Explore – Impact of Computing Innovations
Written Response Submission Template

Please see Assessment Overview and Performance Task Directions for Student for the task directions and recommended word counts.

Computational Artifact

2a)

The computational artifact I created represents quantum computing. Quantum computing is an emerging computing technology that uses qubits (quantum bits) instead of standard bits. While a traditional bit can only be in one of two states at any given time, qubits can be in multiple states simultaneously, a phenomena known as quantum superposition.[1, 2] And for each qubit you add to the system, the amount of data you can store increases exponentially, while also theoretically keeping the power needs below that of a traditional computer.[1]

Quantum computers are so powerful that a system specially designed by the D-Wave Corporation to solve a specific type of mathematical problem, optimization, could find an answer in mere seconds while a traditional computer could take upwards of ten thousand years. And therein lies the rub of Quantum computing – in taking computing power to a new level, it renders the security of traditional computers obsolete. 256-bit RSA encryption, today's standard for secure data transfer between computers, would fold like wet cardboard when subjected to a quantum computer. [3]

2b)

I created my computational artifact in GIMP. I started with a blank image with dimensions of 720x1280 pixels. Then I used the gradient tool to create the fading blue background of the artifact. I then added my two images [x] [y] to the artifact, followed by the text sections, which were added using the Text tool and adjusted for readability from a distance.

Computing Innovation

2c)

Since quantum computing has far-reaching repercussions in all areas of computing, there is plenty of benefit and surprisingly little harm. Encryption would become practically unbreakable if backed up by a quantum computer. Institutions like NASA would no longer require massive supercomputers to complete essential tasks like orbital calculations, instead using a quantum computer to quickly and efficiently chew through the math. AI research, particularly deep learning, would be greatly accelerated – a quantum computer would iterate far faster than a traditional computer, evolving the artificial neural network at a greatly increased pace. If quantum computing reaches the consumer level, the economy could be affected as well. If everyone has access to essentially unlimited computing power, anything could happen – a tech-savvy investor could create an AI to out-invest the competition, netting millions and affecting stock prices massively. Consumers could have computers that never need upgrading, destroying companies like Intel and Nvidia, which have traditionally relied on the upgrade cycle to turn over much larger profits than they would otherwise garner. New companies selling quantum computers to the masses would also destroy most competition, similar to how the Internet allowed companies that adopted early to profit massively, or how Internet shopping has overtaken smaller, local, brick-and-mortar bussinesses.

2d)

According to WIRED [1], quantum computers change the way data is handled by manipulating it in qubits instead of conventional bits. If you input, say, a mathematical formula into a quantum computer, that formula is converted into quantum bits. Quantum bits exist in a state of superposition, so until the final result of the formula is observed, each qubit can be in multiple states at once, as opposed to how a traditional bit can

only be *1* or *0*. And since each qubit added exponentially increases the amount of data a quantum computer can store and process.

Quantum computing would also be useful for analyzing and outputting analysis of big data, which can help as well as harm. Many large companies like Facebook use user data [2] for target advertisements, which can infringe on user privacy. On the other, more Orwellian, hand, government can use big data in conjunction with quantum computing to catch potential criminals before they commit a crime.

Quantum computing also creates worrisome problems in the area of computer security. Also according to WIRED [1], today's standard encryption, 256-bit RSA, would be easily cracked by a quantum computer. 256-bit RSA is used in everything from securing online credit card transactions to scrambling important government communications, and even just to send messages between friends. Since the average consumer probably won't have access to a quantum computer for the forseeable future, there won't be any way to re-secure the Internet and other networks.

References

2e)

1. Wired: Quantum Computing Explained
2. Wikipedia: Quantum Computing (sources checked for accuracy)

3. IBM: What is Quantum Computing

4. Image 1: https://dal.objectstorage.open.softlayer.com/v1/AUTH_46b30cbfa42a44d2b78b111e16898caf/WordPress/wp-content/uploads/2017/07/3bac/IBM-Infographic-Quantum-Computing3.jpg (from IBM)

5. https://cdn-images-1.medium.com/max/1600/1*pjDx_psU07k-1xaU2Sp10Q.png (from Wired)