AP Computer Science Principles

Explore Task

**2a. Computational Artifact**

**Provide information on your computing innovation and computational artifact.**

* Name the computing innovation that is represented by your computational artifact.
* Describe the computing innovation’s intended purpose and function.
* Describe how your computational artifact illustrates, represents or explains the computing innovation’s intended purpose, its function or its effect.

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

**2b. Computational Artifact**

**Describe your development process, explicitly identifying the computing tools and techniques you used to create your artifact. Your description must be detailed enough so that a person unfamiliar with those tools and techniques will understand your process.**

I created my computational artifact in GIMP – essentially Photoshop. 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.

**2c. Computing Innovation**

**Explain at least one beneficial effect and at least one harmful effect the computing innovation has had, or has the potential to have, on society, economy, or culture.**

Since quantum computing has far-reaching repercussions in all areas of computing, there is plenty of benefit 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.

However, quantum computers also have the potential to tank large parts of the economy. Much like how the Internet boom overturned old corporations and gave birth to new ones (such as Amazon), quantum computers would overturn companies like Intel that have traditionally relied on upgrade cycles to turn a reasonable profit. If quantum computing became consumer-level technology, the need to upgrade would be effectively eliminated. Intel would be overturned by whichever unknown future player jumps on the quantum bandwagon at just the right time.

**2d. Computing Innovation**

**Using specific details, describe:**

* The data your innovation uses.
* How the innovation consumes (as input), produces (as output), and/or transforms data.
* At least one data storage concern, data privacy concern, or data security concern directly related to the computing innovation.

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, it can take in and solve any problem far faster than any non-quantum computer ever can.

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 benevolent, hand, scientific studies could make use of quantum computers and big data to help them accelerate their analysis.

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.

**2e. References**

**Provide a list of at least three online or print sources used to create your computational artifact and/or support your responses to the prompts provided in this performance task.**

* At least two of the sources must have been created after the end of the previous academic year.
* For each online source, include the permanent URL. Identify the author, title, source, the date you retrieved the source, and, if possible, the date the reference was written or posted.
* For each print source, include the author, title of excerpt/article and magazine or book, page number(s), publisher, and date of publication.
* If you include an interview source, include the name of the person you interviewed, the date on which the interview occurred, and the person’s position in the field.

1. [Wired: Quantum Computing Explained](https://www.wired.co.uk/article/quantum-computing-explained) (https://www.wired.co.uk/article/quantum-computing-explained) By Abigail Beall and Matt Reynolds. Published 16 Feb 2018.

2. [Wikipedia: Quantum Computing (sources checked for accuracy)](https://en.wikipedia.org/wiki/Quantum_computing) (<https://en.wikipedia.org/wiki/Quantum_computing>) Author and publishing date unknown.

3. [IBM: What is Quantum Computing](https://www.research.ibm.com/ibm-q/learn/what-is-quantum-computing/) (<https://www.research.ibm.com/ibm-q/learn/what-is-quantum-computing/>) Author and publishing date unknown.

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