Instructor's Guide to

Ethics for the Information Age

Third Edition

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Contents

Preface

This booklet has supplementary information for instructors using the third edition of *Ethics for the Information Age*. It gives practical suggestions for running a successful class, points out other resources available via the Web, and contains solutions to all of the book's review questions. If you identify any errors in this manual, or if you have any ideas for additional exercises, I would enjoy hearing from you.

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Teaching Computer Ethics

Introduction

Teaching a computers, ethics, and society course for the first time can be intimidating. Unlike the typical computer science class, which focuses on technical content, a computers and society class focuses on people and the decisions they make. Doing ethics is not like finding the maximum element on a list. The moral problems discussed in this book are complicated, and there are no algorithms that enable you to "solve" a moral problem as neatly as you can construct a binary search tree. If you have little or no formal training in ethics, you may feel uncomfortable teaching an ethics class.

Fortunately, your job is *not* to preach to the students or tell them how they ought to behave. Rather, your role as the teacher is to raise questions, give students the opportunity to formulate answers, and then gently, but firmly insist that the students justify their answers by explaining their reasoning. If you are successful, the students will complete the course with a greater understanding of the social and ethical implications of computer use and abuse, an improved ability to think critically and defend their decisions logically, and a greater appreciation for alternate points of view.

As C. Dianne Martin and Hilary J. Holz put it:

> Our belief is that ethics cannot be taught; rather what can be taught is a framework for evaluating ethical dilemmas and making decisions. In accepting the premise that technology is value-laden, we stress the need to teach a methodology of explicit ethical analysis in all decision-making related to technology... The role of ethics education should be to provide students with at least a minimal theoretical background essential for their understanding of the role that values and ethics play in all decision-making, whether it be technical, economic, political, social, or personal.[1]

What is the best way to achieve this goal? The consensus among experienced instructors is that the best computer ethics classes are discussion-oriented. Students are more receptive to hearing ideas from peers than from you. They will come to realize that every complicated issue can be looked at from multiple points of view. They will also see that all opinions are not equally valid, and that the best arguments are those that use logic to reach conclusions from facts and commonly held values.

Discussions

Finding topics to discuss should not be a problem for you. The book raises far more issues than you will have time to discuss, and late-breaking news stories provide even more discussion material. You will have to pick and choose the topics you deem most important. If you're in a hurry, check out the discussion questions found at the end of each chapter. They can lead to interesting class debates and require no preparation beyond reading the chapter.

[1] "Non-Apologetic Computer Ethics Education: A Strategy for Integrating Social Impact and Ethics into the Computer Science Curriculum," C. Dianne Martin and Hillary J. Holz, The Research Center on Computing & Society (web site), www.southernct.edu/organizations/rccs.

The end-of-chapter interviews, new to the second edition, provide another source of discussion topics. While the text of each chapter is designed to present a balanced view of each issue, the interviews reflect the perspectives and passions of individual people. Some of their opinions may provoke interesting discussions among your students.

One of your important roles is to prevent a few extroverts from dominating the discussion. It is easier to keep the discussion moving from person to person if you can get a wide variety of people used to speaking up regularly. Ideally your class is small enough that you can learn the name of each student. If you know everyone by name, you can call on people even if they do not have their hand up. Try to create an expectation among the students that nearly everyone will contribute something to every class session.

Another one of your responsibilities is to ensure that the students justify their point of view. If a student should say, "I think such-and-such is wrong" without further elaboration, you should ask the student to explain *why* the action is wrong. Sometimes you need to drill down several levels before you get to the fact or value upon which the conclusion rests. I encourage my students to couch their arguments in one or more of these words: benefit, harm, right, obligation, or duty. A utilitarian analysis relies upon an evaluation of benefits and harms. A social contract theory analysis focuses on rights. A Kantian analysis considers duties or obligations. Asking for these words can have two benefits. It makes the analysis more rigorous, and it helps the class understand the ethical theory being used.

Many of the issues discussed in this class are highly controversial. Students often have difficulty coming up with a logical argument defending a point of view to which they are emotionally attached. One way to solve this problem is to poll the class and find out which students support an issue and which are opposed to it. If the class is reasonably well divided between the two points of view, ask the students to argue the point of view opposite to their own personal beliefs. Without an emotional attachment to a particular point of view, students can be more analytical.

You can add value to a discussion and keep it moving along through the use of meta-comments. For example: "Maria has just given a utilitarian argument why the proposed action is wrong. Can someone analyze this issue from a Kantian point of view?"

It is important that students understand there are multiple ways to look at nearly every issue. Through the use of leading questions, you can help ensure that both sides of an issue are expressed. If you cannot find anyone to express a contrarian view, you may need to bring that view out yourself. You have a better chance of getting a wide range of perspectives expressed, however, if you never reveal your own point of view or your favorite ethical theory.

Role-Playing Exercises

You should occasionally set aside time for role-playing exercises. Role-playing activities guarantee that many students will participate, and students particularly enjoy them. The textbook contains many role-playing exercises.

For a typical activity, the class is divided into small groups that give presentations representing a particular point of view. You will need to give the groups time to discuss the issue and devise the arguments they will make to the rest of the class. The amount of time depends on the exercise, but it is often 10–20 minutes. Next, each group makes its case. Again, the amount of time depends on the exercise, but it is often 20–30 minutes. Finally, it is good to have a concluding discussion in which the students have the opportunity to discuss the relative strengths of each group's case.

Writing Assignments

Writing assignments provide another important opportunity for students to practice constructing ethical evaluations. The media are filled with stories raising moral problems related to information technology. It is easy for students to find a current news story related to the topic of a chapter. In a typical 600-word essay I ask students to describe a moral problem, take a clear stand on whether a particular action or decision is right or wrong, and then defend their position through the use of one or more of the practical ethical theories described in the book (Kantianism, act utilitarianism, rule utilitarianism, or social contract theory). You can find guidelines for grading written essays on the Web (see the

next section).

Web Resources

A variety of Web sites contain information valuable to instructors of computer ethics courses. This section describes a few good sites.

The **ComputingCases.org** Web site provides detailed case studies that you can use in class. Some of them overlap with cases described in *Ethics for the Information Age*, while others are different. The site introduces a methodology called "Social Impact Analysis" for exploring the social and ethical issues related to a computing system. It gives practical advice on how to lead an ethics case discussion, and it provides a worksheet that students can use when weighing the pros and cons of alternative actions. The home page for the site is `ComputingCases.org`.

DOLCE is an acronym for Developing On/Off-Line COmputer Ethics. The DOLCE Web site contains several classroom activities, including quizzes and role-playing exercises, that you can use early in the term to help motivate the study of ethics. The site also contains several rubrics (evaluation sheets) that can help you grade written essays. The URL of the DOLCE home page is `csethics.uis.edu/dolce`.

Edward F. Gehringer at North Carolina State University has created an attractive visual map that provides links to Web sites, news articles, and case studies related to computer ethics. The URL for the **Ethics in Computing** site map is `ethics.csc.ncsu.edu`.

RCCS (Research Center of Computing & Society) is a particularly valuable site if you are integrating computer ethics in an existing computer science course. It provides case studies relevant to a wide variety of courses in the typical undergraduate computer science curriculum. You could also take advantage of these case studies if you are teaching a stand-alone computer ethics course. The home page for this site is `www.southernct.edu/organizations/rccs`.

CERIAS is an acronym for Center for Education and Research in Information Assurance and Security. The CERIAS Web site is a good place to check if you are integrating computer ethics into another computer science course. Its materials suggest how discussions of ethical issues can be introduced into various undergraduate courses in computer science. The URL for this site is `www.cerias.purdue.edu`.

Summary

One of your roles as a teacher of computer ethics is to raise questions and ensure that a wide variety of points of view are expressed. You are also serving as a role model, demonstrating to students the importance of thinking about the right thing to do—and then doing it. Ethics—doing the right thing—is not just for people with a Ph.D. in philosophy. Ethics is for all of us, and all of us have more to learn. It's perfectly acceptable to respond to a question with, "I don't know. I'll read up on that and get back to you." I do that all the time. By letting the students know that you are a student of ethics, too, you can give them confidence that they can start—right now—to think about the moral qualities of their professional decisions.

Chapter 1

Catalysts for Change

1. According to the author, there is good reason to say we are living in the Information Age because computer and communication technologies have made it easy to collect, store, manipulate, and distribute vast amounts of information.
2. The Amish demonstrate that people have the ability to evaluate every technology critically and determine whether its use will improve or degrade their quality of life.
3. Three aids to manual calculating are the tablet, the abacus, and the mathematical table.
4. Commercial mechanical calculators became practical in the late nineteenth century because advances in machine tools and mass-production methods made it possible to manufacture reliable devices at a reasonable price.
5. Rapid industrialization, economic expansion, and a concentration of corporate power in the late 19th century created a growing market for devices that could speed up accounting.
6. The Burroughs Adding Machine Company surpassed its competitors by combining an excellent product with excellent marketing.
7. The widespread adoption of the mechanical calculators led to the lowering of wages of bookkeepers and the transformation of a male-only occupation to an occupation employing a large number of women.
8. The invention of the cash register was a response to two needs: the need to prevent clerks from embezzling money, and the need for better sales accounting.
9. In the early twentieth century, the U.S. Census Bureau used punched cards to store census data, Marshall Field's used punched cards to analyze information generated by cash registers, railroads used punched cards to send out bills more frequently, and the Pennsylvania Steel Company used punched cards to do cost accounting on manufacturing processes.
10. A data-processing system has three principle components. The first component inputs data, the second performs calculations, and the third outputs data.
11. The development of radar in World War II stimulated three advances in computing: electrostatic memory (exemplified by the Williams Tube), semiconductor memory (exemplified by the transistor), and graphical user interfaces (exemplified by Doug Engelbart's oNLine System).

12. IBM quickly overtook Remington Rand as the leading mainframe computer maker because it had a larger base of existing customers and a much better sales and marketing organization, and it made a much greater investment in research and development.

13. The motivation for the creation of higher-level programming languages was a desire to make programming less tedious and error-prone and improve programmer productivity. Higher-level programming languages changed computing by enabling programs to be moved more easily from one manufacturer's computers to another manufacturer's computers. It also led to a large increase in the number of people writing computer programs.

14. Time-sharing gave more organizations access to electronic digital computers in the 1960s by allowing them to share the cost of purchasing (or leasing) and operating a computer system.

15. Between 1962 and 1965, the Minuteman II missile program was the largest single consumer of integrated circuits in the United States, representing about 20 percent of total production. In the course of making these chips, manufacturers found ways to make chips less expensive and more reliable.

16. The principal innovation of the IBM System/360 was the creation of a series of nineteen binary-compatible computers. All nineteen computers had the same instruction set. That means customers could upgrade from one IBM System/360 to a bigger, faster computer in the same product line without having to rewrite their programs.

17. The semaphore telegraph was adopted more rapidly on the continent of Europe than in the British Isles because the system only works when atmospheric conditions allow good visibility between stations. Since fog and rain are more common in the British Isles, the semaphore telegraph is not as practical.

18. Morse's telegraph put the Pony Express out of business. Morse's telegraph made possible fire alarm boxes in urban areas.

19. The telephone blurred the traditional boundaries between private life and public life, between family and business. The telephone eroded traditional social hierarchies. The telephone enabled the creation of the first "online" communities.

20. A circuit-switched network sets up a permanent physical circuit between the machines that are communicating. The circuit may not be used for other communications while these two machines are holding the circuit, even when they are not actually exchanging messages. A packet-switched network divides messages into groups of bits called packets. Network routers transfer packets from a message sender to a a message receiver. At one moment a physical wire may be carrying a packet from one message, and at the next moment it may carry a packet from another message.

21. The Internet has a decentralized structure because ARPA did not want the ARPANET to collapse if a single computer were lost. It is widely reported that fear of a nuclear attack led ARPA to this design decision.

22. The National Science Foundation stimulated the creation of commercial, long-distance data networks in the United States by simultaneously (1) encouraging commercial use of regional NSFNET networks and (2) banning commercial traffic on the NSFNET Backbone.

23. The codex is more durable than a papyrus scroll, and it makes it much easier for readers to locate a particular passage in a book.

24. Hypertext is a linked network of nodes containing information.

25. A hypertext link is similar to a citation in a book in the sense that both point to a source of related information. A hypertext link is superior to a citation in that you can jump immediately to the related material by clicking on the link.

26. Douglas Engelbart invented the computer mouse in the 1960s.

27. The Apple Lisa was not commercially successful because it was too expensive and its processor was too slow. The Macintosh was much cheaper and faster.

28. An Apple HyperCard stack is fundamentally different from the World Wide Web because hyperlinks connect pages (cards) all located on the same computer.

29. Constructing the World Wide Web on top of the TCP/IP protocol, rather than one vendor's proprietary network protocol, helped ensure the success of the Web, because it enabled the Web to span computers made by different manufacturers running different operating systems.

30. The first widely used Web browser was Mosaic, developed at the National Center for Supercomputer Applications at the University of Illinois, Urbana-Champaign. The most popular browser in use today is Microsoft's Internet Explorer.

31. The results of these searches will change over time. What I find interesting is how difficult it can be sometimes to distinguish between sponsored and non-sponsored links.

32. A search engine is program that accepts a list of keywords from a user, searches a database of documents, and returns those documents most closely matching the specified keywords.

    Crawler-based search engines automatically create the database of information about Web pages. Google and AltaVista are crawler-based search engines. The other type of search engine relies upon databases of Web page information constructed by humans. OpenDirectory is an example of this kind of search engine.

33. Information technology refers to devices used in the creation, storage, manipulation, exchange, and dissemination of data, sound, and/or images.

34. Inventions mentioned in this chapter that were created for a military application are the the ENIAC, radar, and the ARPANET.

35. The two most popular applications of the Internet are email and the World Wide Web.

36. The need for large amounts of timely information by corporate managers in the late nineteenth century fueled the growth of the manual calculator market. The need to store and manipulate large amounts of data prompted the invention of punched-card tabulation and data-processing systems. A demand for less expensive access to computers stimulated the development of time sharing. BASIC became popular because there was a demand for an easy-to-learn programming language. An interest in accessing and sharing information led to the rapid adoption of the World Wide Web created by Tim Berners-Lee.

37. The adoption of the telephone erased traditional boundaries between work and home. The telephone also make possible the first on-line communities, through party lines. Manual calculators led to the deskilling and feminization of bookkeeping. Time-sharing systems gave many more people access to computers, which they used for both educational and entertainment purposes. Television broadcasts may have influenced the outcome of the U.S. Presidential election of 2000.

Chapter 2

Introduction to Ethics

1. The “ethical point of view” means respecting not only your own goals and aspirations, but taking into consideration the goals and aspirations of other people as well.

2. Morality refers to guidelines that you can use to determine what you ought to do in a particular situation. Morality also allows you to figure out whether a particular decision or action is right or wrong. Ethics is the philosophical study of morality.

3. Morality is focused on solving particular problems. Ethics is broader than morality in that it includes the higher-level activities evaluating moral systems and the creation of new ways of evaluating moral problems.

4. Relativism is the view that “the good” exists inside the human mind. Our role as humans is to invent “the good.” Since “the good” is invented, its definition is malleable. Objectivism is the view that “the good” exists outside the human mind. Our role as humans is to find or discover “the good.” Since “the good” exists independently of our intellectual activity, its definition never changes.

5. By using an ethical theory in which all humans are treated equally and guidelines are developed through a process of logical reasoning, it is more likely that you can craft an ethical argument that will be convincing to a diverse audience.

6. Person B has not made a strong ethical argument because she has not brought up any facts or values that would undermine or contradict the explanation of Person A.

7. When we say an ethical theory is rational, we mean that it relies upon logical reasoning from facts or commonly held values.

8. The many/any fallacy is to conclude that any option is acceptable after observing that many options are acceptable. For example, you may observe me take several different routes between home and work, and all of them are good in the sense that they allow me to reach my destination safely and in a reasonable amount of time. That does not imply that all possible routes between home and work are good.

9. The equivalence fallacy is to confuse similarity with equality. It comes into play in this chapter in the discussion of the divine command theory. When we say “God is good,” it is fallacious to argue that God and the good are identical.

Another example of the equivalence fallacy would be to conclude from the statement "Adolph Hitler was evil incarnate" that everything Hitler said or did was evil.

10. Sometimes I leave home a little late, but I'd still like to get to work on time. I want to be able to drive through red lights on those days when I am running late. The proposed moral rule is: I may ignore traffic laws when I am pressed for time. If we universalized this rule, then traffic signals would cease to have any meaning. The streets would be chaotic. There would be gridlock or accidents at every busy intersection. That contradicts my desire to get to work on time. Hence my proposed moral rule is logically self-defeating. It is wrong for me to drive through red lights on those days when I am running late.

11. Plagiarism is the use of someone else's words or ideas without giving that person credit. Appendix A actually gives five ways of committing plagiarism: copying another's words without putting the words in quotation marks and citing the source; paraphrasing another's words without citing the source; incorporating someone else's figures or drawings without citing the source; referencing facts that are not common knowledge without citing the source; and using another person's ideas without giving that person credit.

12. Plagiarism refers to deliberately concealing the fact that you have used someone else's words or ideas. If the action is not intentional, it should be called misuse of sources.

13. A consequentialist theory determines whether an action is right or wrong by evaluating its consequences. Utilitarianism is a consequentialist theory. A non-consequentialist theory determines whether an action is right or wrong by considering the underlying rule or principle motivating the action. Kantianism and social contract theory are non-consequentialist theories.

14. Three situations in which my action would be primarily motivated by a sense of duty or obligation:

    (a) I promised someone if he could get two tickets to a rock concert, I would purchase a ticket and go with him. He got the tickets and expects me to pay for mine. I keep my promise, even though I just lost my job and I really can't afford to go.

    (b) I pay my income taxes, even though I think the government has some wasteful programs.

    (c) Everybody in my fraternity is going to give blood. I donate blood, too, even though just thinking about it makes me queasy.

    Three situations in which my action is primarily motivated by its expected consequences:

    (a) I give money to a particular charity because it has the lowest administrative overhead of any international relief organization. I figure more of my money will actually reach those who need it.

    (b) I work extra hard in a particular class, even though I am not interested in the material, because I hope the professor will write me a good letter of recommendation.

    (c) I slightly exaggerate my experience in order to get a good job as a server in a nice restaurant.

15. Moral luck is a problem associated with act utilitarianism. According to act utilitarianism, the moral worth of an action depends solely on its consequences. If the consequences are out of the control of the moral agent, an action that should have had a good effect may end up having a harmful effect. In this case, the action is deemed to be wrong, even though it was no fault of the person performing the action.

16. Businesses and governments often use utilitarian thinking to determine the proper course of action because it allows all the consequences of a decision to be boiled down to dollars and cents (or some other quantifiable unit of measure).

17. The difference principle states that social and economic inequalities must be justified, and the only way to justify a social or economic inequality is to show that its overall effect is to provide the most benefit to the least advantaged. For example, under capitalism some people are allowed to have much more wealth than others. In order to justify capitalism, it must be shown that the poorest are better off than under alternative economic systems.

18. Social contract theory is a non-consequentialist theory. Social contract theory as articulated in Rawls's two principles of justice is a non-consequentialist theory.

19. Both divine command theory and Kantianism are objective, holding that right and wrong can be expressed in rules that are true for all people at all times in history. Divine command theory identifies the good with the will of God, and holds that the will of God is communicated through holy books. Kantianism, on the other hand, holds that we can use our reason to determine what is good.

20. Both subjective relativism and act utilitarianism would allow an individual to evaluate a situation to determine whether a particular action is right or wrong. However, subjective relativism allows a person to use any means to decide the right thing to do. According to act utilitarianism, the consequences of the possible actions must evaluated. The correct action is the one that leads to the greatest increase in total happiness among the parties effected.

21. Both Kantianism and rule utilitarianism are objective. According to both theories, right actions are those that are in line with universal moral rules. However, the two theories derive the rules in different ways. Kantianism determines whether a proposed moral rule is acceptable by evaluating it according to the Categorical Imperative. Utilitarianism determines whether a proposed moral rule is acceptable by considering the long-term, overall total change in happiness that would result if everyone always followed the rule.

22. Both act utilitarianism and rule utilitarianism are consequentialist theories. However, act utilitarianism considers the consequences that would result from an action taken in one particular situation. Rule utilitarianism considers the consequences that would result if everyone always took a certain course of action in all similar situations.

23. Both theories focus on the notion of society, but they are quite different. For one thing, cultural relativism is an example of relativism, while social contract theory is an example of objectivism. Cultural relativism says each society must determine for itself what people ought to do in various situations. Different societies come up with different moral codes. These rules may be based heavily on tradition and not on reason. Social contract theory says morality consists in those rules that rational people ought to recognize are in everyone's best benefit if they are universally obeyed.

24. Both Kantianism and social contract theory are objective, rule-based theories. In Kantianism, proposed rules are derived by seeing if they can meet the requirements of the Categorical Imperative. In social contract theory, proposed rules are derived by seeing if their universal adoption would be to everyone's mutual benefit.

25. Alexis did wrong when she lied to the librarian. By deceiving the librarian, Alexis treated the librarian as a means to her end of getting access to the private college's computers.

    The anti-spam organization is treating the innocent computer users in the East Asian country as means to its end of reducing spam. That is wrong.

    The analysis depends upon the expectation of privacy people should have. The existence of the cameras is public knowledge. If nobody is being "used," the action appears to be morally acceptable.

Releasing the software without informing the potential users of the possible bugs would be wrong. However, if the hospital staff were fully notified that the product was in beta test, a decision to release the product could be justified.

26. The benefits to Alexis were large. The harms to others were small. Her action was morally acceptable.

    Millions of people are getting much less spam. The benefit to each of these persons is small, but meaningful. Tens of thousands of citizens of the East Asian country cannot send email to the United States. The harm to each of these persons is significant. Concluding whether the action is right or wrong depends upon the weight you give to each person's benefit or harm.

    In this case the benefits seem to outweigh the harms. The actions of the East Dakota State Police are morally acceptable.

    To do the analysis, we must examine the various courses of action and weigh, for each one, the potential benefits and harms to the patients, nurses, hospital, and members of the start-up company.

27. A rule utilitarian is likely to subscribe to the rule "Lying is wrong," since widespread lying can lead to many harms. For this reason, Alexis did wrong when she deceived the librarian.

    The challenge with this scenario is to determine whether any moral rules have been broken. In general, utilitarianism is comfortable with the notion that maximizing the overall good may mean that the majority gains a benefit while the minority suffers a harm.

    The East Dakota State Police is using technology to increase the safety of the community. Its actions appear to be morally acceptable.

    As long as the company fully discloses the status of the product, it appears to be on safe ground.

28. Alexis violated the property rights of the private college when she used its computers without permission. Her action was wrong.

    The residents of the East Asian country had a reasonable expectation that their email would be delivered. By blacklisting the country's ISPs, the anti-spam organization encouraged American ISPs to refuse to forward email. This seems wrong.

    How much privacy should a person have while operating a motor vehicle on a freeway? If a person has given up all privacy, then there seems to be nothing wrong with this action. If a person has a reasonable expectation of privacy, then the East Dakota State Police may have done something wrong if it secretly gave the FBI access to the information.

    The purchaser of a product has a right to expect the manufacturer stands behind the quality of the product. In this case it would be wrong for the company to sell the product as if it were completely debugged and 100 percent reliable. On the other hand, the hospital might be willing to beta test the device if it could get a discounted price or if that would help the company certify its reliability. The company could begin shipping the device to hospitals that understood the current state of the software.

29. Kantianism: The college student used his roommate and his roommate's girlfriend by broadcasting the images without their consent. What he did was wrong.

    Act utilitarianism: The roommate and the roommate's girlfriend had their privacy violated and were humiliated. They suffered great harm. The college student undoubtedly harmed his relationship with the roommate and the roommate's girlfriend, and perhaps with others, too. Some Internet voyeurs were undoubtedly pleased to receive the images. The conclusion of the analysis depends upon how much weight is given to the various consequences.

There is plenty of pornography already available on the Web, so the value of this video to those who enjoyed watching it is probably quite low, compared to the great harm caused the roommate and his girlfried. For this reason it is probable that an act utilitarian would conclude the action was wrong.

Rule utilitarianism: The college student violated the trust of his roommate. He disclosed information that should have been kept private. If everyone routinely violated the trust of roommates, friends, business associates, and family members, there would be significant negative consequences. People would need to be much more secretive. Without the ability to confide in someone else, people would be more miserable. The potential positive consequences of violating trust pale against the negative consequences. What he did was wrong.

Social contract theory: The college student violated the privacy rights of his roommate and his roommate's girlfriend. His action was wrong.

Chapter 3

Networking

1. The Internet is a network of networks that uses two protocols, collectively known as TCP/IP, to control the exchange of data.
2. The first part of an email address (before the @ sign) identifies a particular computer user. The second part of an email address (after the @ sign) contains a domain name.
3. Unless the email message is short, the mail server divides the message into packets. The message is sent from mail server through zero or more intermediate routers to the mail server of the person to whom you are sending the email. The destination email server reassembles the message from the packets (if necessary) and transmits the message to the intended recipient.
4. In order to be delivered, both email and physical mail must have a valid destination address. People assume that letters sent by physical mail are private; many people assume that email should also be kept private.
5. Spam is unsolicited, bulk email.
6. A spam blocker attempts to keep spam from reaching someone's mailbox by identifying and discarding (or routing to a special folder) emails that appear to be spam.
7. Trend Micro maintains a list of networks that either forward spam or allow spam to be created. The list is called the Realtime Blackhole List. Some Internet service providers refuse to accept email sent from hosts on the Realtime Blackhole List.
8. Email is less interactive. With email, the sender composes and mails a message. After the message is delivered, the recipient reads the message and may compose a reply. Because there is higher overhead with email, messages tend to be longer and are sent less frequently.

   Instant messaging is more interactive. A screen displays a conversation as it unfolds. A message is sent every time one of the parties hits the "Enter" key. Because there is little overhead with instant messaging, messages are much shorter and are sent more frequently.
9. A PC bang is a Korean cybercafe in which people play persistent, on-line games.
10. A URL is a Uniform Resource Locator. Every Web page has a unique URL, enabling hyperlinks to be set up between arbitrary pages.

11. Here are five among a multitude of other uses of the Web:

    (a) We sell stuff in on-line auctions (such as eBay).

    (b) We seek medical information from on-line special interest groups of people suffering from particular diseases.

    (c) We learn about the weather.

    (d) We find out about current traffic conditions before deciding whether to leave work.

    (e) We get directions before driving to a place we've never been before.

12. There are three forms of direct censorship: government monopolization, pre-publication review and licensing and registration. Government monopolization means the government owns all the media outlets. Pre-publication review means the government must approve information before it is disseminated. Licensing and registration means a news organization must get a license from the government before operating. It is used for media with limited bandwidth, such as radio and television.

13. Broadcasters have the most limited First Amendment rights because they have a pervasive presence. Broadcasters beam signals into the privacy of the home. Since people can turn radios and televisions on and off, they may turn a device on in the middle of a show. That means that warnings at the start of a show are less effective than a warning at the front of a newspaper or magazine article. Also, broadcasting is accessible to children, even those too young to read. Restricting the access of children to radio or television is more difficult than restricting access to adult magazines or books.

14. Censorship is difficult on the Internet because:

    (a) The Internet supports many-to-many communication. The Internet has far more information outlets than television or radio.

    (b) The Internet is dynamic. Millions of computers are being added to the Internet every year.

    (c) The Web is huge, containing billions of pages. Nobody can keep track of everything published on the Web.

    (d) The Internet is global. Laws passed in one nation may have no effect outside that nation's borders.

    (e) It is hard to distinguish between children and adults on the Internet.

15. The term "Internet addiction" stretches the traditional concept of addiction because the traditional definition of addiction focuses on the misuse of a chemical substance or drug.

16. The Enlightenment view of addiction is that people are responsible for the decisions they make about what they put into their bodies. Therefore, the responsibility for a person becoming addicted rests with the addict himself/herself.

Chapter 4

Intellectual Property

1. Intellectual property is a unique creation of the human mind that has commercial value. Examples of intellectual property include poems, photographs, songs, plays, books, paintings, sculptures, movies, logos, slogans, designs, perfumes, recipes, and computer programs.

2. John Locke holds that when people remove something from Nature through their own labor, they have mixed their labor with it, and therefore they have a property right in that object.

3. If more than two people create the identical intellectual property, there is only one instance of that property, not two, meaning both people cannot claim full rights to that property. Copying an intellectual property is different from stealing a physical property. Perfect copies can be made of objects embodying an intellectual property. When this happens, the original owner has lost exclusive control over use of the property, even though he or she still has the original article.

4. An individual or firm in the United States may protect intellectual property through trade secrets, trademarks, service marks, patents, and copyrights.

5. A trademark is a word, symbol, picture, sound, color, or smell used to identify a product. It is good when a company's trademark becomes well known to the public. Examples of trademarks are Kleenex, McDonald's Golden Arches, and Advil. A trade secret is a piece of intellectual property that is kept confidential. Examples of trade secrets are formulas, processes, proprietary designs, strategic plans, and customer lists. The information loses much or all of its value if it becomes public knowledge.

6. The advantage of a trade secret is that it does not expire. The disadvantage of a trade secret is that a company cannot prevent another company from reverse engineering the formula or process. The advantage of a patent is that the government gives the patent owner the exclusive right to the intellectual property. The disadvantage of a patent is that this right expires after 20 years.

7. Fair use refers to those circumstances under which it is legal to reproduce a copyrighted work without permission.

8. As information technology has advanced, companies have begun using digital media (such as CDs and DVDs) to store copyrighted songs, movies, and computer programs. The widespread availability of personal computers and CD/DVD burners has made it much easier for consumers to make copies of CDs and DVDs.

9. The Digital Millennium Copyright Act curtails fair use of copyrighted material by consumers by making it illegal to make copies of DVDs.

10. Digital rights management refers to any of a variety of actions owners of intellectual property stored in digital form may take to protect their rights. Examples of digital rights management include encryption, digital watermarking, and making CDs copy-proof.

11. CD-ROM drives in PCs use a different standard than CD audio players. When a CD audio player encounters a bad block of bits, it skips over it. When a CD-ROM drive in a PC encounters a bad block of bits, it keeps re-reading the block until the bits in the block make sense. By deliberately planting bad blocks of data onto a CD, you can make a CD that sounds good on a CD player but is unreadable by a CD-ROM drive.

12. The Apple/EMI agreement changes the landscape of digital rights management because EMI agreed to let Apple distribute its music without digital rights management, albeit at a 30 percent markup, making it easier for consumers to transfer the music to a variety of devices.

13. A peer-to-peer network is a transient (temporary) network allowing computers running the same networking program to connect with each other and access files stored on each other's hard drives. Peer-to-peer networks facilitate file sharing.

14. Napster relied on a single central server to mediate requests. FastTrack distributes the index of available files among many supernodes. Shutting down Napster simply requires shutting down the single central server. Shutting down FastTrack would require shutting down all of the supernodes. Hence FastTrack would be more difficult for the judicial system to shut down than Napster.

15. BitTorrent achieves an order-of-magnitude increase in downloading speed, compared with KaZaA and Grokster, by allowing a user to download different pieces of a file from many different sources simultaneously.

16. The answer to this question varies from university to university.

17. MP3 spoofing refers to posting a bogus MP3 file on a peer-to-peer network. In other words, the content of the file does not match the title. The recording industry supports MP3 spoofing because it makes downloading songs more difficult.

18. Sony did not actively encourage its customers to break copyright law. The Supreme Court ruled that time-shifting was not an infringement of copyright. In contrast, Grokster and StreamCast actively encouraged the availability of copyrighted files on their networks and helped consumers download these files, because these actions increased the popularity of their services and heightened their advertising revenues.

19. The answer to this question will vary over time, but Apple is making large profits from its music downloading service.

20. Patents are considered an unreliable way of protecting intellectual property rights in software because the Patent Office has given out many bad software patents than cannot hold up in court. This has happened because for decades the Patent Office did not give out patents on software. During this time a lot of "prior art" was being developed. Now, when a company applies for a software patent, the Patent Office may not be aware of some of the prior art. It may issue a patent even though the algorithm is not novel. Such a patent has little value. The existence of bad patents in software reduces the value of software patents in general.

21. Company A resorts to “clean room” software development. Two independent teams work on the project. The first team is responsible for determining how Company B’s program works and produces a technical specification. The second team relies solely on the technical specification to develop the software. Because the code developers are isolated from Company B’s product, Company A can ensure no code get copied, even unconsciously.

22. Open source refers to software in which the source code is distributed along with the executable program.

23. Linux has affected the market for proprietary software by putting price pressure on companies selling proprietary versions of Unix. It is providing an alternative to servers running the Windows operating system. Linux is also putting pressure on Microsoft and Apple, which sell proprietary operating systems for desktop computers.

24. The band can select a Creative Commons license that allows people to download music for noncommercial purposes, but still protects the band’s copyright to the song.

Chapter 5

Privacy

1. Google combines information in two databases. The first database ties phone numbers to addresses. The second database ties addresses to locations on a map. By combining information in these databases, Google can associate a location on a map with a phone number.
2. Students will come up with many different responses to this question. Next edition I need to remember to move this question to the "Discussion Questions" section!
3. Privacy is a negative right in the sense that all I have to do to give you privacy is leave you alone.
4. The Third Amendment to the U.S. Constitution gives people the right to refuse to let the government quarter soldiers in their homes in peacetime.
5. When the author says privacy is a prudential right, he means that granting people this right provides a net benefit to society. Hence it is prudent for a society to choose to give its members some privacy.
6. With the invention of air conditioning and television, people spend more time in their own apartments than they did 100 years ago. Automobiles and taxicabs give people more privacy than subway cars. Young adults are more likely to live away from their parents than they were 100 years ago.
7. A public record contains information reported to a government agency for the purpose of informing the public. Public information is information that is provided to an organization that has the right to share it with other organizations.
8. Disclosure of information that becomes part of a public record is typically required by law. For example, you must disclose certain information in order to get a marriage license. For this reason, it is easier for a person to control public information.
9. Here are a few examples: legal name, address, list of property owned, property tax records, political party, date of birth, date of marriage, date of divorce, date of death
10. Here is one possible answer. If you want to check out a book from a public library, you must provide certain information (such as your name, address, and phone number).
11. Here is one possible answer. People called to testify at a trial may be forced to reveal personal information, whether or not they consent.

12. Here is one possible answer. Many organizations keep track of the Web sites accessed by their computers. By monitoring the packets flowing from Web sites to particular machines, a company can determine the Web sites each of its employees is visiting.

13. A digital video recorder records television shows on a hard disk instead of a tape. It may have features making it much easier to program. It may connect with a central database and report viewing patterns.

14. Enhanced 911 service raises new concerns about privacy because in order to implement this service, cell phone companies must install technology that enables them to track the positions of all active cell phones.

15. Spyware is a program that communicates over your Internet connection without your knowledge or consent. Free software downloaded from the Internet often contains spyware.

16. Information about criminal convictions may be kept indefinitely, and bankruptcy information may be held for 10 years.

17. The Fair and Accurate Credit Transactions Act helps consumers verify the accuracy of their credit reports by giving them the right to request a free copy of their credit report once a year from each of the three major credit reporting bureaus.

18. The Family Education Rights and Privacy Act gives students 18 years old and older the right to review their educational records. It also gives them the right to request changes to records containing errors. Students may prevent others from accessing these records without permission, except under certain circumstances. If a student is less than 18 years old, these rights are held by the student's parents or guardians.

19. The Video Privacy Protection Act enhances privacy by making it illegal for videotape service providers to disclose rental records without the consent of the customer. The law also requires stores to destroy information about who rented what within a year of when the information is no longer needed for the purposes of the original transaction.

20. The Employee Polygraph Protection Act helps jobs applicants and company employees maintain their privacy by making it illegal for companies to require polygraph tests as a condition of employment (except for a few types of job). The EPPA also makes it illegal for companies to give polygraph tests to current employees, with a few exceptions. The most significant loophole of the Employee Polygraph Protection Act is that it does not apply to federal, state, or local government agencies.

21. The major provisions of the Financial Services Modernization Act are: allowing banks to offer insurance and brokerage services, requiring financial institutions to disclose their privacy policies to their customers at least once a year, and requiring financial institutions to take measures to prevent the unauthorized access of customers' confidential information.

22. The purpose of the Children's Online Privacy Protection Act is to reduce the amount of public information gathered from children using the Internet.

23. The Health Insurance Portability and Accountability Act limits how doctors, hospitals, pharmacies, and insurance companies can use medical information collected from patients. The regulations forbid health care providers from releasing information to life insurance companies, banks, or other businesses without specific signed authorization from the person being treated. Health care providers must provide their patients with a notice describing how they use the information they gather. Patients have the right to see their medical records and request corrections to errors they find in those records.

24. During World War I, the Census Bureau provided the names and addresses of young men to the military, which was searching for draft resistors. After the attack on Pearl Harbor, the Census Bureau provided the Justice Department with information about the general location of Japanese-Americans. The Army used this information to round up Japanese-Americans and send them to internment camps.

25. Consumer groups complained about H&R Block's Web-based Free File tax filing service because H&R Block used this service to do cross-marketing of a mortgage refinancing service.

26. The National Crime Information Center helped the FBI identify James Earl Ray as the assassin of Dr. Martin Luther King, Jr. The NCIC helped the FBI capture Timothy McVeigh, who was later convicted of the bombing of the Federal Building in Oklahoma City.

27. The purpose of the OneDOJ database is to give state and local police officers access to information generated by five federal law enforcement agencies. Since the database contains incident reports, interrogation summaries, and other such information, there is information about people who have never been arrested or charged with a crime. Critics say local police should not have access to this kind of information, which may include unsubstantiated and erroneous reports that will never be corrected or removed.

28. The Privacy Act is criticized because it applies only to government databases, only covers records indexed by a personal identifier, does not assign any federal agency the responsibility of enforcing its provisions, and allows federal agencies to share records.

29. The Fourth Amendment to the U.S. Constitution people from unreasonable searches and seizures of their property by law enforcement authorities.

30. In *Charles Katz v. United States*, the U.S. Supreme Court affirmed that citizens should be protected from all electronic surveillance conducted without warrants, including bugs.

31. The Patriot Act expands the kinds of information that law enforcement officials can gather with pen registers and tap-and-trace devices. It allows the use of pen registers on the Internet to track email addresses and URLs. It allows warrants to be issued without probable cause. It gives judges nationwide jurisdiction to issue warrants. It expands the number of circumstances under which roving surveillance can take place. It allows searches to be conducted without serving a search warrant in certain circumstances. It makes it easier for the FBI to collect business, medical, educational, library, and church/mosque/synagogue records.

32. Secondary use refers to when information collected for one purpose is put to another purpose.

33. Collaborative filtering is a way of helping an individual wade through a large amount of choices and focus in on the best ones. It uses information about the preferences of a large number of people to predict those items an individual is more likely to like. On-line retailers and DVD-rental sites uses collaborative filtering to make recommendations.

34. The IRS uses data mining to determine whom it should audit. New York City's Syndromic Surveillance System looks for epidemics, environmental problems, or bioterrorism. The Terrorist Information Awareness project is a third example of data mining by the U.S. government.

35. The Platform for Privacy Preferences is designed to help Internet users control the use of their personal information by the sites they visit. Web browsers can use P3P to compare a user's preferences with a site's privacy policy, steering users away from sites that are not compatible. However, the standard is voluntary, and P3P cannot monitor whether a site is actually abiding by its stated policy.

36. The most common form of identity theft in the United States is credit card fraud.

37. Yes, a private company can legally ask for your Social Security number.

38. Social Security numbers are not unique. They are rarely checked, so criminals can get away with supplying fake SSNs. They have no error-detecting capability, so SSNs are prone to data-entry errors.

39. This answer assumes that the implementation of the REAL ID Act will result in a de facto national identification card.

    Here are a few benefits touted by proponents of a national ID card. A national ID card would be harder to forge than a Social Security card. A national ID card would make it harder to people to enter the United States illegally. A national ID card would make it harder for illegal aliens to work in the United States. A national ID card would reduce crime.

    Here are a few harms suggested by opponents of a national ID card. Even hard-to-forge ID cards cannot prevent fakes from being made. There is no evidence that a national ID card would reduce crime. A national ID card would make governmental data mining easier. A national ID card would give agencies easier access to old files, even those containing incorrect or obsolete information.

40. In a traditional, symmetric encryption scheme the same key is used both to encode and decode the message. Since the sender must send the key to the receiver somehow, that introduces a security risk. In a public-key encryption scheme different keys are used to encode a decode the message. This eliminates the security risk of having to pass keys.

41. The U.S. government tried to stop the distribution of the Pretty Good Privacy (PGP) program because the widespread use of this program would make it more difficult to U.S. intelligence agencies to read messages.

42. The Justice Department advocated adoption of the Clipper chip, because the government had the Clipper's mathematical decryption key. With the key in hand, the government knew it could listen in on conversations encrypted with the Clipper chip.

43. Criminals can steal information at ATMs by looking over someone's shoulder to learn their PIN number, by installing a skimmer to capture the information stored on the access card, or by collecting receipts that customers have left behind.

44. Digital cash is anonymous electronic money. It differs from an ordinary credit card in that when you use it to purchase an item, a computer cannot link you with the purchase. It differs from ordinary cash in that it is stored electronically, rather than in physical form.

45. A blind signature protocol is a way for a bank to endorse the validity of digital cash without leaving an electronic "mark" that would enable the bank to determine the identity of someone making a purchase. Blind signatures are needed to preserve the anonymity of digital cash.

46. These pieces of legislation increased personal privacy rights: the Privacy Act of 1974, the Fair Credit Reporting Act, the Fair and Accurate Credit Transactions Act, the Family Educational Rights and Privacy Act, the Video Privacy Protection Act, the Employee Polygraph Protection Act, the Financial Services Modernization Act, the Children's Online Privacy Protection Act, and the Health Insurance Portability and Accountability Act.

    These pieces of legislation gave the government greater surveillance powers: Title III of the Omnibus Crime Control and Safe Streets Act of 1968, the Electronic Communications Privacy Act, the Communications Assistance for Law Enforcement Act, and the USA PATRIOT Act.

Chapter 6

Computer and Network Security

1. A computer virus is a piece of self-replicating code embedded within another program called the host.

2. A worm is a self-contained program that spreads through a computer network by exploiting security holes in the computers connected to the network.

3. A worm has the ability to spread on its own. A virus spreads when a computer user executes the host program.

4. Andy Sudduth's email was of no help for two reasons. First, it didn't have a subject line. Second, and more importantly, the email was not delivered in a timely manner, because the mail server handling it was infected with the worm.

5. A fast-moving worm is more dangerous because it can infect more computers before a way to plug the security hole is discovered. In addition, a fast-moving worm consumes more of the Internet's bandwidth.

6. A slow-moving worm could be more dangerous than a fast-moving worm if it propagated so slowly that it was not detected until it had spread to a large number of systems.

7. Filipino computer science student launched The Love Bug virus in 2000. The Internet worm was launched by Robert Tappan Morris, Jr., a computer science graduate student at Cornell University, in 1988.

8. A Trojan horse is a program with a benign capability that conceals another, sinister purpose.

9. It is dangerous for an email program to open attachments automatically, because the attachment may be an executable program containing a virus.

10. The word "hacker" is derived from the word "hack." A "hack" is a newly constructed piece of equipment that serves a useful purpose and demonstrates its creator's technical virtuosity. MIT's Tech Model Railroad Club was a hacker hotbed in the 1950s.

    A "phreak" is someone who manipulates the telephone system in order to communicate with others without paying for the call. The "f" sound is spelled with a "ph" because the "f" sound in "telephone" is spelled with a "ph."

11. The first major network to get hacked was the telephone network.

12. Hackers and phreaks do not think taking information from computers is a serious crime, certainly not as serious as the authorities would make it seem. In general, those who download MP3 files illegally seem to have the same attitude.

13. A denial-of-service attack is an intentional action designed to prevent legitimate users from making use of a computer service. The service is provided by a computer called a server. The denial-of-service attack tries to disable the server, preventing it from responding to legitimate users. Disabling the server can be done many ways, including: crashing the server, consuming its disk storage, filling its primary memory, or saturating its connections to the Internet.

14. Email bombing is like spamming in the sense that a lot of email messages are sent. Email bombing is unlike spamming because all of the messages are sent to the same address. In both email bombing and spamming, the sender modifies the message header to disguise the true source of the email message.

15. One way to use a worm in a DoS attack is to penetrate the target's computer with a worm that intentionally generates a long string of errors. Since the target computer logs errors in a data file, eventually the disk fills up, preventing the target from handling legitimate requests for service.

    Another way to use a worm in a DoS attack is to penetrate the target's computer with a worm that replicates very rapidly. The presence of many active worm processes either crashes the target computer or significantly degrades its performance.

16. The administrator of a Web server can stop a DoS attack temporarily by configuring the server so that it refuses to accept any packets from the attacker's computer, but all the attacker has to do is launch a new attack from another computer.

17. Filtering of outgoing Internet traffic is an important tool in the fight against DoS and DDoS attacks, because even if an outsider should gain access to one or more computers, the filtering can keep these computers from being used as launching pads for DoS or DDoS attacks.

18. A vote thief could cast multiple votes in an on-line election by purchasing pass codes from people willing to sell their right to vote. A thief could fool other voters into revealing their pass codes and then using this information to cast multiple votes.

19. The author concludes it is a bad idea for a government to allow on-line voting from home computers, because then the security of the voting system would depend on the security of home computers, which is poor.

20. The quickest and safest way to make a computer secure is to disconnect it from any networks.

Chapter 7

Computer Reliability

1. Here are three ways a computer may produce faulty output:
   (a) There is a bug in the program.
   (b) Incorrect data are input into the system.
   (c) A query for information is entered incorrectly.
2. A data-entry error is an error resulting from incorrect data being entered into a computer system. A data-retrieval error is an error resulting from the output of a computer system being misunderstood.
3. A lot of the information entered into the NCIC comes from other law enforcement and intelligence agencies. It is not practical for the FBI to check all of this information. Sometimes the veracity of information is questionable. Agents should be able to use their discretion is to determine which information may be useful in criminal investigations. If all data had to be double-checked before being entered into the NCIC, there would be far fewer records in the NCIC, reducing its usefulness.
4. An embedded system is a computer used as a component of a larger system. A real-time system is a computer that processes data from sensors as events occur.
5. A linear accelerator is a device that is used to treat cancer patients with radiation.
6. In the Therac-20 the PDP 11 minicomputer was an optional add-on. Hardware interlocks to prevent accidental overdoses remained in place. In contrast, the PDP 11 front end computer was fully integrated into the Therac-25. Some hardware interlocks on the Therac-20 were replaced with software controls on the Therac-25.
7. The Therac-25 was in operation two years before the first documented accident. It took another 20 months for the Therac-25 to be declared defective by the FDA.
8. A race condition in software is a situation in which two or more concurrent tasks share a variable, and the order in which they read or write the value of the variable can affect the behavior of a program. Race conditions are difficult to debug, because in order for a failure to occur, the timing of events must be exactly right. Often the probability that an error will occur is very low.
9. (a) Patriot missile: I, III

(b) Ariane 5: III

(c) AT&T long distance network: IV

(d) Mars Climate Orbiter: III

(e) Mars Polar Lander: VII

(f) Denver International Airport baggage system: V

(g) Therac-25: VI, V, II

(h) Direct recording electronic voting machines: III, VII

10. The advantage of allowing software users to identify and report bugs is that there are usually many more users outside the company than software testers inside the company. When many more people are exercising the software, there is a greater chance that errors can be uncovered.

    One disadvantage of allowing software users to identify bugs is that if a lot of bugs are discovered, the reputation of a company can suffer. Most users probably do not think it is their job to find and report errors (unless we're talking about people who have agreed to test a beta release of the software). Also, most software users are not trying to break the software, so even if a lot of people are using a program, that is no guarantee that every bug will be found in a reasonable amount of time.

11. Computer simulations are playing an increasingly important role in science and engineering because physical experiments are often too expensive and/or impossible to perform.

12. Five uses of computer simulation are weather prediction, searching for oil, designing consumer products such as disposable diapers, simulating galactic evolution, and predicting global population growth.

13. A model is a representation of an actual system. There are different kinds of models, including physical models and mathematical models. A computer simulation is a program that implements a mathematical model.

14. Verification is the process of determining if the computer program correctly implements the model. Validation is the process of determining if the model is an accurate representation of the real system.

15. You can validate a computer simulation by compare its predicted result with the actual result found by doing the experiment in the real world. For example, you can use a computer simulation to predict what happens when you drive a Ford Explorer into a wall at 35 miles per hour. Then you can drive a real Ford Explorer into a wall at 35 miles per hour and compare the predicted results with the actual results. Another way to validate a computer simulation is to take its prediction to an expert and ask the expert if the prediction is accurate.

16. Article 2 of the Uniform Commercial Code governs the sale of products in the United States. It helps protect the rights of consumers.

17. One purpose of the Magnuson-Moss Warranty Act was to prevent manufacturers from putting unfair warranties on products costing more than $25. Another purpose was making it feasible for consumers to bring warranty suits by allowing courts to award attorney's fees.

18. Some people argue that shrinkwrap software should be exempt from the Magnuson-Moss Warranty Act and Article 2 of the Uniform Commercial Code, because there is no such thing as error-free software. A program is much more complicated than a pocket knife. If software manufacturers can be held liable for all sorts of damages caused by a bug in a program, less software will be available, and the software that is available will be more expensive.

19. The significance of the court's ruling in *Step-Saver Data Systems v. Wyse Technology and The Software Link* was that the purchase order, the invoice, and the oral statements constituted the contract, not the software license agreement.

20. The significance of the court's ruling in *ProCD v. Zeidenberg* is that shrinkwrap licenses are enforceable unless their terms are unconscionable, even though the licenses are not visible before the box is opened.

21. The significance of the court's ruling in *Mortenson v. Timberline Software* was that the licensing agreement limited the consequential damages that Mortenson could recover from Timberline, even though Timberline knew there was a bug in the program and had not told Mortenson.

Chapter 8

Professional Ethics

1. A profession is a vocation requiring a high level of education and practical experience in the field. Software engineering has little in common with a fully developed profession such as medicine or law, other than the ability to cause great harm. Intial professional education is very helpful, but not required. Even if software engineers get an undergraduate degree in computer science, the program may not be accredited by ABET. There is no mandatory licensing of software engineers. Professional societies exist, but software engineers do not have to belong to one of them. A code of ethics exists, but following the code is strictly voluntary.

2. ACM opposed the licensing of software engineers in 1999 because it believed licensing "would not be effective in addressing the problems of software quality and reliability."

3. Clauses related to privacy: 2.05, 3.12, 5.03, 7.06

4. Clauses related to intellectual property: 2.02, 2.06, 5.09

5. Rule utilitarian viewpoint: 1.03, 1.07, 3.01, 4.06, 5.05 (more could be justified)

6. Kantian viewpoint: 1.01, 1.04, 1.06, 2.01, 2.02, 2.03, 3.02, 4.03, 4.04, 4.05, 4.06, 5.02, 5.06, 5.07, 5.11 (more could be justified)

7. Virtue ethics is the ethical theory that holds the right thing to in a particular circumstance is what a person of high moral character would do in that situation. A person obtains high moral character by possessing many virtues. A person possesses a virtue by repeatedly practicing that virtue.

8. The advantage of virtue ethics is that it is grounded on virtues (honesty, courage, generosity, etc.) that most people can relate to. The disadvantage of this theory is that is does not provide a methodology for ethical decision-making.

9. Five additional virtues: empathy, gentleness, helpfulness, kindness, trustworthiness. (There are many more good answers.)

10. Whistleblowing occurs when an organization is involved in an activity that is fraudulent or a threat to public safety, and a member of that organization reveals information about this activity to someone outside the organization.

Harms of whistleblowing: Whistleblowing usually ruins the career of the whistleblower and causes turmoil within the organization. The public relations damage caused the organization may harm it for years to come.

Possible benefits of whistleblowing: Whistleblowing may keep people from being hurt, or it may prevent the public from being defrauded. Whistleblowing may discourage other companies from engaging in activities that defraud or harm the public.

11. These clauses of the Software Engineering Code of Ethics and Professional Practice tend to support the legitimacy of whistleblowing under certain circumstances: 1.02, 1.04, 1.05, 4.01, 6.13

    Even if the whistleblower is telling the truth, the whistleblower may be violating these clauses of the Code: 2.03, 2.09, 6.05

Chapter 9

Work and Wealth

1. Automation reduces the price of goods, increasing the real income of the people who buy those goods. With a higher real income, people can use the extra money to buy other things. Hence automation increases the standard of living. However, automation puts some people out of work. They must go through unemployment, and perhaps retraining, before getting another job. People who are too old may be unable to find another job after being displaced by a machine.

2. There is evidence that automation eliminates jobs. More than 43 million manufacturing jobs disappeared in the United States between 1979 and 1994. Spreadsheets and other software packages are reducing the need for accountants and bookkeepers. A large number of white-collar, middle-management jobs were eliminated in 1991–1996. Most of these people had at least some college education. Only 35 percent of these people were able to find new jobs that paid as well.

   There is also evidence that automation creates more jobs than it destroys. The total number of manufacturing jobs in the world is increasing, not decreasing. Two studies commissioned by the International Labor Office concluded that automation does not result in job losses. Total information-technology-related employment in California increased between 1990 and 2002.

3. The work week hasn't gotten shorter because the increase in productivity has been used to improve the average standard of living. Another reason is that people are aware that layoffs have happened and can happen again. This knowledge is a strong incentive for people to work harder so they won't be part of the next layoff.

4. Information technology can lead to changes in the structure of an organization by opening up new communication paths. Access to information can lead to a decentralization of decision-making.

5. Telework can improve the environment by reducing pollution caused by automobiles driven by commuters.

6. Teleworkers fret about being less visible, because they do not want to be forgotten when it's time for raises or promotions.

7. Proponents of globalization say it helps workers in developing countries in several ways. Globalization increases competition and lowers prices. That improves the purchasing power of everyone, raising the global standard of living. Globalization gives people in developing countries access to jobs. When they gain employment, their prosperity increases. Every example in the 20th century of a poor country becoming more prosperous has been

the result of that country producing goods for the world market, rather than trying for self-sufficiency. Prosperity reduces the chance of countries going to war.

Opponents of globalization say it hurts workers in developing countries by forcing them to compete with subsidized American agribusinesses. Mexican farmers who cannot compete with these prices are driven out of business. Most of them cannot find jobs in Mexico and end up immigrating to the United States.

8. Pippa Norris says the digital divide has two dimensions. The global divide refers to the disparity in Internet access between more industrialized nations and less industrialized nations. The social divide refers to the difference in access between the rich and poor within a particular country.

9. Mark Warschauer says the term "digital divide" promotes the idea that the difference between the "haves" and the "have nots" is simply a question of access. In reality, it also depends on the underlying social systems. Second, it implies that there is simple binary split, when in actuality it is more like a continuum. Third, it implies a lack of access will lead to a less advantaged position in society. But there is no simple causality. Each factor affects the other.

10. One reason why the percentage of low-income U.S. families sending children to four-year public colleges has dropped in the past three decades is that the cost of a college education has risen much more rapidly than the average family income.