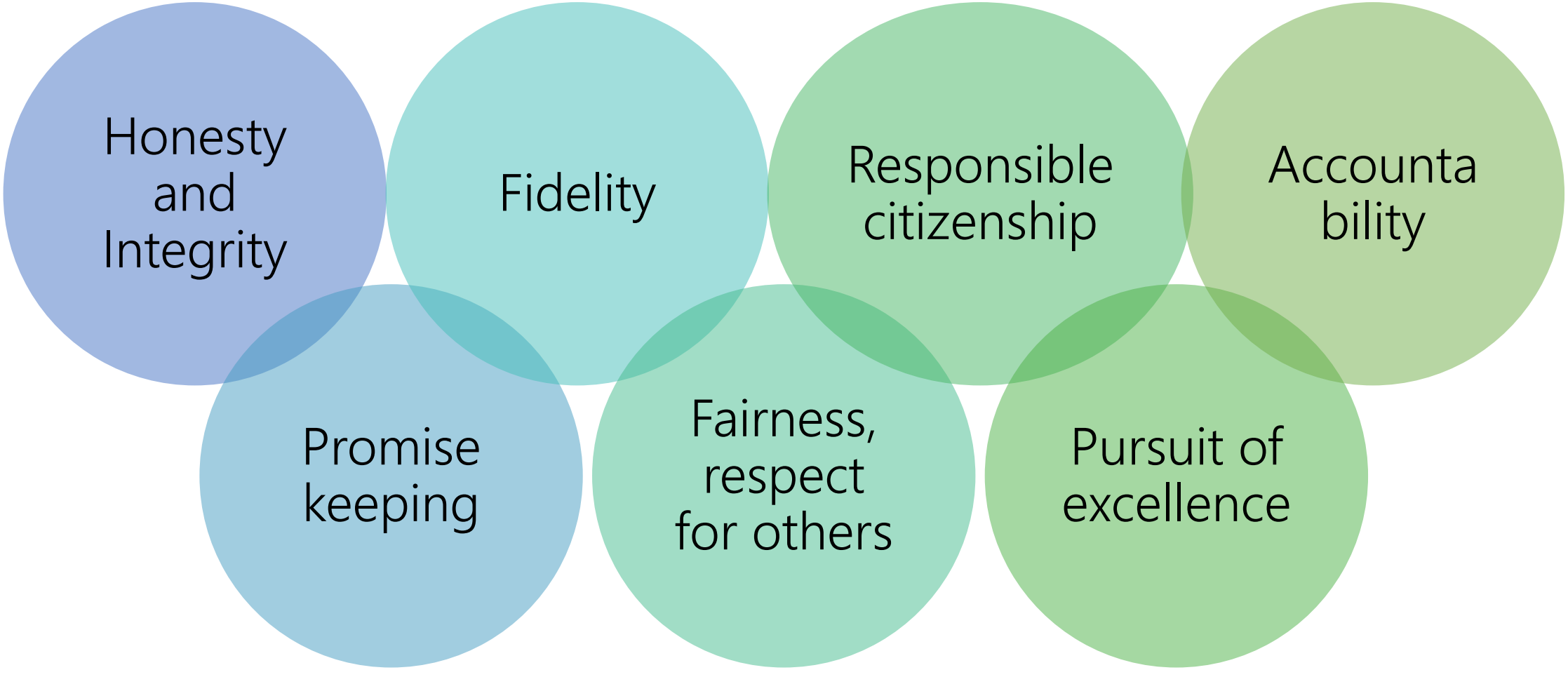
Ethics is part of engineering for two main reasons:

a) Engineers need to be socially responsible when building products and processes for society.

b) Social responsibility requires professional responsibility.

- One main connection between ethics and engineering comes from the **impact** that engineered products and processes have on society.
- Engineers must think about designing, building, and marketing products that benefit society.
- Social Responsibility requires taking into consideration the needs of society.

Seven Principles of Engineering Ethics



The Example of Integrity

- ✓A building has structural integrity when it is designed in a way such that it appropriately responds to the stresses and loads that it is designed to act under.
- ✓Just as a building can have poor integrity or good integrity, a person can also.
- ✓A person has integrity when he/she can follow the codes, he/she is supposed to follow under the stresses and loads of his/her role.

Engineering Codes of Ethics

- National Society of Professional Engineers (NSPE)
- Accreditation Board for Engineering and Technology (ABET)
- Institute of Electrical and Electronic Engineers (IEEE)
- American Society of Mechanical Engineers (ASME)
- American Society of Civil Engineers (ASCE)
- American Institute of Chemical Engineers (AIChE)

Extract of NSPE Code

General rules: Engineers, in the fulfillment of their professional duties, shall:

- Hold paramount (vital) the safety, health and welfare of the public in the performance of their professional duties.
- Perform services only in areas of their competence.
- Issue public statements only in an objective and truthful manner.
- Act in professional matters for each employer or client as faithful agents or trustees.
- Avoid deceptive acts in the solicitation of professional employment.

Important Notes about the Code of Ethics

- It is not a legally binding document.
- It is not something that we want (or need) engineers to memorize.
- It is something we want engineers to understand and be able to live by as engineers.
- However, in the beginning knowing the code is a guide to understanding how to apply it.

Personal Ethics (everyday examples)

- Software piracy
- Copying of homework or tests
- Borrowing office supplies from employer
- Copying of Videos or CD's
- Plagiarism
- Expense account padding (Adding unnecessary material or expenses for the purpose of increasing the cost claim)
- Personal use of the copy machine at work

Ethical Issues are Seldom Black and White

Conflicting Demands

Ethical standards are usually relative and personal, there is seldom an absolute standard

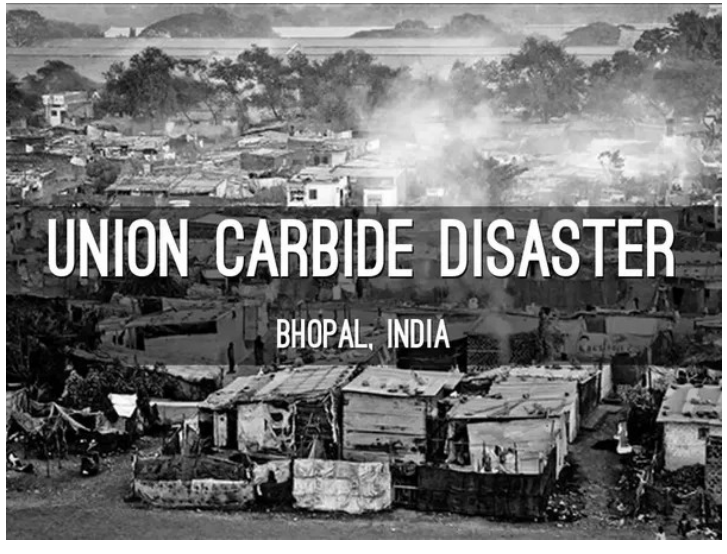
Whistle-Blowing

- The term whistle-blower comes from the whistle a referee uses to indicate an illegal or foul play.
- **Whistleblower** is a person who exposes **misconduct** or **illegal activity** occurring in an organization such as fraud, health and safety violations, and corruption.
- Whistleblowers may make their allegations internally (within the accused organization) or externally (to regulators, law enforcement agencies, to the media or to groups concerned with the issues).

Whistle-Blowing (cont'd)

- It is morally permissible for engineers to engage in external whistle-blowing if:
  - ✓The harm that will be done to the public is serious and considerable.
  - ✓Getting no satisfaction from their immediate superiors, even after going to the board of directors.
- Need a documented evidence that would convince a reasonable, impartial observer.
- There must be strong evidence that making the information public will in fact prevent the threatened harm.

Consider the history of industrial accidents, like !!



British Air Ways Flight 38

Case Studies in Engineering Ethics

Case 1: The "challenger" disaster (1986)

- Designed a system that required a gasketed connection and did not have sufficient data to predict performance across a spectrum of conditions; pressure from management to end the job lead to:
  - Poor Engineering Judgment
  - Entire crew lost
  - Space program set back years
  - Lost public confidence

Case Studies in Engineering Ethics

Case 2: The "Ford Pinto" Gas Tank (1972)

Under management pressure, engineers designed an automobile component that later proved to fail under certain conditions and could be replaced for only $11 under a recall

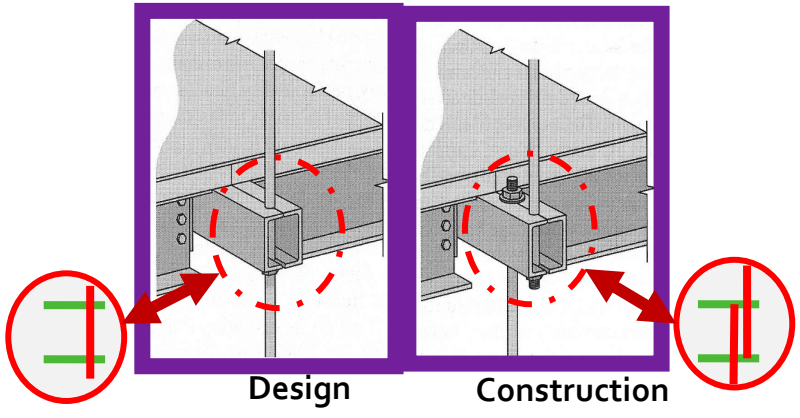
- At $11 per vehicle to recall, the total cost would be $137 million
- Corporate decision based on a Benefit/Cost analysis
- Fearing the loss, Ford did not recall for repair.
- Over 500 documented deaths related to rear-end collisions in the Pintos Hundreds of serious injuries and thousands of burned vehicles
- Lawsuits and personal injury cases totaled over $450 million
- Company nearly folded after the lawsuits and low sales due to lack of trust in Ford products

Case Studies in Engineering Ethics

Case 3: The "Hyatt Regency " (Kansas City 1981)

Engineers were asked to sign on a set of shop drawings that had come from a reliable vendor with whom they had a very good working relationship.

- The support system was changed in the shop drawings by the steel fabricator.
- Engineer failed to review the shop drawings and therefore did not discover the change.
- The change doubled the load on the supports!
- 32-ton walkways collapsed!
- 114 deaths, 200 injuries
- Engineers prosecuted!



Case 3: The “Hyatt Regency ” (Kansas City 1981)

Ask yourself (when Making Decisions)

Is it safe?

Is it legal?

Is it the right thing to do?

Is it just, balanced, and fair?

How will it make me feel about myself?

If something terrible happened, could I defend my actions?

Does this choice lead to the greatest good for the greatest number?

Final Thoughts

- Read carefully the code of ethics of your profession, better yet memorize it!
- Never disclose information given to you in confidence, unless it violates ethical codes
- Assume responsibilities of your mistakes
- Never accept gifts that compromise your ability to perform with freedom
- Start applying (no plagiarism, no software pirating, no abuse of office resources,…)

"Indeed, the most honorable of you in the sight of God is the most righteous."

Chapter 49, Verse 13

إِنَّ أَكْرَمَكُمْ عِندَ ٱللَّهِ أَتْقَىٰكُمْ

Ethics – Courage & Integrity

As we will be seeing, more and more being ethical requires:

Courage to do the right thing the situation calls for.

&

The integrity to withstand the pressures that push you in the wrong direction.

Try it yourself

You are supervising a product with specifications that only U.S.-made parts may be used.

Late in the project you discover a sub-contractor has supplied a part with foreign-made bolts.

They aren't very noticeable and would function identically to U.S.-made bolts.

Your customer urgently needs the finished product.

What should you do?

Clicker Question

A person's behavior is always ethical when one:

A. Does what is best for oneself

B. Has good intentions, no matter how things turn out

C. Does what is best for everyone

D. Does what is most economical

Clicker Question

Engineers should follow their professional code of ethics because:

A. The public will trust engineers more if they know engineers have a code of ethics.

B. It helps them avoid legal problems, such as getting sued.

C. It provides a clear definition of what the public has a right to expect from responsible engineers.

D. It raises the image of the profession and hence gets engineers more pay.

Clicker Question

Should you:

A. Say nothing and deliver the product with the foreign bolts because the customer won't notice.

B. Find some roughly equivalent violation of the contract/specs for which the customer is responsible and tell them you will ignore their violation if they ignore yours.

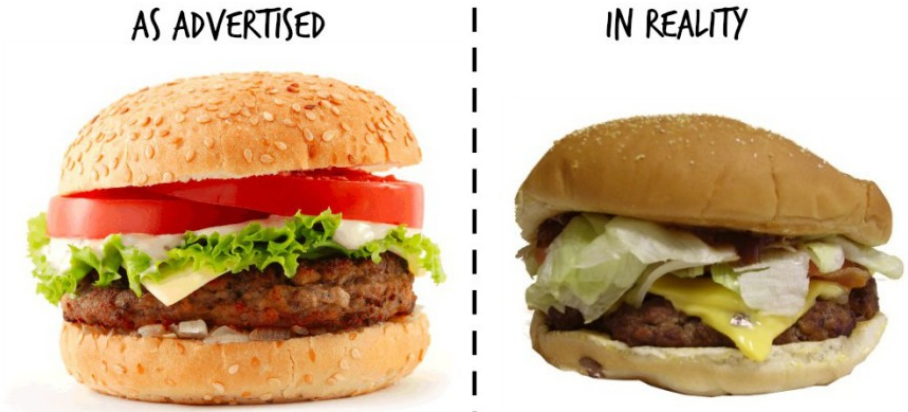
C. Tell the customer about the problem, and let them decide what you should do next.

D. Find loopholes in the original specifications so that your company hasn't legally violated the specs.

Answer

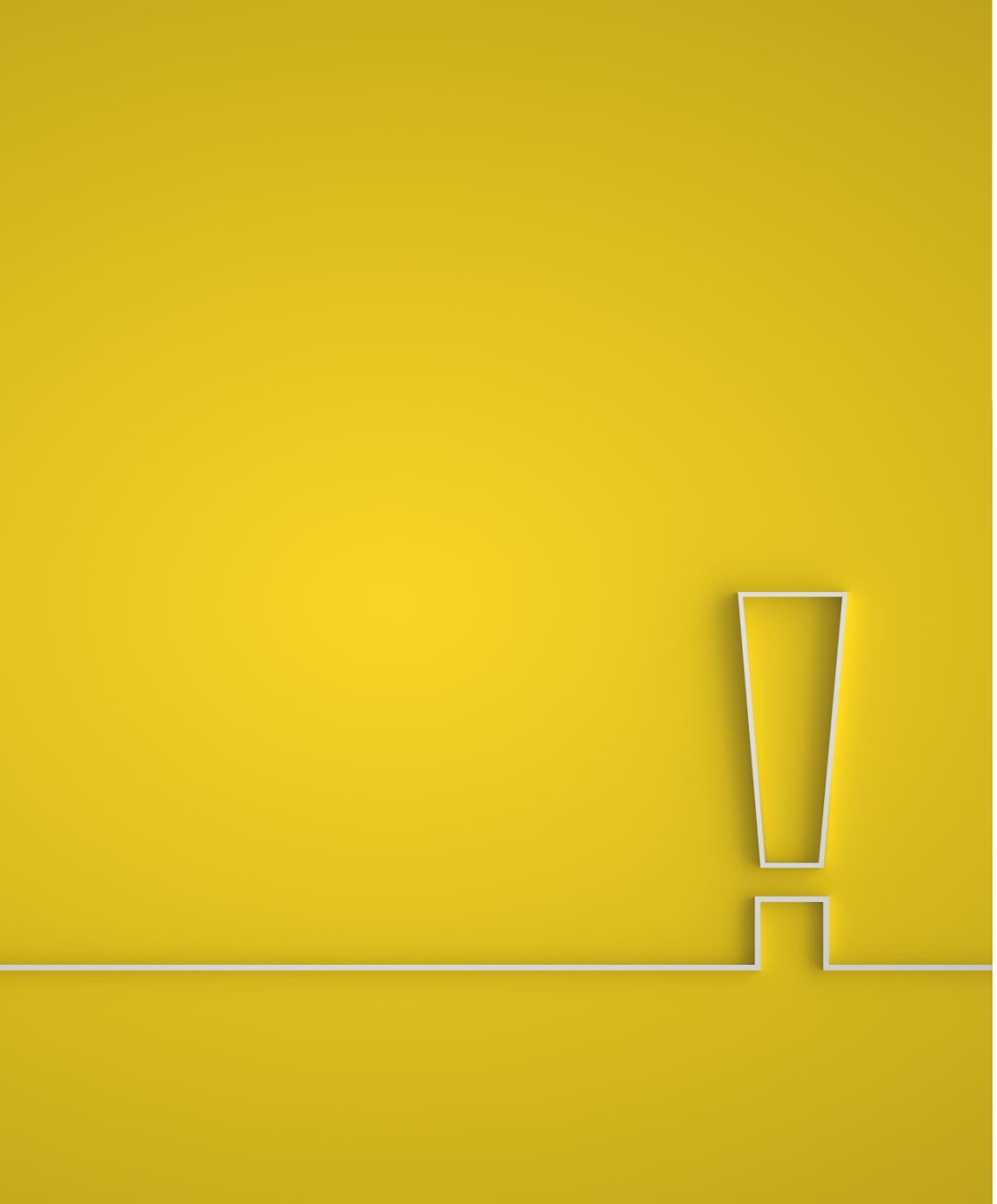
✓C (tell the customer): because it lets the customer decide what is in their best interest given new information.

This may be tough, because your job may be on the line and your company's reputation may be at stake.



Avoid deceptive acts

Act for each employer or client as faithful agents or trustees



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