professional ethics in computing

Burak Galip ASLAN, PhD

why professional ethics?

Therac-25... Y2K...

complex relationships... with people who have severely limited understanding of IT systems and how they work

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the work of computer professionals involves social relationships (with clients, employers and others...)

the paradigm of professions

social mechanism for managing expertise and deploying it in ways that benefits society

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not about salaries or social status, it is about being "**strongly differentiated**"

characteristics of professions

1) mastery of an esoteric body of knowledge

which is abstract and systematized, can be mastered only through disciplined study – typically higher ed, researchers devote themselves to continuous improvement of body of knowledge while practitioners use the knowledge (*medicine, engineering...*)

characteristics of professions

2) autonomy

a good deal of autonomy in daily work compared to employees who take orders and are closely supervised, autonomy both at work and regulating themselves – admission standards, educational requirements, standards of practice, “self-policing”, outsiders are not capable of understanding the esoteric body of knowlegde

characteristics of professions

3) formal organization

single unifying orgs recognized by regional and/or national govns, even in some cases specify criteria for licensing members and power to expel individual members from profession

characteristics of professions

4) code of ethics

a code of professional conduct, public statement for public, a formal specification of special contract, offen difficult to enforce but very important issue

characteristics of professions

5) a culture of practice

distinctive culture (medicine – health, auditor – unbiased judgement etc.) e.g. medicine values science but compassionate to patients, **engineering emphasizes efficiency and objectivity,** the culture of profession sometimes under attack – medicine (arrogant), police (ruthless), lawyer (dishonest), engineers (socially inept and myopic), society recognization is also important

characteristics of professions

social contract with society – a system of trust, the social contract does not exist forever, it can be broken or re-negotiated where required

sorting out computing and its status as a profession

challenging task – computer experts occupy so many different roles in a wide variety of contexts (jobs), wide range of education systems even some successful specialists have no formal training in computing

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a relatively new field, most differentiated is “software engineering”

mastery of knowledge

most computer experts are adept at a body of knowledge, the important question is:

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researcher/practitioner not exactly divided, not only scientists develop, also in R&D labs in IT industries

formal organization

not single institution – quite variety

no universally accepted formal admission process, accreditated degree in CE or CS or particular certification may have an advantage for certain positions

autonomy

no regulation about who can do what in computing – varying degrees of autonomy for individuals

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control over computer code – an important form of autonomy, power on behalf of others who cannot understand or read code -> **be careful, it also correlates to responsibility!**

codes of ethics

no single code e.g. 1992, ACM Code of Ethics

the process of developing and adopting a code of ethics is complex and often highly politicized

the culture of computing

variety again -> difficult to generalize culture

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but with Internet, being glued to computer is no more a non-social activity

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bottomline:

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software engineers (a subgroup of computing) are the pioneers

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quality and safety of software being sold – controlling quality

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in Canada even “engineering” of computing is controversary, lawsuits against software engineering, some approved by some engineering organizations

software engineering

NCEES
advancing licensure for engineers and surveyors
P.O. Box 1686 (280 Seneca Creek Rd.), Clemson, SC 29633 USA T: (864) 654-6824 F: (864) 654-6033 NCEES.ORG

NEWS RELEASE
March 13, 2018
Contact: Tim Miller, P.E.
Director of Exam Services
tmiller@ncees.org

NCEES discontinuing PE Software Engineering exam

NCEES will discontinue the Principles and Practice of Engineering (PE) Software Engineering exam after the April 2019 exam administration. Since the original offering in 2013, the exam has been administered five times, with a total population of 81 candidates. Only 19 candidates registered for the April 2018 administration. Per NCEES exam development policy, the Committee on Examination Policy and Procedures (EPP) is required to review the history of any exam with fewer than 50 total first-time examinees from NCEES jurisdictions in two consecutive administrations and provide recommendations to the NCEES board of directors concerning the desirability of continuing the exam.

At the January 2018 meeting, the EPP Committee reviewed the history of the PE Software Engineering exam, the low candidate population, and the potential for increasing the number of first-time examinees. After consideration of all information, the EPP Committee recommended that NCEES discontinue the PE Software Engineering exam.

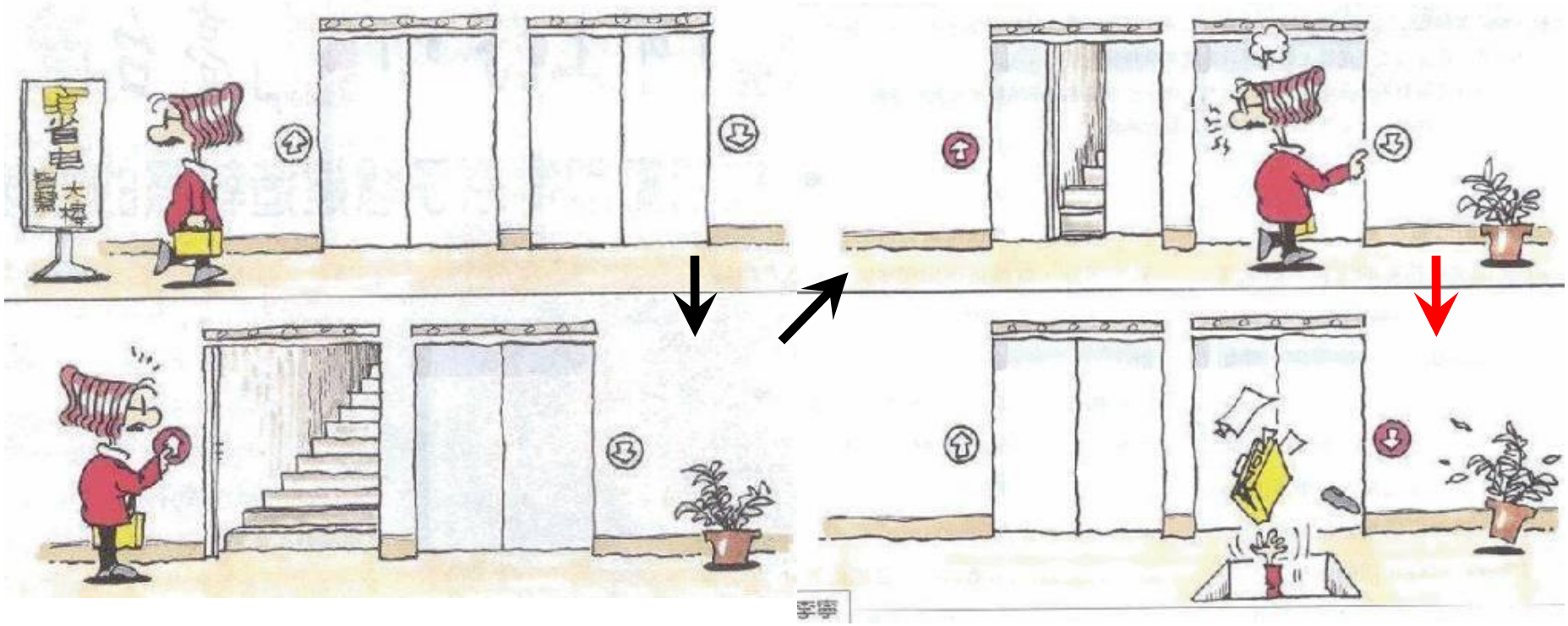
At its February 2018 meeting, the NCEES board of directors accepted the EPP Committee's recommendation to discontinue offering the PE Software Engineering exam. Since this exam is offered only once per year, the board directed that NCEES discontinue the PE Software Engineering exam after the April 2019 exam administration.

NCEES provided official notification to all member boards of the discontinuation of the PE Software Engineering exam in accordance with policy.

software engineering

grew out of a growing awareness about "**software crisis**"

larger programs -> exponential increase in failures and bugs – even impossible to fix



software engineering

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1) speficification: requirement analysis

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4) evolution: evolving sw to meet the changing needs of users

software engineering

software quality is really improving due to appropriate use of software engineering techniques

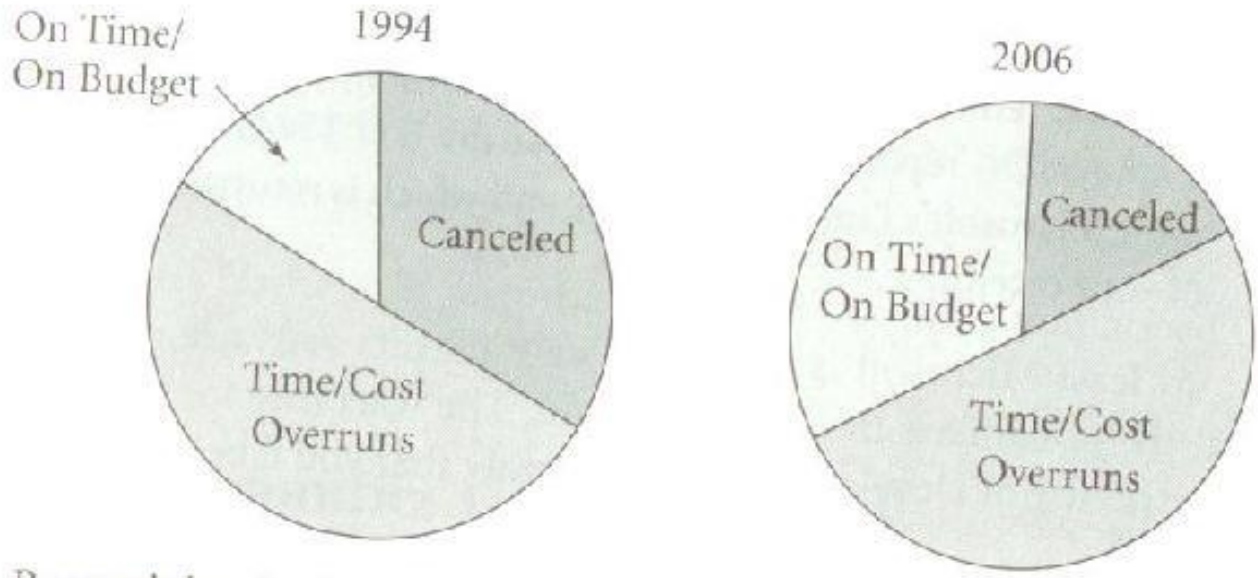

FIGURE 7.9 Research by the Standish Group reveals that the success rate of IT projects in 2006 was twice that of 1994. Today, about one-third of software projects are completed on time and on budget.

computer engineering

National Council of Examiners for Engineering and Surveying

NCEES
advancing licensure for engineers and surveyors

NCEES Principles and Practice of Engineering Examination
ELECTRICAL AND COMPUTER—COMPUTER ENGINEERING Exam Specifications

Effective Beginning with the April 2018 Examinations

- The exam is an 8-hour open-book exam. It contains 40 multiple-choice questions in the 4-hour morning session, and 40 multiple-choice questions in the 4-hour afternoon session. Examinee works all questions.
- The exam uses both the International System of units (SI) and the US Customary System (USCS).
- The exam is developed with questions that will require a variety of approaches and methodologies, including design, analysis, and application. Some questions may require knowledge of engineering economics.
- The knowledge areas specified as examples of kinds of knowledge are not exclusive or exhaustive categories.

computer engineering

	Approximate Number of Questions
I. Computer Systems	**24**
A. Data Representation	6
1. Number representation	
2. Character representation	
3. Encoding schemes	
4. Error detection and correction	
5. Data compression	
6. Encryption	
B. Computer Architecture	18
1. Computer organization and processor design	
2. Embedded systems	
3. System architecture	
4. Memory systems	
5. System performance	
II. Hardware	**24**
A. Digital Devices and Systems	10
1. Memory devices	
2. Standard modular devices (e.g., multiplexers)	
3. Programmable devices	
4. Serialization and deserialization	
5. Combinational and sequential circuits	
6. Implementation technology (e.g., FPGA, ASIC)	
7. Arithmetic hardware (e.g., ALU, FPU)	
8. Synchronous	
9. Asynchronous	
10. Testability	
11. Tristate logic	
12. System design (datapath/control)	
B. Digital Electronics	6
1. Basic solid-state devices	
2. Operating parameters	
3. Data conversion and instrumentation	
4. Circuit implementation	
5. Timing design and analysis	
C. Hardware Description Languages	8
1. Testbench development	
2. Abstraction levels (RTL, structural, behavioral) and hierarchical design	
3. Synthesis issues	
4. Verification (e.g., assertions, coverage)	
III. Embedded System Software	**16**
A. Systems Software	8
1. Operating systems	
2. Real-time operating systems	
3. Computer security	
4. Device drivers	
5. Interrupts and exception handling	
6. Firmware (e.g., BIOS)	
B. Application Development	8
1. Software design	
2. Quality assurance	
3. Software fundamentals	
4. Development tools (e.g., debuggers, disassemblers, trace tools, emulators)	
IV. Computer Networks	**16**
A. Protocols and Standards	2
B. Configuration/Topology	4
1. Wireless	
2. Wired and optical	
C. Hardware	4
D. Safety, Security, Privacy	4
E. Cyber Physical Systems	2
1. Distributed sensing	
2. Self-configuration	
3. Mobile network systems	

professional relationships

1) employer – employee
2) client – professional
3) other stakeholders – professional
4) professional – professional
5) conflicting responsibilities

employer – employee

relationship starts after hiring, some written (tasks, salary, hours of work...) and some not mentioned (assumed or not anticipated)

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assumed – not doing sth illegal, working overtime, no public speaking, not refusing assignments (even when employee thinks immoral)

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Kant’s categorical imperative holds, employee provides labor, employer provides compensation, no party treats other as means to an end, both must be honest, if lying to manipulate -> means to an end

employer – employee

workplace hazards -> exploiting employees
  weaknesses, outstanding salaries with benefits, not mentioning about dangers, employees being treated merely as means to an end

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loyalty -> most difficult area, loyalty both good and bad, bad if I choose my friend for an application, good for being loyal to company (increasing level – up to family etc.), vote-routing and buying products enforcement (abuse of loyality)

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trade secrecy – the generic knowledge captured is my only asset, resigning contracts

client – professioal

contractual relationship on formal (written) contract

client seeks professional’s special knowledge and expertise, the client has no knowledge and must depend on the professional

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doctor – computer professional analogy on all levels

other stakeholders – professional

activities may affect others who are neither employers nor clients

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this doesn't mean no responsibility – professionals must even have different understandings (not direct contact like lawyers or doctors, affecting indirectly)

professional – professional

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what do you owe your co-professional?

what do you owe your employer?

what do you owe the public?

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balancing obligations, help your co-worker because behavior will affect reputation? tolerating is important but up to which degree? (*e.g. space hulk*)

conflicting responsibilities

when to “rock the boat”? when to “blow the whistle”?

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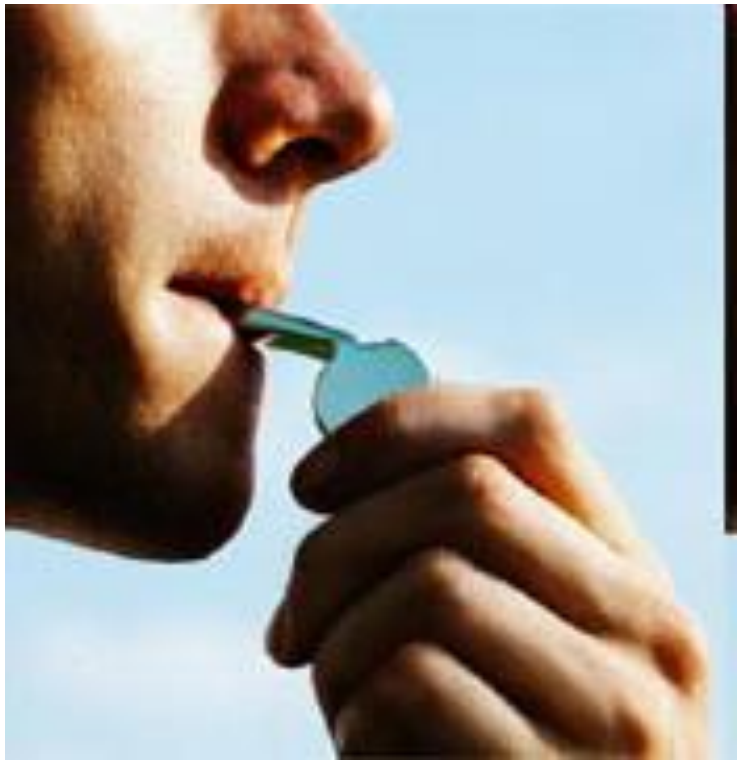
- Should I work on military projects or other projects that I believe are likely to have bad effects?
- What am I to do when I know that a certain kind of system can never be built safely or securely enough, but I need the money or my company needs the contract?
- What do I do when a client is willing to settle for much less safety or security than is appropriate?

whistleblowing

breaking ranks within an organization in order to make unauthorized disclosure of information about a harmful situation after attempts in organizational channels fail



Morton Thiokol / NASA

engineer Roger Boisjoly (Morton Thiokol engineer) working for Challenger project on O-rings which seal connections at booster rockets, 1985, saw in two occasions that primary O-ring fails, report at NASA officials, NASA officials frustrated, he turned to vice president of engineering Robert Lund that O-ring failure is very critical and shuttle can be lost if the problem wasn’t fixed

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- January 27, 1986 group of Morton Thiokol engineers met to discuss tomorrow's launch, Florida in the middle of cold snap, about -8 C overnight, engineers knew that cold temperatures can trigger O-ring failures, 14-slide presentation to describe problem

Morton Thiokol / NASA

evening of January 27 Morton Thiokol teleconference with NASA centers (Marshall and Kennedy Space Centers), presentation ends with **“do not launch Challenger if temperature is below 12 C”**, NASA asks Morton Thiokol side for a go/no-go decision, Morton Thiokol vice president said “no”

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Morton Thiokol's top managers gathered, senior VP Jerald Mason and VP Calvin Wiggins "launch", VP Joseph Kilminster and VP Robert Lund "no", Mason told Lund "to take of his engineering hat and put on his management hat" (More than half of Morton-Thiokol's profits come from NASA), Lund changed his mind: vote: 3 against 1 (Kilminster)

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Kilminster returns to teleconference and says the NASA officials to "go ahead"

Morton Thiokol / NASA

January 28, 1986

Cape Canaveral, Florida

73 seconds after lift-off

Morton Thiokol / NASA

a month after loss Boisjoly has been testified at investigation, lawyers of Morton Thiokol advised him to reply every question with only “yes” or “no”, Boisjoly explained everything and shared his hypotheses with investigation commission supporting his claims with his 1985 report, contradictions with Morton Thiokol management testimony

then what?

Morton Thiokol / NASA

Boisjoly isolated from NASA personnel, removed from O-ring re-design efforts, distressed by hostile environment, Boisjoly resigned from Morton Thiokol at July, 1986, found a job +2 years later as a forensic engineer

Hughes Aircraft

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two kind of tests; functionality and resistance (shock, high temp, moisture), 10% percent of chips fail at least one of these tests, common problem: defective seal (moisture in) -> called “leakers”

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then Goodearl and Ibarra found some boxes of chips with blank paperwork (no tests) -> upper management, they told her that "she was no longer part of team", Goodearl filed a formal harrassment complaint, mid-level personnel manager called her and said "If you ever do anything like that again, I will fire your ass"

Hughes Aircraft

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Ibarra left Hughes Aircraft in 1988, Hughes Aircraft fired Goodearl in 1989, Goodearl and Ibarra filed a civil suit against in 1990

Hughes Aircraft

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Goodearl and her husband bankrupt and divorced later on, Ibarra and her husband went on welfare until they could find work

Hughes Aircraft

despite these hardships, both whistleblowers said they "**would do it all again.**", 1996

Ford Pinto failure

design in 60s, safety test problem (windshield fail), maneuver crash impact to gas tank (loophole in tests), 1971 first sell

competition against Japanese cars with same price around $2000 (they also got bonuses from Nixon)

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August 10, 1978; struck from behind, gas tank explodes, two sisters Judy (18) & Lynn (16) and their cousin Donna (18) Ulrich burnt to death

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design in 60s, safety test problem (windshield fail), maneuver crash impact to gas tank (loophole in tests), 1971 first sell

August 10, 1978; struck from behind, gas tank explodes, two sisters Judy (18) & Lynn (16) and their cousin Donna (18) Ulrich burnt to death

gas tank found defective, instead of calling them (more costly!?) they go ahead to cover trials with a blunt calculation (cheaper!?) <- cost/benefit analysis

Ford Pinto failure

Safety doesn't sell?

There was a corporate belief, attributed to Lee Iacocca himself, which stated "safety doesn't sell."

"This became a corporate belief what we can see where it led the Ford motor company, i.e. towards a hasty design of Ford Pinto which eventually came out as being hugely defected".

Lee Iacocca

(1924 –)

businessman,
former Ford chairman,
former Chrysler president

morality of whistleblowing

primary motivation is important, ok until no raise or promotion or ok until realize that things are getting worse

whistleblowing as a moral duty

DeGeorge's 5 questions: (ask your self before)

1) do you believe the problem may result in "serious and considerable harm to the public"?

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guns for hire professionals

non-professional -> gun for hire argument

selling his/her expertise to do anything anyone wants as long as it is legal (not likely to result in prosecution) and pays well

expertise as a means and leaves it to others what ends will be pursued

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quickly and cheaper sw enforcing for marketing, computer experts are caught in the middle, gun-for-hire approach: vulnerability to charlatan computer experts, professionalism issue

efficacy of computer professionals

the ability and capacity to affect the world by their knowledge and their roles in organizations

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efficacy -> responsibility for safe and reliable computing for the sake of society and computer professionalism

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role responsibility: assigned duties (bookkeeper to send invoices and pay bills on time)

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causal responsibility: action or inaction cause harm (Joe crashed network with his virus)

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legal responsibility: assigned by law (if your dog bites postal carrier)

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moral responsibility is not exclusive (if an infant is brought into home, both the mother and father are responsible for the baby's well-being)

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Michael McFarland suggested: engineers helping each other by organizing in whistleblowing cases:

"If whistleblowing should be done, and no individual has the strength to do it, then it must be done by a group acting collectively."

Product development from an IT failures perspective

How the customer explained it

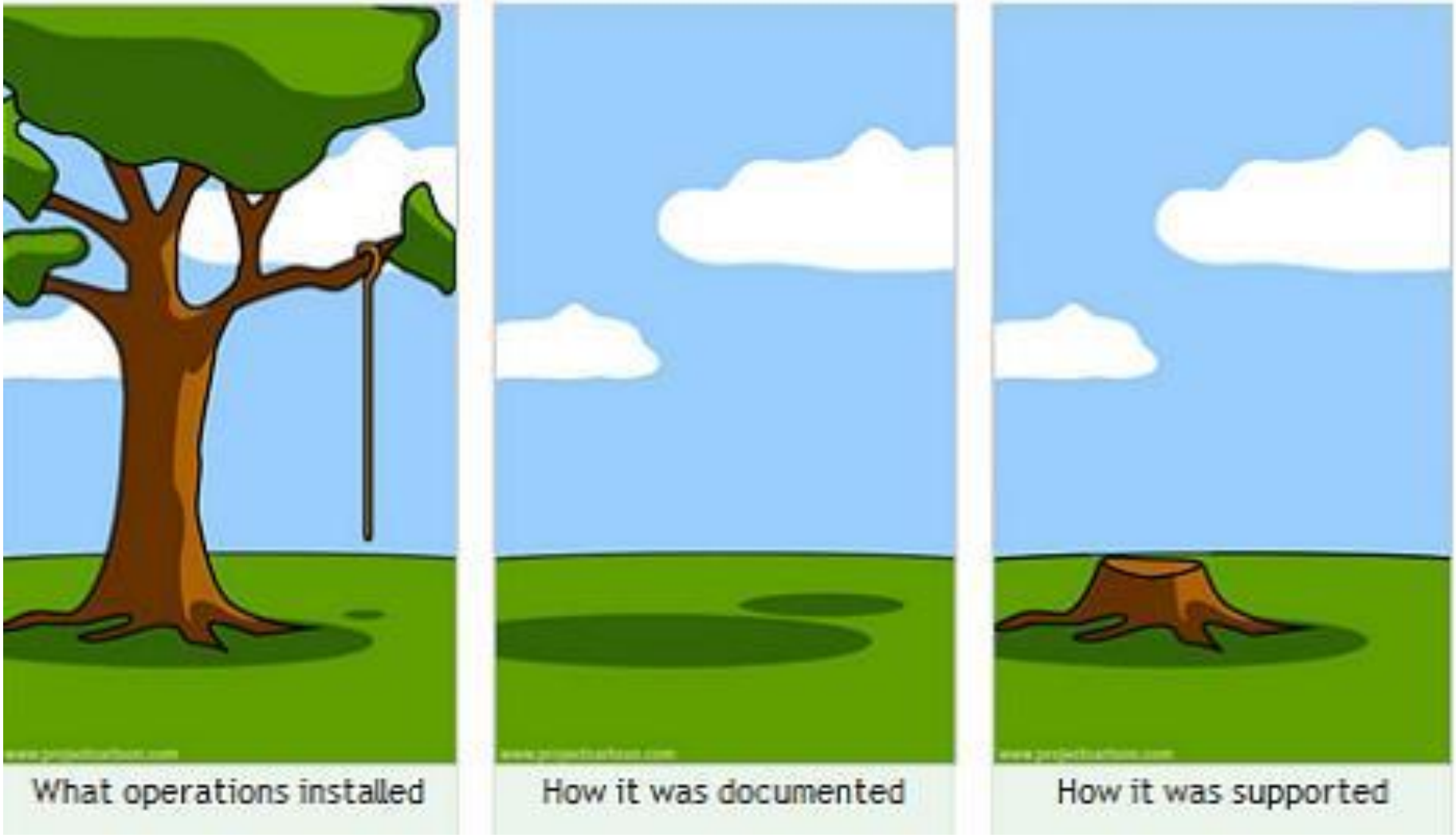
How the project leader understood it

How the analyst designed it

How the business consultant described it

How the programmer wrote it

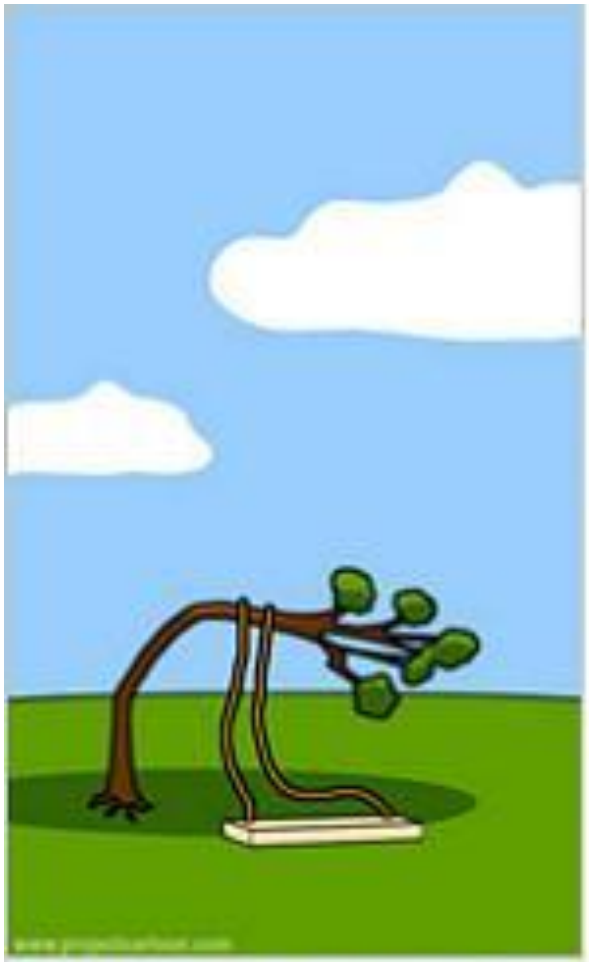
What the beta testers received


What operations installed
How it was documented
How it was supported

What marketing advertised

What the customer really needed

How it performed under load

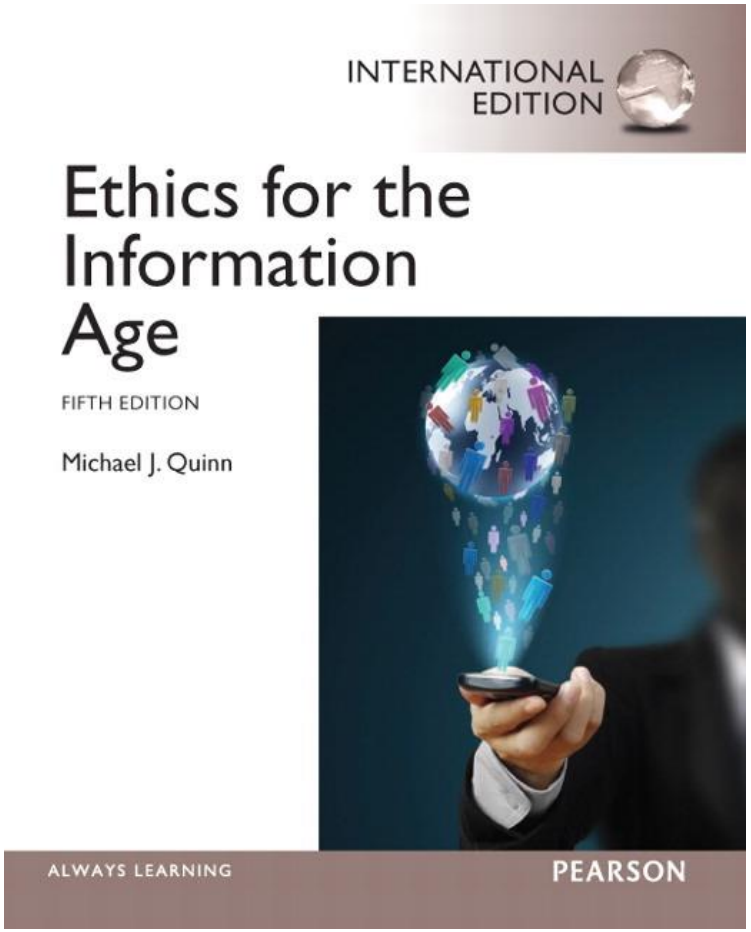


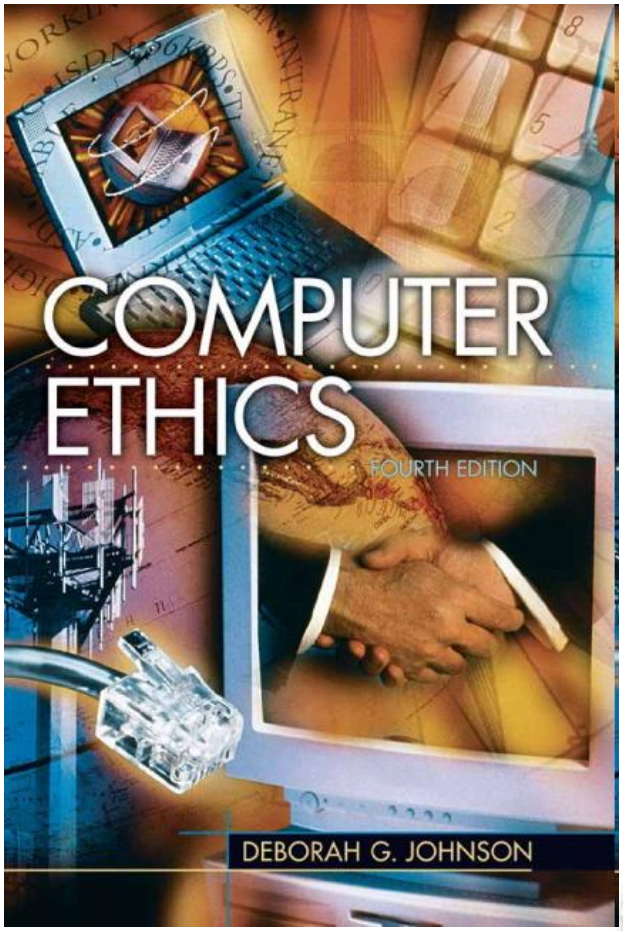
The disaster recover plan

How they advertised the open source version

How they applied open source patches

references





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