Online Ethics Center
FOR ENGINEERING AND SCIENCE

Scenarios in Business and Engineering Settings - (How to Be a Good Engineer, Speaker's Guide)

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Description

Fictitious scenarios drawn from a composite of situations that may have occurred in several distinct cases and intended to stimulate discussion.

Body

Scenarios

These scenarios are fictitious. However, some are drawn from a composite of situations that may have occurred in several distinct cases.

The scenarios are intended to stimulate discussion. If you are so inclined, consider using one in a "role playing" mode. You may play "the boss" or other suitable character and have a participant play the engineer. You then try to convince the engineer to behave in accord with some of the implied practices given in the comments and questions of the scenario. It may be useful, and even necessary, to discuss first the given part of the scenario so as to be sure it is understood. One should not become too concerned with the technical details. Take these as givens, and maintain concentration on the ethics issues.

Be sure to make the observation that in discussing ethics there is not always a right answer. Unlike technical courses where one underlines and arrows the solution, ethics problems are often fuzzy and discussions may generate a diversity of opinions.

The Choice of a Job

You are seeking a job as a design engineer and have had several interviews. You have firm job offers from each of the companies listed below and now must choose between them. Assume that all other factors such as job interest & challenge, salary & benefits, location, etc. between the companies are identical. Unless otherwise noted, all the companies are owned by US investors. Your decision, then, is to be based on what appears in the descriptions of the company's products listed below.

Ace Computers, Inc. is the USA-subsidiary of an multinational company with foreign ownership. Ace designs and manufactures personal computers.
Acme Medical Electronics, Inc. designs and manufactures human health-monitoring hardware. Principal sales are to hospitals and physicians.
Ajax Communications, Inc. Designs and manufactures communications hardware and specializes in electronic surveillance equipment. A significant fraction of their revenues are probably from sales to the U.S. Central Intelligence Agency.
Able Electronics, Inc. designs and manufactures expensive electronic gadgets. Most persons would consider their products luxuries.

- Which of these in your opinion is a "good job?" Why? State your reasons.

- Which job would you choose? If your choice is not from your answer in 1, state why.
- If you knew more about the jobs than is presented here, what factors would lead you to change your decision in 2, above.
- How much importance would you attach to company's reputation for ethical treatment of:
- Customers, clients.
- The communities where they are based.
- Employees.

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Profits vs. Risk to Society

You are an engineer charged with performing safety testing and obtaining appropriate regulatory agency or outside testing laboratory (agency) approvals of your company's product. The Gee-Whiz Mark 2 (GWM2) has been tested and found compliant to both voluntary and mandatory safety standards in North America and Europe.

Because of a purchase-order error and subsequent oversights in manufacture, 25,000 units of GWM2 ("bad units") were built that are not compliant to any of the North American or European safety standards. A user would be much more vulnerable to electric shock than from a compliant unit. Under some plausible combinations of events the bad-unit user could be electrocuted. Retrofitting these products to make them compliant is not feasible because the rework costs would exceed the profit margin by far. All agree that because of this defect the agency safety-labels will not be attached to the bad units, as per the requirements of the several agencies. Only two options exist:(a) Scrap the units and take the loss. (b) Sell the units.

An employee of the company notes that many countries have no safety standards of any kind for this type of product. It is suggested that the bad units be marketed in these countries. It is pointed out that many of these nations have no electrical wiring codes; or if codes exist they are not enforced. The argument is thus advanced that the bad GWM2 units are no worse than the modus operandi of the electrical practice of these countries and their cultural values. Assume that no treaties or export

regulations would be violated.

- What is your recommendation?
- Suppose one of the countries under consideration was the country of origin for you or your recent ancestors. Would this affect your recommendation?
- Now suppose you are not asked for a recommendation, only an opinion. What is your response?
- Suppose it is suggested that the "bad units" be sold to a third party who would very likely sell the units to these countries. Your comment?
- You are offered gratis one of the bad units for your use at home, provided you sign a release indicating your awareness of the condition of the unit, and that it is given to you as a *test unit.* (Assume that you can't retrofit it, and that the product could be very useful to you.) Would you accept the offer?
- Suppose it is suggested that the offer above (in 5) be made to all employees of the company. Your comment?

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Integrity of Data

The U.S. Federal Communications Commission (FCC) Rule Part 15J applies to a virtually every digital device (with a few exceptions) manufactured in the USA. The manufacturer must test and certify that the equipment does not exceed FCC-mandated limits for the generation of communications interference caused by conducted and radiated emissions. The certification consists of a report sent to the FCC for review. It is largely an "honor system" because the FCC has only a small staff to review an enormous number of applications. The FCC then issues a label ID, to be attached to each unit, that authorizes marketing of the product. Prior to receiving the label the manufacturer cannot offer for sale or advertise the product.

An EMC (electromagnetic compatibility) consultant operating a test site installs a new antenna system and finds that it results in E-field measurements consistently higher than those obtained with the "old" antennas. Both "track" within the site-calibration limits and both antenna vendors claim National Institute of Standards and Technology (formerly National Bureau of Standards) traceability. Which system is the better in absolute calibration is thus unknown. There is not enough time to resolve this discrepancy before a client's new product must be tested for FCC Rules

Part 15J compliance.

- Which antenna system should be used to test the product?
- Is averaging the results ethical, assuming engineering judgment indicates this procedure is valid?
- Suppose the site was never properly (scientifically or statistically) calibrated. Should this fact be made known voluntarily to the FCC?

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It's not my job to

You are an engineer working in a manufacturing facility which uses toxic chemicals in processing. Your job has nothing to do with the use and control of these materials.

The chemical "MegaX" is used at the site. Recent stories in the news have reported alleged immediate and long-term human genetic hazards from inhalation or other contact with the chemical. The news items are based on findings from laboratory experiments, done on mice, by a graduate student at a well-respected university physiology department. Other scientists have neither confirmed nor refuted the experimental findings. Federal and local governments have not made official pronouncements on the subject.

Several employee-friends have approached you on the subject and asked you to *do something* to eliminate the use of MegaX at your factory. You mention this concern to your manager who tells you, *Don't worry, we have an Industrial Safety Specialist who handles that.*

Two months elapse and MegaX is still used in the factory. The controversy in the press continues, but there is no further scientific evidence pro or con in the matter. The use of the chemical in your plant has increased and now more workers are exposed daily to the substance then was the case two months ago.

- What, if anything, do you do?
- Suppose you again mention the matter to your manager and are told, "Forget it, it's not your job." What now?
- Your sister works with the chemical. What is your advice to her?
- Your pregnant sister works with the chemical. What is your advice to her?

- The company announces a voluntary phasing-out of the chemical over the next two years. What is your reaction to this?
- A person representing a local political activist group approaches you and asks you to make available to them company information regarding the amounts of MegaX in use at the factory and the conditions of use. Do you comply? Why or why not?

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Copying Software

You and a colleague, Pat, are working on a similar problem that will require extensive computation. Each of you own a Little Giant (LG) personal computer.

You are aware of a software package, The Universal Wondrous Calculator (UWC), which runs on the LG. The software has been well-received by the user community, and can perform all of the computations needed to solve your problem. The UWC package sells for between $150 and $300, dependent upon discounts and seller mark-ups.

You tell Pat of this software, and both of you agree that it is highly desirable to have access to it. Later that day Pat visits you with news of having the program, and offers to share it with you. When Pat hands over the program diskette, you observe that it has a crude, handwritten label rather than the usual printed kind. When you ask Pat about this, you are told, *I copied it from the original disk of a friend who bought the program.*

You insert the diskette in your machine, and the title screen shows clearly that the program is copyrighted. Pat notes that it is reasonable to make a back-up copy, indeed many user manuals for software encourage this practice. Pat believes, *If they didn't want you to copy it they would have made the program copy-protected!*

In responding to each of the items below, include statements of your opinion regarding both the legal and ethical aspects of the advocated practice. If and where you believe it appropriate, in your response distinguish between the case of using a copy of the program made from a "copy-protected" program vs. the case of using a copy made from an "unprotected" program.

- What is your comment on Pat's statement regarding copy protection?
- Is it legal or ethical for you to use the program? (After all, you didn't make the copy.)
- Is there any difference, legally and ethically, between the act of your using the UWC program and the act of Pat's copying it?
- Now suppose that you and Pat are students, with all other conditions identical to those given above. Respond to questions 2 and 3 above.
- Now suppose that you and Pat are professors, with all other conditions identical to those given above. Respond to questions 2 and 3 above.

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Voluntary Recall

The Zilch Materials Corporation employs you as a Test Engineer. The company recently introduced a new two-component composition-resin casting material, Megazilch, which is believed to have been well-tested by the company and a few selected potential customers. All test results prior to committing to production indicated that the material meets all published specifications and is superior in performance, and lower in estimated cost, than competitor's materials used in the same kinds of applications.

Potential and committed applications for Megazilch include such diverse products as infant's toys, office equipment parts, interior furnishings of commercial aircraft, and the case material for many electronic products. Marketing estimates predict a 25% increase in the corporation's revenues in the first year after the product is shipped in production quantities.

The product is already in production and many shipments have been made when you discover, to your horror, that under some conditions of storage temperature and other (as yet) unknown factors, the shelf-life of the product is seriously degraded. In particular, it will no longer meet specifications for flame-retardation if stored for more than 60 days before mixing, instead of the 24 months stated in the published specifications. Its tensile and compressive strength is reduced significantly as well.

Substantial quantities have been shipped, and the age and temperature history of the lots shipped are not traceable. To recall these would involve great financial loss

and embarrassment to the company, and at this point it is not clear that the shelf-life can be improved. Only you and a subordinate, a competent test technician, know of the problem.

Assume no quick-fixes by chemical or physical means are possible, and that the problem is real. That is, there are no mistakes in the scientific findings.

- What is the first action you would take relevant to this matter?
- Suppose you express concern to your immediate supervisor, who tells you, "Forget it! It's no big deal and we can correct it later. Let me handle this.
- *Suppose further that you detect no action after several weeks have elapsed since you told your supervisor. What now?*
- *In 3 above, assume you speak to your supervisor who then tells you, I spoke to the Executive Staff about it and they concur. We'll keep shipping product and work hard to 'fix' it. We've already 'taken out all the stops,' ... people are working very hard to correct the problem. What, if anything, do you do?*
- It is now three months since you told your supervisor, and in a test of product sampled from current shipments, you know that no 'fix' has been incorporated. What now?

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Conflict of Interest

Marsha is employed as the City Engineer by the city of Oz, which has requested bids for equipment which is to be installed in a public facility. Oz is bound by law to purchase the lowest bid that meets the procurement specifications except *for cause.*

The low bidder, by a very narrow margin, is Diogenes Industries, a local company. The Diogenes proposal meets the specifications. Marsha recommends purchase of the equipment from Diogenes.

After the equipment is installed, it is discovered that John, the Chief Engineer for Diogenes, is the spouse of Marsha. John was the engineer who had charge of the proposal to Oz, including the final authority on setting the price. As a result of this, Marsha is requested to resign her position for *... breach of the public trust.*

- Was the city justified in seeking Marsha's termination of employment?

- Suppose Marsha had never been asked to sign a conflict of interest statement. Would this affect your response to question 1?
- Given the conditions of question 2, suppose Marsha had mentioned, before going to bid, in casual conversation with other persons involved in the procurement, that she was married to the Chief Engineer at Diogenes. Does this affect your responses?
- Suppose Marsha and John were not married, but shared a household. Does this affect your responses
- Now suppose Marsha had made known officially her relation to John and the potential for conflict of interest before soliciting bids. Then suppose Marsha rejects the Diogenes bid because she is concerned about the appearance of conflict of interest. She then recommends purchase of the next lowest bid which meets the specifications. Comment on Marsha's action.

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The Hackers

Mo and Jo are employees of Zip, Inc. and are zealous users of the computer network there. One evening *after hours,* in a spirit of fun, they begin writing comic phrases into the other's computer files. This "game" becomes a mutual challenge. They then tire of the game and decide to try accessing corporate files not normally open to them.

Mo and Jo then collaborate, Mo at the computer terminal and both suggesting commands to try. Through a relatively short sequence of simple attempts they finally succeed in entering the confidential files. Proud of their "computer virtuosity," they decide to leave a cartoon message in the files: "The Phantom was here." To their horror, part of the sequence of commends for this causes the files to be jumbled! Moreover, the chaotic action occurs over the entire network files.

At great cost to the company the system files must be purged and reloaded from backup sources. Mo and Jo are discovered and admit their act, but argue that it was not their intent. Both are fired.

- Is Zip justified in the firings? Mo and Jo did not mean to do this; it was a prank that *misfired.*

- *Mo argues further that, It was ridiculously easy to access the files, the company should do a better job of protecting them. Comment on this argument.*
- Jo pleads to keep the job, arguing that Mo was at the keyboard and Jo was only suggesting some of the commands. Neither Mo or Jo is certain who made the specific suggestion that led to the system chaos. Comments?
- Mo argues thus: They violated no law, because the act was internal to the company. Therefore, at most they should be disciplined and allowed to keep their jobs. Comment.

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Acknowledgments

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Scenarios D, E, and F are from the paper, *Some Practical Exercises in Engineering Ethics,* by J. H. Wujek, presented at the conference, *A Delicate Balance: Technics, Culture, and Consequences,* California State University, Los Angeles, 20-21 October 1989, sponsored by the Los Angeles Chapter of the IEEE Society for Social Implications of Technology.

The general idea for Scenario D was suggested by Lee Hornberger of Santa Clara University, and was motivated by the Silkwood and asbestos episodes in the USA.

James S. Gidley, Professor of Civil Engineering in West Virginia University, suggested developing a scenario of software-copying as a result of hearing Wujek's remarks on the subject in an ethics lecture at WVU in April 1989. Scenario E is the result of his suggestion.

Scenario F was developed by J. Wujek from a suggestion by engineering instructor Andrew McFarlin of Evergreen Valley College (San Jose, CA), who also put him in touch with retired engineer William L. Walker. Mr. Walker contributed some helpful comments about the draft scenario. He also furnished ideas for questions, some of which have been used near-verbatim.

Scenario G is suggested by one given in Johnson, page 310.

See the Johnson citation.

Rights

Discipline(s)

Computer, Math, and Physical Sciences
Engineering
Research Ethics