Please answer the questions below as fully and completely as you can. Turn in your written answers in class during the next class meeting. As part of this exercise set, you must read the following.

- Ch 1, A Gift of Fire: Prologue, Skim 1.1-1.2, Read 1.3-1.4, Skim Appendix A

1. Besides catastrophic failures (e.g., when software causes physical injury to users), in what other ways can using software potentially harm users? List as many harms/damages as you can think of.

2. A famous philosopher once said “the most important thing is not life, but the good life” (that is, not just living an acceptable life, but an excellent and admirable life). Ethics is not just about avoiding harms, but also about doing good and making positive contributions to the world through your existence. What sorts of things can excellent software engineers contribute to the “good life”? Answer as fully and in as many ways as you are able.
3. Consider the following case study.

“Mike is a father of 3, and to save for their college educations, he has been working two jobs since his kids were born. His daughter Sarah has worked as hard as she can in high school to get high grades and SAT scores; as a result of her hard work she has been accepted to a prestigious Ivy-League college, and the deposit for her first year is due today. If the deposit goes unpaid, Sarah loses her spot in the freshman class. Mike paid the bill last week, but today he gets an email from the college admissions office saying that his payment was rejected for insufficient funds by his bank, and if he does not make the payment by the end of the day, Sarah will lose her place and be unable to attend in the Fall. Panicked, Mike calls the bank—he had more than enough money in his savings to cover the bill, so he cannot understand what has happened. The bank confirms that his account had plenty of funds the day before, but cannot tell him why the funds are gone now or why the payment was rejected. They tell him there must be some ‘software glitch’ involved and that they will open an investigation, but that it will take weeks to resolve. They will only restore the funds in his account once the investigation is completed and the cause found. Mike has no other way to get the money for the deposit on such short notice, and has to tell Sarah that he couldn’t cover the bill despite his earlier promise, and that she won’t be attending college in the Fall.”

What kinds of harm has Mike probably suffered as a result of this incident? What kinds of harm has Sarah probably suffered? (Make your answers as full as possible; identify as many kinds of harm done as you can think of.)

4. Could the problem with Mike’s account have been the result of an action (or a failure to perform an action) by a software engineer? List as many scenarios/explanations as you can. For each, state whether the action or failure to perform an action could have resulted from an ethical failure of the engineer.
5. Many elderly people have trouble remembering words, people’s names, and recent events. Imagine a memory-aid product. What features would it have? What technologies would you use if you were designing it? (Question 1.19)

6. When designing such a system, what must be considered in the design and development of the system to avoid potential harms to users? What types of harms could result in such a system?

7. Software systems are sometimes used in ways not originally intended by developers. In what other (unintended) ways might the memory-aid product be used? What potential harms might this result in? Should the designers of the system be held responsible for these harms?
8. Autonomous, self-driving cars are very close to becoming a reality. Laws allowing self-driving cars are quickly emerging, and many companies not only have developed the technology and prototypes, but there are even cars on the market that provide many self-driving features today. However, like many new technologies, all of the potential technological and social issues that could arise from self-driving cars are unknown. Do you think it is ethical, or see any potential ethical issues, in selling autonomous cars today, given that many of the issues that could arise are unknown? List as many potential ethical issues as you can and explain your thought process behind them.

9. Compare the situation of self-driving cars with other types of software. In particular, are there any potential ethical issues when it comes to producing and distributing novel software (or computing devices) that support completely new ways to do things or allow people to do things that were not possible before (even when the impacts are not fully known)? What, if anything, distinguishes self-driving cars from novel software approaches in terms of potential ethical issues?
10. Ideally, a patent on an invention can be used to protect the owner of the patent from other people/companies employing the invention in their products. Is it “ethical” to patent an invention without any intent to develop and sell a product based on it? Explain your answer.