**Fall 2019 CSCI Ethics Paper**

**Due: October 30, 2019 by 11:59PM**

This ethics paper will consider the fundamental problem of software availability and reliability. Most applications we write are viable with a low success rate. Health technology is a huge exception.

For example, the THERAC-25 (<https://en.wikipedia.org/wiki/Therac-25>) was a radiation therapy machine that, due to software errors, gave lethal doses of radiation to patients. One error was produced by:

1. The technician mistakenly typed "x" into the computer, which signified x-ray beam (high-radiation.)
2. Then immediately realizing the error, changed the "x" into an "e" for electron beam (low-radiation), and hit "enter".
3. Then the machine showed it was ready to start treatment.
4. This sequence occurred in less than 8 seconds
5. (BTW this particular sequence, in this time frame, was never tried in the original testing of the machine.)
6. The computer gave the signal of "beam ready", and the technician pressed "b" to deliver the beam to the patient.
7. But then the computer responded with an error message. Usually this message meant that the treatment had not been delivered.
8. So the technician repeated the process and delivered another beam to the patient. And yet again, an error message occurred.

After an investigation of the problem (<http://www.cs.umd.edu/class/spring2003/cmsc838p/Misc/therac.pdf> also directly available on github as therac.pdf) it was determined that the software at fault was developed by a single programmer. This single programmer focused on integrating the software with the hardware and spent little time on testing only the software piece (the system was tested as a whole.)

While many people may quickly conclude that it is solely the programmer's fault, this problem can be complex. In industry, software testing is a financial investment. A company must pay a team of people (programmers and others) to test their system. As the law of diminishing returns kick in, the cost of testing increases with the need of higher availability/reliability. Since companies must compete, they are tempted to reduce software testing in order to provide a lower cost product.

For the first part of your ethics paper, answer how do we determine how much testing is necessary? With regards to THERAC-25, if the system is too expensive (due to testing) then it would be unaccessible to certain individuals who cannot afford it. Is there a viable to reason to sell a less reliable life-threating system to potentially help more citizens? Or, is there another way to solve these issues? Would you use the machine?

Secondly, consider that most US states require a certification process for (non-software) engineers (<https://en.wikipedia.org/wiki/Regulation_and_licensure_in_engineering>.) This certification process helps ensure that the engineer can build a reliable product. Should a similar process be required for Software Engineers? Why/why not?

You are free to give *your* opinion on what you think is right or wrong regarding the way this technology has impacted society and the moral obligations of a computer professional. However, you must provide a balanced discussion of it utilizing other sources to create a logical argument for your opinion. Good sources include the **Bible**, ACM Code of Ethics and Professional Conduct, the IEEE Code of Ethics, and other sources from the library or respectable sites on the Internet. I am looking for your ability to create a logical argument including 3 or more sources in the confines of 2 pages, 12 pt font, double spaced.

Deuteronomy 22:8 When you build a new house, make a parapet around your roof so that you may not bring the guilt of bloodshed on your house if someone falls from the roof.

1 Corinthians 8:9 But take care that this right of yours does not somehow become a stumbling block to the weak

Matthew 5:13-16: You are the salt of the earth. But if the salt loses its saltiness, how can it be made salty again? It is no longer good for anything, except to be thrown out and trampled by men. You are the light of the world. A city on a hill cannot be hidden. Neither do people light a lamp and put it under a bowl. Instead they put it on its stand, and it gives light to everyone in the house. In the same way, let your light shine before men, that they may see your good deeds and praise your Father in heaven.

Luke 6:31: Do to others as you would have them do to you.

Ephesians 4: 29: Do not let any unwholesome talk come out of your mouths, but only what is helpful for building others up according to their needs, that it may benefit those who listen.

1 Corinthians 10: 23-24: “Everything is permissible” – but not everything is beneficial. “Everything is permissible” – but not everything is constructive. Nobody should seek his own good, but the good of others. (NIV)