Unit 6 Lesson 1

Explore PT - Review the Task

Resources

Total score	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	*This document combines student sample, scoring guidelines and scoring commentary from: Explore PT Sample E*
Sample: A	**0**	**1**	**1**	**1**	**1**	**0**	**1**	**1**	

Computational Artifact

Your computational artifact must provide an illustration, representation, or explanation of the computing innovation's intended purpose, its function, or its effect. The computational artifact must not simply repeat the information supplied in the written responses and should be primarily non-textual.

Student Response	Scoring Guidelines	
	Row and Task	**Decision Rules**
Value Explore Sample E 1 of 1	**Row 1 Computational Artifact** The computational artifact: • Identifies the computing innovation. **AND** • Provides an illustration, representation, or explanation of the computing innovation's intended purpose, function, or effect.	The written response can be used to aid the understanding of how the computational artifact illustrates, represents, or explains the computing innovation's intended purpose, function, or effect. **Do NOT award a point if any one of the following is true:** ● there is no artifact; ● the artifact is not a computational artifact; ● the innovation identified in the artifact does not match the innovation described in the written response; ● the artifact does not identify the innovation clearly; ● the artifact does not illustrate, represent or explain the innovation's intended purpose, function, or effect; ● the artifact illustrates a feature of the innovation instead of the purpose, function, or effect; or ● the computational artifact doesn't clearly illustrate, represent, or explain as required in the scoring criteria **AND** the written response describes the innovation's intended purpose and function without explaining how the computational artifact illustrates, represents, or explains the intended purpose, function, or effect..

	The response DID NOT earn a point for this row. The artifact does not provide an illustration, representation, or explanation of the computing innovation's intended purpose, function, or effect.

Computational Artifact

2a. 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.

(Must not exceed 100 words)

Student Response	Scoring Guidelines	
	Row and Task	**Decision Rules**
Bitcoin is a digital currency that has become highly popular among investors and traders alike. Bitcoins are mined in a series of block chains that include generating hashes to open hatches in order to open a Bitcoin block which gives a reward of a predetermined amount of Bitcoins [4]. The creator's intended purpose of creating the virtual currency, known as Bitcoin, was to make an international currency that is accepted anywhere in the world without language barriers, currency barriers, or exchange rate [4].	**Row 2 - Response 2A** States a fact about the correctly identified computing innovation's intended purpose OR function.	**Do NOT award a point if**: ● the identified innovation is not a computing innovation; or ● the written statement gives an effect (which is required for the scoring criteria in Row 3, not Row 2).
	The response earned a point for this row. The response states a fact about the computing innovation: "Bitcoin is a digital currency that has become highly popular among investors and traders alike."	

2b. 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.
(Must not exceed 100 words)

Student Response	Scoring Guidelines	
	Row and Task	**Decision Rules**
Through a few hours of research and asking around, I could gather enough information about Bitcoins in the real world. A common misconception about Bitcoins is that many people	--	---

<table>
<tr>
<td>cannot wrap their heads around the idea of a virtual currency that society agrees upon to be worth more or less currency [1]. I used YouTube as a resource while fact checking the information that was provided through videos. I also used and fact checked Wikipedia in order to come to a definition and history of the currency. I then created a PowerPoint with all of the new information I had gathered.</td>
<td>**NOTE: This response is not officially scored,** but you can use this section to cite any sources used in the creation of your computational artifact. This section may also be referenced if there is any suspicion of plagiarism. Do not skip!
● All images, diagrams, or information that appears in your computational artifact and that you yourself did not make should appear both in your citations and within this response.
● Also, by briefly describing the tool used to make the artifact and how you went about it can further help verify that you are the author of your artifact and did not merely submit someone else's work.</td>
</tr>
</table>

Computing Innovation

2c. 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.

(Must not exceed 250 words)

Student Response	Scoring Guidelines	
One benefit of Bitcoin is that it can be used internationally and, with its recent popularity, can be used in many online retailers [2]. This is a fantastic trait for currency to have because of the many language barriers across the world and with all of the exchange rates including currency barriers in each and every country [3]. <mark>Economically this makes investors have another way to invest besides in the stock market.</mark> Drawing similarities to the stock market, Bitcoin has had exponential grown in the past month growing almost to $20,000 USD [4]. This has many people predicting the crash of the stock market along with the crash of the Bitcoin's acclaimed cost. This is a major downfall and defect of the system because as the price goes up, so does the difficulty of mining Bitcoins. With there only being a limited amount of Bitcoins in the market, this is cause for exponential price increases [1]. Another harmful effect of Bitcoin is that there are other more affordable legitimate virtual currencies within the marketplace now [1]. This is making Bitcoin look overpriced, although the other virtual currencies	**Row and Task**	**Decision Rules**
	Row 3 - Response 2C Identifies at least ONE effect of the identified or described computing innovation.	The effect does not need to be specifically identified as beneficial or harmful. The effect must be identified, but it doesn't have to be described to earn the point. **Do NOT award a point if any one of the following is true:** ● the described innovation is not a computing innovation; or ● the identified effect is actually a purpose for using the computing innovation (e.g., allows me to make videos to share with my family); or ● the identified effect is actually a function or use of the computing innovation (e.g., self-driving cars can drive me to work); or ● the identified effect is not a result of the use of the innovation as intended (e.g., a self-driving car is not intended to crash, therefore, its exposure to hacking is not an effect of its intended use).
	The response earned a point for this row. The response identifies an effect of the innovation as it <mark>"makes investors have another way to invest besides in the stock market,"</mark> because it can be used internationally and doesn't have a language or exchange rate barriers.	
	Row 4 - Response 2C	Responses that earn this point will also earn the point for Row 3. Responses should be evaluated on the rationale provided in the

| aren't as widely accepted as Bitcoin. Bitcoin's harmful effect to the investment market and stock market may cause a crash because of how fast the price has grown and how many investors have joined the cause [4]. <mark>If Bitcoin's value were to crash, there would be a large crisis among investors and it could lead to the stock market crashing along with it</mark> [1]. | ● Identifies a beneficial effect of the identified or described computing innovation.

AND

● Identifies a harmful effect of the identified or described computing innovation. | response not on the interpretation or inference on the part of the scorer.

Do NOT award a point if any one of the following is true:
  ● the described innovation is not a computing innovation; or
  ● the response is missing the adjectives harmful or beneficial (or synonyms thereof); or
  ● the response is missing a plausible beneficial effect; or
  ● the response is missing a plausible harmful effect; or
  ● the identified effect is actually a purpose for using the computing innovation (e.g., allows me to make videos to share with my family); or
  ● the identified effect is actually a function or use of the computing innovation (e.g., self-driving cars can drive me to work); or
  ● the identified effect is not a result of the use of the innovation as intended (e.g., a self-driving car is not intended to crash, therefore, its exposure to hacking is not an effect of its intended use). |

The response earned a point for this row. The response identifies a beneficial effect of the innovation as, <mark>"makes investors have another way to invest besides in the stock market,"</mark> because it can be used internationally and doesn't have a language or exchange rate barriers. The response identifies a harmful effect of the innovation as <mark>"if Bitcoin's value were to crash, there would be a large crisis among investors and it could lead to the stock market crashing along with it."</mark>

Row 5 - Response 2C Explains how ONE of the identified effects relates to society, economy, or culture.	Responses that earn the point for this row must have earned the point for Row 3. Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer. **Do NOT award a point if any one of the following is true:** ● the described innovation is not a computing innovation; or ● the explanation does not connect one of the effects to society, economy, or culture

The response earned a point for this row. The response connects the beneficial effect: <mark>"Economically this makes investors have another way to invest besides in the stock market."</mark>

2d. Using specific details, describe:
- the data your innovation uses;
- how the innovation consumes (as input), produces (as output), and/or transforms data; and
- at least one data storage concern, data privacy concern, or data security concern directly related to the computing innovation.

(Must not exceed 250 words)

Student Response	Scoring Guidelines	
	Row and Task	**Decision Rules**
Bitcoin uses a hash generation system which leads users to unlock hatches. The hash is a randomly generated code that increases difficulty the more hatches that are opened. The user must generate this code before opening a hatch and receiving a reward in Bitcoin. The system of mining is a hard hobby to break into because of the difficulty of hashes now. The system puts out an output which is the randomly generated hash and the user must test many hashes before they ultimately guess the exact hash that the system created [4, 1]. A data privacy concern includes the user's names. There is a large ledger that is kept on an open server that can only be changed by transactions. A user makes an account and a username that will be seen on the transaction ledger. This ledger will include every transaction ever made with a Bitcoin. This ledger tracks every Bitcoin ever found and shows which users are in possession of them. The ledger also Explore Sample E 1 of 12 shows which user lost the Bitcoin and which user gained the Bitcoin in the transaction. The ledger is text but has a file size near 2 gigabytes [4]. The storage of this ledger is not a concern, nor is the security because of the level of encryption on the ledger itself. Privacy is an issue because there was a discovery of the federal government using Bitcoin to make transactions on the black market [4, 1]. The	**Row 6** **Response 2D** ● Identifies the data that the identified or described computing innovation uses AND ● Explains how that data is consumed, produced, OR transformed.	Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer. **Do NOT award a point if any one of the following is true:** ● the described innovation is not a computing innovation; or ● the response does not state the specific name of the data or simply says "data"; or ● the response confuses or conflates the innovation with the data: response fails to explain what happens to the data; or ● the response confuses the source of the data with the data.
	The response DID NOT earn the point for this row. The response does not identify the data and explain how that data is consumed, produced, or transformed. The response describes how Bitcoin functions rather than the data and its use of the data.	
	Row 7 **Response 2D** ● Identify one data storage, data privacy, OR ● data security concern related to the identified or described computing innovation.	Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer. Responses can earn this point even if they refer to the data in a general without specifically identifying the data being used. **Do NOT award a point if any one of the following is true**: ● the described innovation is not a computing innovation; or ● the response identifies or describes a concern that is not related to data
	The response earned a point for this row. The response raises a data privacy concern that username data is maintained on "a large ledger that is kept on an open server that can only be changed by transactions. A user makes an account and a username that will be seen on the transaction ledger. This ledger will include every transaction ever made with a Bitcoin."	

privacy of users rises an issue within the community.	

References

2e. Provide a list of at least three online or print sources used to create your computational artifact and/or support your responses through in-text citation 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 complete and 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.
- Include in-text citations for the sources you used.
- Each source must be relevant, credible, and easily accessed.

Student Response	Scoring Guidelines	
[1] "m0E TV," "Moe's Intro To Bitcoin And Cryptocurrency," "YouTube, CoinBase, BitConnect, Numivcoin, Steneum," 12/17/17, 12/2/17, https://www.youtube.com/watch?v=CijcNgLsCyg [2] "m0E TV," "Bitcoin Talk (Lending Platforms? Are They SCAMS?),", "YouTube, CoinBase, BitConnect, Numivcoin, Steneum," 12/17/17, 12/4/17, https://www.youtube.com/watch?v=- 9vsnq42vMM [3] "m0E TV," "How To Buy Bitcoin!" "YouTube, CoinBase, BitConnect, Numivcoin, Steneum," 12/17/17, 12/7/17, https://www.youtube.com/watch?v=FdgzdXh3_lg [4] "Wikipedia," "History of bitcoin," "Wikipedia, Satoshi Nakamoto," 12/17/17, 12/15/17, https://en.wikipedia.org/wiki/History_of_bitcoin WIKIPEDIA'S REFERENCES: References[edit] Jump up ^ Jerry Brito; Andrea Castillo (2013). "Bitcoin: A Primer for Policymakers" (PDF). Mercatus Center. George Mason University. Retrieved 22 October 2013.	**Row and Task**	**Decision Rules**
	Row 8 **Response 2E & Artifact** References, through in-text citation, at least 3 different sources.	The in-text citations can be in either the artifact or the written response. The in-text citations may be oral in the computational artifact. **Do NOT award a point if any one of the following is true**: ● the response contains a list of sources only, no in-text citations; ● the response contains less than three in-text citations; or ● there are not three in-text citations with corresponding references.
	The response earned the point for this row. The response contains three in-text citations that refer to references provided in the response. [1] Referenced in 2b, 2c, and 2d [2] Referenced in 2c	

Jump up ^ Chaum, David (1983). "Blind signatures for untraceable payments" (PDF). Advances in Cryptology Proceedings of Crypto. 82 (3): 199–203. doi:10.1007/978-1-4757-0602-4_18. Chaum, David; Fiat, Amos; Naor, Moni. "Untraceable Electronic Cash" (PDF). Lecture Notes in Computer Science. Jump up ^ Dai, W (1998). "b-money". Archived from the original on 2011-10-04. Retrieved 5 December 2013. Jump up ^ Szabo, Nick. "Bit Gold". Unenumerated. Blogspot. Archived from the original on 2011-09-22. Retrieved 5 December 2013. ^ Jump up to: a b Tsorsch, Florian; Scheuermann, Bjorn (15 May 2015). "Bitcoin and Beyond: A Technical Survey of Decentralized Digital Currencies" (PDF). Retrieved 24 June 2015. Jump up ^ "Reusable Proofs of Work". Archived from the original on December 22, 2007. ^ Jump up to: a b "Satoshi Nakamoto is (probably) Nick Szabo". LikeInAMirror. WordPress. Archived from the original on 2014-04-13. Retrieved 5 December 2013.	[3] Referenced in 2c [4] Referenced in 2a, 2c, and 2d
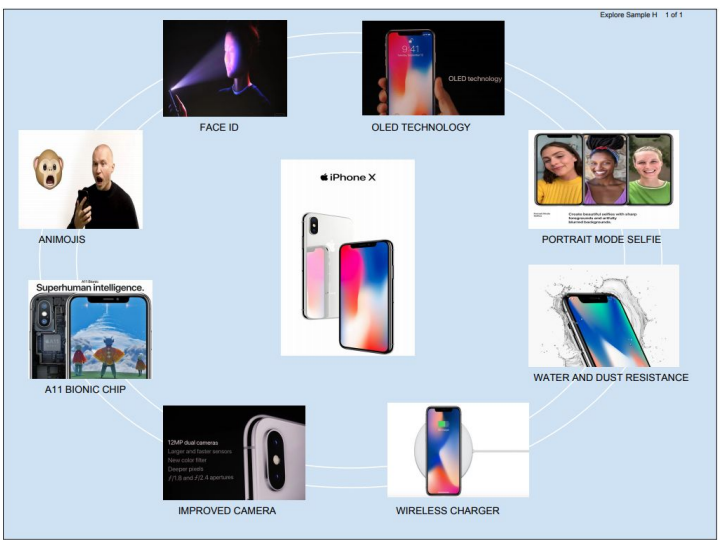
Explore PT Annotated Sample H - Score 4/8

Total score	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	*This document combines student sample, scoring guidelines and scoring commentary from: Explore PT Sample H*
Sample: A	**1**	**1**	**0**	**0**	**0**	**0**	**1**	**1**	

Computational Artifact

Your computational artifact must provide an illustration, representation, or explanation of the computing innovation's intended purpose, its function, or its effect. The computational artifact must not simply repeat the information supplied in the written responses and should be primarily non-textual.

Student Response	Scoring Guidelines	
	Row and Task	**Decision Rules**
	Row 1 Computational Artifact The computational artifact: • Identifies the computing innovation. **AND** • Provides an illustration, representation, or explanation of the computing innovation's intended purpose, function, or effect.	The written response can be used to aid the understanding of how the computational artifact illustrates, represents, or explains the computing innovation's intended purpose, function, or effect. **Do NOT award a point if any one of the following is true:** ● there is no artifact; ● the artifact is not a computational artifact; ● the innovation identified in the artifact does not match the innovation described in the written response; ● the artifact does not identify the innovation clearly; ● the artifact does not illustrate, represent or explain the innovation's intended purpose, function, or effect; ● the artifact illustrates a feature of the innovation instead of the purpose, function, or effect; or ● the computational artifact doesn't clearly illustrate, represent, or explain as required in the scoring criteria **AND** the written response describes the innovation's intended purpose and function without explaining how the computational artifact illustrates, represents, or explains the intended purpose, function, or effect..
	The response earned a point for this row. The computational artifact illustrates functions of the iPhoneX such as Animojis, Face Id, and portrait mode selfie.	

Computational Artifact

2a. 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.

(Must not exceed 100 words)

Student Response	Scoring Guidelines	
	Row and Task	**Decision Rules**
The computing innovation that is represented by my computational artifact is apple iphone x. Iphone x is the latest version of iphone with lots of new features. The purpose and function of iphone x is to make a improved technology with new features like the face ID, entirely screen, improved display, etc. The computational artifact illustrates the new features of iphone x such as the face ID, animojis, organic light emitting diode (OLED) technology, wireless charging, water and dust resistance, improved camera, A11 bionic chip (1), (25% faster performance and 75% faster efficiency) and portrait mode selfies with lighting effect.	**Row 2 - Response 2A** States a fact about the correctly identified computing innovation's intended purpose OR function.	**Do NOT award a point if**: ● the identified innovation is not a computing innovation; or ● the written statement gives an effect (which is required for the scoring criteria in Row 3, not Row 2).
	The response earned a point for this row. The response states that "The purpose and function of iPhone x is to make a improved technology with new features like the face ID, entirely screen, improved display, etc."	

2b. 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.
(Must not exceed 100 words)

Student Response	Scoring Guidelines	
	Row and Task	**Decision Rules**
The computing tool I used to create my artifact is google drawing. At first I searched on google for some pictures that could represent my topic. I got some pictures from google images that shows the new features of my computing innovation. I placed the images in google drawing, and I had to crop some of the images to make it more efficient. I created a circle shape artifact to make it more creative. I did this by	--	---
	NOTE: This response is not officially scored, but you can use this section to cite any sources used in the creation of your computational artifact. This section may also be referenced if there is any suspicion of plagiarism. Do not skip!	

first Explore Sample H 1 of 4 placing the images in a circle then placing the pictures on top of the circles and gave it a blue color square background and finally converted it to a PDF.	● All images, diagrams, or information that appears in your computational artifact and that you yourself did not make should appear both in your citations and within this response. ● Also, by briefly describing the tool used to make the artifact and how you went about it can further help verify that you are the author of your artifact and did not merely submit someone else's work.

Computing Innovation

2c. 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.
(Must not exceed 250 words)

Student Response	Scoring Guidelines	
One of the beneficial effect of iphone x is it's display. The iphone x has a Organic Light Emitting Diodes (OLED) display technology. It is much thinner, much lighter, fast response time, better viewing angle, better color accuracy, image contrast accuracy, and higher brightness (4). One of the harmful effect of iphone x is it's glass on the back and stainless steel frame which is very easy to scratch and break and repairing it is really expensive (2) . The glass back allow the phone to have wireless charging. Smartphone device insurer SquareTrade,Inc. Said in a youtube video, that it is the most breakable, highest priced, and most expensive to repair iphone ever. And they give a breakability score of 90 high risk (3).	**Row and Task**	**Decision Rules**
	Row 3 - Response 2C Identifies at least ONE effect of the identified or described computing innovation.	The effect does not need to be specifically identified as beneficial or harmful. The effect must be identified, but it doesn't have to be described to earn the point. **Do NOT award a point if any one of the following is true:** ● the described innovation is not a computing innovation; or ● the identified effect is actually a purpose for using the computing innovation (e.g., allows me to make videos to share with my family); or ● the identified effect is actually a function or use of the computing innovation (e.g., self-driving cars can drive me to work); or ● the identified effect is not a result of the use of the innovation as intended (e.g., a self-driving car is not intended to crash, therefore, its exposure to hacking is not an effect of its intended use).
	The response DID NOT earn the point for this row. All the identified effects are features of the iPhoneX. For example, the OLED display, and the glass back are features of the phone.	
	Row 4 - Response 2C ● Identifies a beneficial effect of the identified or described computing innovation.	Responses that earn this point will also earn the point for Row 3. Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer. **Do NOT award a point if any one of the following is true**: ● the described innovation is not a computing innovation; or

	AND ● Identifies a harmful effect of the identified or described computing innovation.	● the response is missing the adjectives harmful or beneficial (or synonyms thereof); or ● the response is missing a plausible beneficial effect; or ● the response is missing a plausible harmful effect; or ● the identified effect is actually a purpose for using the computing innovation (e.g., allows me to make videos to share with my family); or ● the identified effect is actually a function or use of the computing innovation (e.g., self-driving cars can drive me to work); or ● the identified effect is not a result of the use of the innovation as intended (e.g., a self-driving car is not intended to crash, therefore, its exposure to hacking is not an effect of its intended use).
	The response DID NOT earn a point for this row. While the response attempts to describe a beneficial and a harmful effect of the iPhoneX, the response identifies features of the phone, not effects of the phone.	
	Row 5 - Response 2C Explains how ONE of the identified effects relates to society, economy, or culture.	Responses that earn the point for this row must have earned the point for Row 3. Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer. **Do NOT award a point if any one of the following is true:** ● the described innovation is not a computing innovation; or ● the explanation does not connect one of the effects to society, economy, or culture
	The response DID NOT earn a point for this row. The response does not relate any of the effects to society, economy, or culture	

2d. Using specific details, describe:
- the data your innovation uses;
- how the innovation consumes (as input), produces (as output), and/or transforms data; and
- at least one data storage concern, data privacy concern, or data security concern directly related to the computing innovation.

(Must not exceed 250 words)

Student Response	Scoring Guidelines	
	Row and Task	**Decision Rules**
The data that iphone x use is mobile data. Iphone x consumes as input as that there is touch screen, apps, games, etc and produces as output as that it uses audio, voice, power, etc. The iphone x's uses lots of data for the new feature, face ID. The data from the infrared camera is sent to A11 chip to process, in which it compare the information about you on the phone(5). Apple has analyzed over a billion images for data about faces(5). One of the data storage concern is that the there is limited space to store files for example, pictures and videos have bigger size because of improved cameras, so it require more data to store. The face ID has some security concerns, someones can crack the Face ID with a composite mask of 3-D-printed plastic, silicone, makeup, and simple paper cutouts, which in combination trick an iPhone X into unlocking (6). So there is concern about the security of face ID on iphone x.	**Row 6** **Response 2D** ● Identifies the data that the identified or described computing innovation uses AND ● Explains how that data is consumed, produced, OR transformed.	Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer. **Do NOT award a point if any one of the following is true:** ● the described innovation is not a computing innovation; or ● the response does not state the specific name of the data or simply says "data"; or ● the response confuses or conflates the innovation with the data: response fails to explain what happens to the data; or ● the response confuses the source of the data with the data.
	The response DID NOT earn a point for this row. The input data is not identified. The response does mention audio and voice as output, which would be produced by the phone, not used by the phone	
	Row 7 **Response 2D** ● Identify one data storage, data privacy, OR ● data security concern related to the identified or described computing innovation.	Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer. Responses can earn this point even if they refer to the data in a general without specifically identifying the data being used. **Do NOT award a point if any one of the following is true**: ● the described innovation is not a computing innovation; or ● the response identifies or describes a concern that is not related to data
	The response earned a point for this row. A security concern is identified: "The face ID has some security concerns, someones [sic] can crack the Face ID with a composite mask of 3-D printed plastic, silicone, makeup, and simple paper cutouts, which in combination trick an iPhone X into unlocking"	

References
2e. Provide a list of at least three online or print sources used to create your computational artifact and/or support your responses through in-text citation 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 complete and 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.
- Include in-text citations for the sources you used.
- Each source must be relevant, credible, and easily accessed.

Student Response	Scoring Guidelines	
	Row and Task	**Decision Rules**
1.(https://www.fool.com/investing/2017/09/13/3-things-you-need-to-know-about-apples-a1 1-bionic.aspx), Ashraf Eassa, "3 Things You Need to Know About Apple's A11 Bionic Chip", September 13, 2017 *2. (https://www.cnet.com/news/apple-iphone-x-drop-test/), Vanessa Hand Orellana, "The iPhone X cracked on the first drop", November 4, 2017* *3. (https://www.youtube.com/watch?v=T_OT1FQSWuU&feature=youtu.be), SquareTrade,inc., "SquareTrade iphone x breakability", November 6, 2017* *4. (http://www.displaymate.com/iPhoneX_ShootOut_1a.htm), Dr. Raymond M. Soneira President, DisplayMate Technologies Corporation, "iPhone X OLED Display Technology Shoot-Out" 2017*	**Row 8** **Response 2E & Artifact** References, through in-text citation, at least 3 different sources.	The in-text citations can be in either the artifact or the written response. The in-text citations may be oral in the computational artifact. **Do NOT award a point if any one of the following is true**: ● the response contains a list of sources only, no in-text citations; ● the response contains less than three in-text citations; or ● there are not three in-text citations with corresponding references.
5. (https://www.computerworld.com/article/3224569/apple-ios/iphone-x-and-face-id-everyt hing-you-need-to-know.html), Jonny Evans, Computerworld, "iPhone X & Face ID: Everything you need to know", SEP 13, 2017 *6. (https://www.wired.com/story/hackers-say-broke-face-id-security/), Andy Greenberg, "Hackers say they've broken face ID a week after iphone x release", November 12, 2017*	**The response earned a point for this row.** Three references and three in-text citations are included. [1] Referenced in 2a [2] Referenced in 2c [3] Referenced in 2c [4] Referenced in 2c [5] Referenced in 2d [6] Referenced in 2d	

C O D E

Total score	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	*This document combines student sample, scoring guidelines and scoring commentary from: Explore PT Sample J*
Sample: A	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	

Computational Artifact

Your computational artifact must provide an illustration, representation, or explanation of the computing innovation's intended purpose, its function, or its effect. The computational artifact must not simply repeat the information supplied in the written responses and should be primarily non-textual.

Student Response	Scoring Guidelines	
	Row and Task	**Decision Rules**
Explore Sample J 1 of 1 Carrier Parent — Carrier Parent Genetic disorders are passed on through DNA. Affected Child The knowledge of the human genome would allow scientists to directly alter the affected genes and eliminate genetic disorders. The big data of genomics was once too vast to be acquired entirely. Now, the human genome can be completely sequenced with new sequencing technologies that handle big data and can be used to pinpoint exactly which genes are affected. Small head, Low nasal bridge, Epicanthal folds, Small eye openings, Flat midface, Short nose, Smooth philtrum, Thin upper lip, Underdeveloped jaw ✳ADAM Some examples of genetic disorders that can be prevented and/or cured in the future with the help of genetic sequencing	**Row 1 Computational Artifact** The computational artifact: • Identifies the computing innovation. **AND** • Provides an illustration, representation, or explanation of the computing innovation's intended purpose, function, or effect.	The written response can be used to aid the understanding of how the computational artifact illustrates, represents, or explains the computing innovation's intended purpose, function, or effect. **Do NOT award a point if any one of the following is true:** ● there is no artifact; ● the artifact is not a computational artifact; ● the innovation identified in the artifact does not match the innovation described in the written response; ● the artifact does not identify the innovation clearly; ● the artifact does not illustrate, represent or explain the innovation's intended purpose, function, or effect; ● the artifact illustrates a feature of the innovation instead of the purpose, function, or effect; or ● the computational artifact doesn't clearly illustrate, represent, or explain as required in the scoring criteria **AND** the written response describes the innovation's intended purpose and function without explaining how the computational artifact illustrates, represents, or explains the intended purpose, function, or effect..
	The response earned a point for this row. The artifact provides an illustration of the purpose for Human Genome Sequencing. Even though computing is involved in order to	

	complete Human Genome Sequencing, it is not considered a computing innovation. The response can earn this row even though it isn't a computing innovation.

Computational Artifact

2a. 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.

(Must not exceed 100 words)

Student Response	Scoring Guidelines	
	Row and Task	**Decision Rules**
My computational artifact represents the benefits of human genome sequencing. The human genome project uses highly distributed data acquisition and is in the process of converting to single-molecule sequencing technologies with much longer reads to handle the astronomical growth of the genomic big data. Once the human genome can be completely sequenced, we would be one step closer to preventing and curing genetic disorders[1], which is what is depicted by my artifact.	**Row 2 - Response 2A** States a fact about the correctly identified computing innovation's intended purpose OR function.	**Do NOT award a point if**: • the identified innovation is not a computing innovation; or • the written statement gives an effect (which is required for the scoring criteria in Row 3, not Row 2).
	The response DID NOT earn a point for this row. Even though in order to complete Human Genome Sequencing, computing is involved, it is not considered a computing innovation.	

2b. 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.
(Must not exceed 100 words)

Student Response	Scoring Guidelines	
	Row and Task	**Decision Rules**
To create my computational artifact, I used Microsoft Word. First, I used the clipart on Microsoft Word to find and arrange 3 people outlines with two on top and one below. Second, I used Google to find a website that contained pictures of	--	---

genetic disorders and copied and pasted the images below the lower person outline. I then inserted arrows from Microsoft Word to show the direction of gene flow[1]. I also inserted text boxes to explain how genome sequencing can affect this gene flow.	**NOTE: This response is not officially scored,** but you can use this section to cite any sources used in the creation of your computational artifact. This section may also be referenced if there is any suspicion of plagiarism. Do not skip! ● All images, diagrams, or information that appears in your computational artifact and that you yourself did not make should appear both in your citations and within this response. ● Also, by briefly describing the tool used to make the artifact and how you went about it can further help verify that you are the author of your artifact and did not merely submit someone else's work.

Computing Innovation

2c. 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.

(Must not exceed 250 words)

Student Response	Scoring Guidelines	
This computing innovation would benefit the medical field. Complete human genome sequencing would make pinpointing specific genes that cause disorders more efficient as well as more accurate. If we know the cause, finding the solution will come soon after. It would take us one step closer to altering specific genes to not only eliminate genetic disorders but also to make people healthier, smarter, and more attractive. Physical limitations would lift and humans would achieve better in their ideal bodies. One negative consequence is the possibility of data misuse[2]. If all of our genetic information is recorded, there is no guaranteeing that the information would remain private. It could perhaps affect employment and insurance rates in the future if a person's genes are flawed and the wrong people get a hold of the private information. In many ways, genetic information is much more explicit than social security numbers. Releasing such information to others is obviously risky.	**Row and Task**	**Decision Rules**
	Row 3 - Response 2C Identifies at least ONE effect of the identified or described computing innovation.	The effect does not need to be specifically identified as beneficial or harmful. The effect must be identified, but it doesn't have to be described to earn the point. **Do NOT award a point if any one of the following is true:** ● the described innovation is not a computing innovation; or ● the identified effect is actually a purpose for using the computing innovation (e.g., allows me to make videos to share with my family); or ● the identified effect is actually a function or use of the computing innovation (e.g., self-driving cars can drive me to work); or ● the identified effect is not a result of the use of the innovation as intended (e.g., a self-driving car is not intended to crash, therefore, its exposure to hacking is not an effect of its intended use).
	The response DID NOT earn the point for this row. The described innovation connected to the effect is not a computing innovation.	
	Row 4 - Response 2C ● Identifies a beneficial	Responses that earn this point will also earn the point for Row 3. Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer.

	effect of the identified or described computing innovation. AND ● Identifies a harmful effect of the identified or described computing innovation.	**Do NOT award a point if any one of the following is true**: ● the described innovation is not a computing innovation; or ● the response is missing the adjectives harmful or beneficial (or synonyms thereof); or ● the response is missing a plausible beneficial effect; or ● the response is missing a plausible harmful effect; or ● the identified effect is actually a purpose for using the computing innovation (e.g., allows me to make videos to share with my family); or ● the identified effect is actually a function or use of the computing innovation (e.g., self-driving cars can drive me to work); or ● the identified effect is not a result of the use of the innovation as intended (e.g., a self-driving car is not intended to crash, therefore, its exposure to hacking is not an effect of its intended use).
		The response DID NOT earn a point for this row. The described innovation connected to the effect is not a computing innovation.
	Row 5 - Response 2C Explains how ONE of the identified effects relates to society, economy, or culture.	Responses that earn the point for this row must have earned the point for Row 3. Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer. **Do NOT award a point if any one of the following is true:** ● the described innovation is not a computing innovation; or ● the explanation does not connect one of the effects to society, economy, or culture
		The response DID NOT earn a point for this row. The described innovation connected to the effect is not a computing innovation.

2d. Using specific details, describe:
- the data your innovation uses;
- how the innovation consumes (as input), produces (as output), and/or transforms data; and
- at least one data storage concern, data privacy concern, or data security concern directly related to the computing innovation.

(Must not exceed 250 words)

Student Response	Scoring Guidelines	
The Human Genome Project uses approximately 1 zetta-base per year. The innovation acquires data from highly distributed sources such as universities, hospitals, and research laboratories. There are currently more than 2,500 sequencing instruments made by different manufacturers that are distributed throughout different nations.The resulting big data is distributed in units as a few genetic comparisons or gene sequences or as bulk downloads from from central repositories. To reduce the computing resources necessary for large-scale analysis of the data, cloud computing is used so that only small sections of code are uploaded and highly processed data are downloaded. The data for genomics is enormous, and it's estimated that up to 40 exabytes will be needed by 2050. Efficient data compression is one solution but decompression time is also a concern. The data is medically sensitive information and must be carefully guarded. Homomorphic encryption can be used to allow only certain groups to view the data, but it is currently too expensive[2].	**Row and Task**	**Decision Rules**
	Row 6 **Response 2D** ● Identifies the data that the identified or described computing innovation uses AND ● Explains how that data is consumed, produced, OR transformed.	Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer. **Do NOT award a point if any one of the following is true:** ● the described innovation is not a computing innovation; or ● the response does not state the specific name of the data or simply says "data"; or ● the response confuses or conflates the innovation with the data: response fails to explain what happens to the data; or ● the response confuses the source of the data with the data.
	The response DID NOT earn a point for this row. It is unclear whether the data that has been identified is connected to a computing innovation.	
	Row 7 **Response 2D** ● Identify one data storage, data privacy, OR ● data security concern related to the identified or described computing innovation.	Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer. Responses can earn this point even if they refer to the data in a general without specifically identifying the data being used. **Do NOT award a point if any one of the following is true**: ● the described innovation is not a computing innovation; or ● the response identifies or describes a concern that is not related to data
	The response DID NOT earn a point for this row. Even though cloud computing is a computing innovation and mentioned in this prompt, it is unclear how this is connected to the data storage concerns.	

References
2e. Provide a list of at least three online or print sources used to create your computational artifact and/or support your responses through in-text citation 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 complete and 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.
- Include in-text citations for the sources you used.
- Each source must be relevant, credible, and easily accessed.

Student Response	Scoring Guidelines	
1. *"FAQ About Genetic Disorders." Genome.gov, National Human Genome Research Institute (NHGRI), 10 Nov. 2015, www.genome.gov/19016930/faq-about-genetic-disorders/.* 2. *Stephens, Zachary D., et al. PLoS Biology, Public Library of Science, 7 July 2015, www.ncbi.nlm.nih.gov/pmc/articles/PMC4494865/.* 3. *"Top 10 Most Common Genetic Disorders." PositiveMed, PositiveMed, 31 Dec. 2017, positivemed.com/2014/03/24/10-common-genetic-disorders/.*	**Row and Task**	**Decision Rules**
	Row 8 **Response 2E & Artifact** References, through in-text citation, at least 3 different sources.	The in-text citations can be in either the artifact or the written response. The in-text citations may be oral in the computational artifact. **Do NOT award a point if any one of the following is true**: ● the response contains a list of sources only, no in-text citations; ● the response contains less than three in-text citations; or ● there are not three in-text citations with corresponding references.
	The response DID NOT earn a point for this row. While there are three references, there are only two in-text citations. [1] Referenced in 2a and 2b [2] Referenced in 2c and 2d [3] Not referenced	

Explore PT Annotated Sample A - Score 8/8

Total score	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	*This document combines student sample, scoring guidelines and scoring commentary from: Explore PT Sample A*
Sample: A	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	

Computational Artifact
Your computational artifact must provide an illustration, representation, or explanation of the computing innovation's intended purpose, its function, or its effect. The computational artifact must not simply repeat the information supplied in the written responses and should be primarily non-textual.

Student Response	Scoring Guidelines	
	Row and Task	**Decision Rules**
	Row 1 Computational Artifact The computational artifact: • Identifies the computing innovation. **AND** • Provides an illustration, representation, or explanation of the computing innovation's intended purpose, function, or effect.	The written response can be used to aid the understanding of how the computational artifact illustrates, represents, or explains the computing innovation's intended purpose, function, or effect. **Do NOT award a point if any one of the following is true:** ● there is no artifact; ● the artifact is not a computational artifact; ● the innovation identified in the artifact does not match the innovation described in the written response; ● the artifact does not identify the innovation clearly; ● the artifact does not illustrate, represent or explain the innovation's intended purpose, function, or effect; ● the artifact illustrates a feature of the innovation instead of the purpose, function, or effect; or ● the computational artifact doesn't clearly illustrate, represent, or explain as required in the scoring criteria **AND** the written response describes the innovation's intended purpose and function without explaining how the computational artifact illustrates, represents, or explains the intended purpose, function, or effect..

	The response earned a point for this row. The computational artifact identifies a computing innovation, blockchain, and illustrates a function of blockchain: "verify your transaction and add the data to a digital ledger."

Computational Artifact

2a. 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.

(Must not exceed 100 words)

Student Response	Scoring Guidelines	
	Row and Task	**Decision Rules**
My innovation is Blockchain, which is designed to create a framework for online transactions that is more secure (Rosic). Blockchain functions as a series of computers, called nodes. When one computer requests a transaction, each computer independently verifies the authenticity of the request, using certain algorithms. Then, once all of the nodes verify the request's identity, the data about the request is added to a computerized ledger, creating another "block" in the "chain." (Rosic) My artifact provides an illustration for each step of the process of how Blockchain works. It also allows the reader to see the amount of data blockchain uses).	**Row 2 - Response 2A** States a fact about the correctly identified computing innovation's intended purpose OR function.	**Do NOT award a point if**: - the identified innovation is not a computing innovation; or - the written statement gives an effect (which is required for the scoring criteria in Row 3, not Row 2).
	The response earned a point for this row. The response states that "blockchain functions as a series of computers, called nodes."	

2b. 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.
(Must not exceed 100 words)

Student Response	Scoring Guidelines	
	Row and Task	**Decision Rules**
I used Google Slides to create my artifact. I gathered relevant images with an online search. I then made captions to explain my images, and made a flowchart with the steps of how Blockchain works. I included extra images to show where the data is stored. This is a new artifact, as I gathered images and wrote the explanations myself. Bhaskar, Raghav "Securing the Future of Cryptocurrency" Appspicket, July 27, 2017,	--	---
	NOTE: This response is not officially scored, but you can use this section to cite any sources used in the creation of your computational artifact. This section may also be referenced if there is any suspicion of plagiarism. Do not skip! - All images, diagrams, or information that appears in your computational artifact	

https://appspicket.com/private-key-security-cryptocurrency/ 12/13/17 Frisby, Dominic. "Entrepreneurs Move in on Bitcoin as Blockchain Makes its Mark" Virgin, October 7, 2014 https://www.virgin.com/entrepreneur/entrepreneurs-move-bitcoin-blockchain-makes-its -mark 12/13/17	and that you yourself did not make should appear both in your citations and within this response. ● Also, by briefly describing the tool used to make the artifact and how you went about it can further help verify that you are the author of your artifact and did not merely submit someone else's work.

Computing Innovation

2c. 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.

(Must not exceed 250 words)

Student Response	Scoring Guidelines	
A beneficial effect is that blockchain will save money on financial services infrastructure- since it's distributed, it is safer by design- and this security will allow the financial sector to decommission expensive systems that are currently used to secure transactions. It would reduce the amount of human resources that are necessary to audit and check the validity of transaction requests, and put that duty into the hands of the computer software. (di Gregorio). Banks and financial security companies would save a lot of money and time that would otherwise be spent training and paying human employees. This has an impact on the economy, because banks save a lot of money in transaction security. This creates more confidence in the US economy as a whole, as stock values for the major banks rise. A harmful effect is that blockchain technology uses a lot of energy. When the computers check with each other to see if they "agree," their verification process is more complex than any other. Going through the process uses a lot of computing power, and consequently, electricity. (Fairley). Everyone in the country is impacted,	**Row and Task**	**Decision Rules**
	Row 3 - Response 2C Identifies at least ONE effect of the identified or described computing innovation.	The effect does not need to be specifically identified as beneficial or harmful. The effect must be identified, but it doesn't have to be described to earn the point. **Do NOT award a point if any one of the following is true:** ● the described innovation is not a computing innovation; or ● the identified effect is actually a purpose for using the computing innovation (e.g., allows me to make videos to share with my family); or ● the identified effect is actually a function or use of the computing innovation (e.g., self-driving cars can drive me to work); or ● the identified effect is not a result of the use of the innovation as intended (e.g., a self-driving car is not intended to crash, therefore, its exposure to hacking is not an effect of its intended use).
	The response earned a point for this row. The response gives the effect: "blockchain will save money on financial services infrastructure ... to decommission expensive systems that are currently used to secure transactions."	
	Row 4 - Response 2C ● Identifies a beneficial effect of the identified or described computing innovation.	Responses that earn this point will also earn the point for Row 3. Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer. **Do NOT award a point if any one of the following is true**: ● the described innovation is not a computing innovation; or

because we all use energy, and soon, we may all be using the blockchain. Society itself, namely the environment, is harmed. If a growing technology uses more energy, we are forced to burn more resources to create electricity. With the growing issue of climate change, this is an issue for all of humankind.	AND ● Identifies a harmful effect of the identified or described computing innovation.	● the response is missing the adjectives harmful or beneficial (or synonyms thereof); or ● the response is missing a plausible beneficial effect; or ● the response is missing a plausible harmful effect; or ● the identified effect is actually a purpose for using the computing innovation (e.g., allows me to make videos to share with my family); or ● the identified effect is actually a function or use of the computing innovation (e.g., self-driving cars can drive me to work); or ● the identified effect is not a result of the use of the innovation as intended (e.g., a self-driving car is not intended to crash, therefore, its exposure to hacking is not an effect of its intended use).
	The response earned a point for this row. The response gives the beneficial effect: "blockchain will save money on financial services infrastructure ... to decommission expensive systems that are currently used to secure transactions." The response gives the harmful effect that because blockchain uses a significant amount of energy, "Society itself, namely the environment, is harmed. If a growing technology uses more energy, we are forced to burn more resources to create electricity."	
	Row 5 - Response 2C Explains how ONE of the identified effects relates to society, economy, or culture.	Responses that earn the point for this row must have earned the point for Row 3. Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer. **Do NOT award a point if any one of the following is true:** ● the described innovation is not a computing innovation; or ● the explanation does not connect one of the effects to society, economy, or culture
	The response earned a point for this row. The response explains how the harmful effect relates to society: "Society itself, namely the environment, is harmed. If a growing technology uses more energy, we are forced to burn more resources to create electricity."	

2d. Using specific details, describe:
- the data your innovation uses;
- how the innovation consumes (as input), produces (as output), and/or transforms data; and
- at least one data storage concern, data privacy concern, or data security concern directly related to the computing innovation.

(Must not exceed 250 words)

Student Response	Scoring Guidelines	
	Row and Task	**Decision Rules**
The system of blockchain operates with a distributed ledger. According to Coindesk, "a distributed ledger is a database held and updated independently by each participant (or node) in a large network." (Bauerle)The computers use metadata from transaction requests. Each block of data contains a pointer to the previous block, a timestamp, and transaction data. Then, this chain of blocks is held in the storage of each node. The data it produces is the blockchain itself, which is a stream of transaction data separated into blocks by set intervals of time. This data is kept in a ledger, which does not need to be verified by a central authority. (Siegel)	**Row 6** **Response 2D** ● Identifies the data that the identified or described computing innovation uses AND ● Explains how that data is consumed, produced, OR transformed.	Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer. **Do NOT award a point if any one of the following is true:** ● the described innovation is not a computing innovation; or ● the response does not state the specific name of the data or simply says "data"; or ● the response confuses or conflates the innovation with the data: response fails to explain what happens to the data; or ● the response confuses the source of the data with the data.
	The response earned a point for this row. The response identifies the data: "Each block of data contains a pointer to the previous block, a timestamp, and transaction data." It then states that "It computes by taking the data and runs it through algorithms to verify the identity of the request," which describes how the data is consumed.	
It computes by taking the data and runs it through algorithms to verify the identity of the request. "In the case of blockchain technology, private key cryptography provides a powerful ownership tool that fulfills authentication requirements. Possession of a private key is ownership." (Bauerle). So essentially, the blockchain computes by running transaction data through algorithms that verify private key ownership. A privacy concern is that "Bitcoin relies on a public blockchain, a system of recording transactions that allows anyone to read or write transactions. Anyone can aggregate	**Row 7** **Response 2D** ● Identify one data storage, data privacy, OR ● data security concern related to the identified or described computing innovation.	Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer. Responses can earn this point even if they refer to the data in a general without specifically identifying the data being used. **Do NOT award a point if any one of the following is true**: ● the described innovation is not a computing innovation; or ● the response identifies or describes a concern that is not related to data
	The response earned a point for this row. The response identifies the privacy concern: "Bitcoin relies on a public Blockchain, a system of recording transactions that allows anyone to read or write transactions."	

and publish those transactions, provided they can show that a sufficient amount of effort went into doing so." (Berke) This means that anyone who really wanted to could see transactions being made on the blockchain, and with a little effort and computing ability, they'd have access to transaction amounts, time, and other data.	

References
2e. Provide a list of at least three online or print sources used to create your computational artifact and/or support your responses through in-text citation 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 complete and 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.
- Include in-text citations for the sources you used.
- Each source must be relevant, credible, and easily accessed.

Student Response	Scoring Guidelines	
[1] Bhaskar, Raghav "Securing the Future of Cryptocurrency" Appspicket, July 27, 2017, https://appspicket.com/private-key-security-cryptocurrency/ 12/13/17 [2] Frisby, Dominic. "Entrepreneurs Move in on Bitcoin as Blockchain Makes its Mark" Virgin, October 7, 2014 https://www.virgin.com/entrepreneur/entrepreneurs-move-bitcoin-blockchain-makes-its -mark 12/13/17 [3] Rosic, Ameer. "What is Blockchain Technology." Blockgeeks, December 2016, https://blockgeeks.com/guides/what-is-blockchain-technology/ 12/13/17 [4] di Gregorio, Max. "Blockchain; a new tool to cut costs" PwC, February 2017	**Row and Task**	**Decision Rules**
	Row 8 **Response 2E & Artifact** References, through in-text citation, at least 3 different sources.	The in-text citations can be in either the artifact or the written response. The in-text citations may be oral in the computational artifact. **Do NOT award a point if any one of the following is true**: ● the response contains a list of sources only, no in-text citations; ● the response contains less than three in-text citations; or ● there are not three in-text citations with corresponding references.

https://www.pwc.com/m1/en/media-centre/articles/blockchain-new-tool-to-cut-costs.ht ml 12/13/17 [5] Fairley, Peter. "The Ridiculous Amount of Energy it Takes to Run Bitcoin" IEE Spectrum, September 28, 2017 https://spectrum.ieee.org/energy/policy/the-ridiculous-amount-of-energy-it-takes-to-run -bitcoin 12/13/17 [6] Bauerle, Nolan. "What is a Distributed Ledger?" Coindesk, March 9, 2017 https://www.coindesk.com/information/what-is-a-distributed-ledger/ 12/26/17 [7] Siegel, David. "Blockchain" Investopedia https://www.coindesk.com/information/what-is-a-distributed-ledger/ 12/26/17 [8] Berke, Alison. "How Safe are Blockchains? It depends." Harvard Business Review, March 7, 2017 https://hbr.org/2017/03/how-safe-are-blockchains-it-depends 12/26/17	**The response earned a point for this row.** The response contains three in-text citations that refer to references provided in the response. [1] Referenced in 2b [2] Referenced in 2b [3] Referenced in 2a [4] Referenced in 2c [5] Referenced in 2c [6] Referenced in 2d [7] Referenced in 2d [8] Referenced in 2d

Computational Artifact

Your computational artifact must provide an illustration, representation, or explanation of the computing innovation's intended purpose, its function, or its effect. The computational artifact must not simply repeat the information supplied in the written responses and should be primarily non-textual.

Computational Artifact
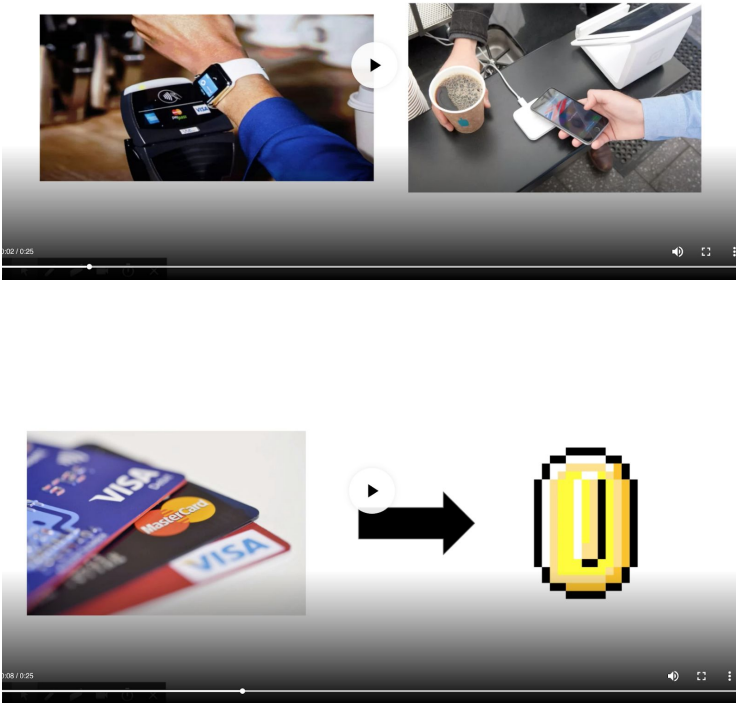
2a. Provide information on your computing innovation and computational artifact.
- Name the computing innovation that is represented by your computational artifact.
- Describe the computing innovation's intended purpose and function.
- Describe how your computational artifact illustrates, represents, or explains the computing innovation's intended purpose, its function, or its effect.

(Must not exceed 100 words)

Scoring Guidelines	
Row and Task	**Decision Rules**
Row 1 **Computational Artifact** The computational artifact: • Identifies the computing innovation. **AND** • Provides an illustration, representation, or explanation of the computing innovation's intended purpose, function, or effect.	The written response can be used to aid the understanding of how the computational artifact illustrates, represents, or explains the computing innovation's intended purpose, function, or effect. **Do NOT award a point if any one of the following is true:** ● there is no artifact; ● the artifact is not a computational artifact; ● the innovation identified in the artifact does not match the innovation described in the written response; ● the artifact does not identify the innovation clearly; ● the artifact does not illustrate, represent or explain the innovation's intended purpose, function, or effect; ● the artifact illustrates a feature of the innovation instead of the purpose, function, or effect; or ● the computational artifact doesn't clearly illustrate, represent, or explain as required in the scoring criteria **AND** the written response describes the innovation's intended purpose and function without explaining how the computational artifact illustrates, represents, or explains the intended purpose, function, or effect..
Row 2 **Response 2A** States a fact about the correctly identified computing innovation's intended purpose OR function.	**Do NOT award a point if**: ● the identified innovation is not a computing innovation; or ● the written statement gives an effect (which is required for the scoring criteria in Row 3, not Row 2).

Student Response A - [Artifact] [Written Response]	Scoring Guidelines	

	Row 1	1

My innovation is Blockchain, which is designed to create a framework for online transactions that is more secure (Rosic). Blockchain functions as a series of computers, called nodes. When one computer requests a transaction, each computer independently verifies the authenticity of the request, using certain algorithms. Then, once all of the nodes verify the request's identity, the data about the request is added to a computerized ledger, creating another "block" in the "chain." (Rosic) My artifact provides an illustration for each step of the process of how Blockchain works. It also allows the reader to see the amount of data blockchain uses).

The response earned a point for this row. The computational artifact identifies a computing innovation, blockchain, and illustrates a function of blockchain: "verify your transaction and add the data to a digital ledger."

Row 2	1

The response earned a point for this row. The response states that "blockchain functions as a series of computers, called nodes."

Student Response B - [Artifact] [Written Response]	Scoring Guidelines	

	Row 1	1

The computing innovation that I chose is virtual reality. This innovation has many different functions, depending on the design. Its intended purpose is to enhance or replace the world around you with a virtual one that can be modified. It can be used for things such as online shopping, gaming, and training. The computational artifact depicts an environment that is being filmed in virtual reality. It shows one of the many purposes of the innovation, allowing others to experience that environment without taking time to travel there. Also, the lower pictures illustrate how the innovation works and looks.

The response earned a point for this row. The artifact identifies the computing innovation as Virtual Reality and illustrates that the purpose is to enhance or replace the world around you with a virtual one that can be modified.

Row 2	1

The response earned a point for this row. The response states a correct fact: "It can be used for things such as online shopping, gaming, and training."

Student Response C - [Artifact] [Written Response]	Scoring Guidelines	
    ** *Video. Includes Audio Narration* The computing innovation represented by my computational artifact is Apple Pay. The purpose of this innovation is to allow users to make secure purchases with their phones. It achieves this by sending a Device Account Number over an encrypted NFC connection instead of using credit card information. My computational artifact illustrates and explains the purpose and function of Apple Pay by showing images of the intended purpose of Apple Pay and explaining how it is achieved.	**Row 1**	**1**
	The response earned a point for this row. The artifact provides an explanation of the computing innovation's intended function stating that "Apple Pay uses tokenization in which it creates a device account number for each card."	
	Row 2	**1**
	The response earned a point for this row. The response states a fact about the computing innovation: "allow users to make secure purchases with their phones."	

Student Response D - [Artifact] [Written Response]	Scoring Guidelines	
	Row 1	**1**
	The response earned a point for this row. The artifact identifies the computing innovation as Microsoft HoloLens and illustrates the purpose is to "produce a realistic 3D hologram that the user can interact with."	
	Row 2	**1**
	The response earned a point for this row. The response states a correct fact: "The intended purpose of the device is to produce holograms in the environment that the user is using and allow the user to see and interact with the hologram like a real-world object."	

** *Video. No narration.*

The computing innovation that is represented by the computational artifact is the Microsoft HoloLens. The intended purpose of the device is to produce holograms in the environment that the user is using and allow the user to see and interact with the hologram like a real-world object [2]. The computational artifact illustrates the purpose by showing the Microsoft HoloLens first scans the user's environment by using its cameras and sensors, then the device will produce a realistic 3D hologram that the user can interact with.
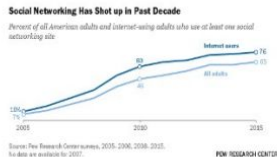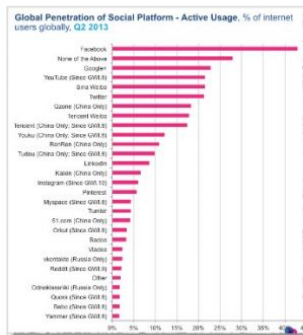
Student Response E - [Artifact] [Written Response]	Scoring Guidelines
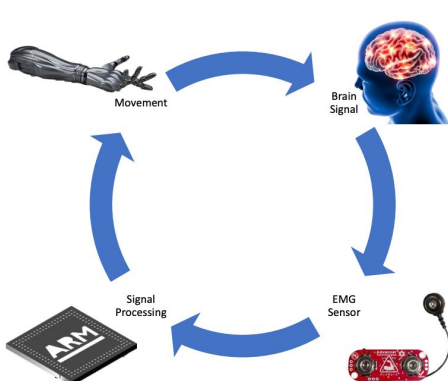
Scoring Guidelines	
Row 1	**0**
The response DID NOT earn a point for this row. The artifact does not provide an illustration, representation, or explanation of the computing innovation's intended purpose, function, or effect.	
Row 2	**1**
The response earned a point for this row. The response states a fact about the computing innovation: "Bitcoin is a digital currency that has become highly popular among investors and traders alike."	

Bitcoin is a digital currency that has become highly popular among investors and traders alike. Bitcoins are mined in a series of block chains that include generating hashes to open hatches in order to open a Bitcoin block which gives a reward of a predetermined amount of Bitcoins [4]. The creator's intended purpose of creating the virtual currency, known as Bitcoin, was to make an international currency that is accepted anywhere in the world without language barriers, currency barriers, or exchange rate [4].

Student Response F - [Artifact] [Written Response]	Scoring Guidelines	
Explore Sample F 1 of 1 Social Media, which is defined as websites and applications that enable users to create and share content or to participate in social networking (7), has become a highly discussed topic in this day and age. The intended purpose of social media is based on the core principle of the ability to share content with others. In the simplest case, social media can provide a highly personalized and relevant 'Table of Contents' by keeping up to date with current research, popular science and broader issues such as science policy, funding, publishing, or personal career development(1).	**Row 1**	**0**
	The response DID NOT earn a point for this row. The artifact does not provide an illustration, representation, or explanation of the computing innovation's intended purpose, function, or effect.	
	Row 2	**1**
	The response earned a point for this row. The response states a fact that the computing innovation "is defined as websites and applications that enable users to create and share content or to participate in social networking."	
Student Response G - [Artifact] [Written Response]	Scoring Guidelines	
Explore Sample G 1 of 1	**Row 1**	**1**
	The response earned a point for this row. The artifact identifies the computing innovation as Electromyographic (EMG) prosthetic limbs and illustrates the purpose is to provide those who are missing limbs with an opportunity to live a normal life.	
	Row 2	**1**
	The response earned a point for this row. The response states a correct function: "... EMG prosthesis unlocks the	

The computing innovation I chose to represent with my artifact submitted is Electromyographic (EMG) prosthetic limbs. EMG prosthesis is meant to provide those who are missing limbs an opportunity to live a normal life. Thanks to the technology's ability to sense brain signals, process them and actuate a prosthetic limb. My computational artifact shows the cycle of how this process takes place.

possibility for virtually natural motion and limited sensations for those missing limbs."

Student Response H - [Artifact] [Written Response]	Scoring Guidelines	
	Row 1	**1**
	The response earned a point for this row. The computational artifact illustrates functions of the iPhoneX such as Animojis, Face Id, and portrait mode selfie.	
	Row 2	**1**
The computing innovation that is represented by my computational artifact is apple iphone x. Iphone x is the latest version of iphone with lots of new features. The purpose and function of iphone x is to make a improved technology with new features like the face ID, entirely screen, improved display, etc. The computational artifact illustrates the new features of iphone x such as the face ID, animojis, organic light emitting diode (OLED) technology, wireless charging, water and dust resistance, improved camera, A11 bionic chip (1), (25% faster performance and 75% faster efficiency) and portrait mode selfies with lighting effect.	**The response earned a point for this row.** The response states that "The purpose and function of iPhone x is to make a improved technology with new features like the face ID, entirely screen, improved display, etc."	

Student Response I - [Artifact] [Written Response]	Scoring Guidelines	
	Row 1	**1**
	The response earned a point for this row. The artifact identifies the computing innovation as Apple Watch Series 3 and illustrates the purpose as allowing users to make calls, send text messages, and track their health.	
	Row 2	**1**
	The response earned a point for this row. The response states a correct fact; it tracks one's health.	

The Apple watch is to help people to not get in a car crash. 1.3 million people get a car crash every year. In a meeting or other places, people don't have to take out their phone and distant others. The computer artificial "your phone on your waist", you can do anything on it. Apple watch is better than your phone. They have everything from your phone plus tracks your health. So, one day leave your phone and you will be protect. You also don't have to be scared of someone taking your phone from your pocket or anywhere.

Student Response J - [Artifact] [Written Response]	Scoring Guidelines	

	Row 1	**1**

Carrier Parent

Carrier Parent

Genetic disorders are passed on through DNA.

Affected Child

The knowledge of the human genome would allow scientists to directly alter the affected genes and eliminate genetic disorders.

The big data of genomics was once too vast to be acquired entirely. Now, the human genome can be completely sequenced with new sequencing technologies that handle big data and can be used to pinpoint exactly which genes are affected.

Small head
Low nasal bridge
Epicanthal folds
Small eye openings
Flat midface
Short nose
Thin upper lip
Smooth philtrum
Underdeveloped jaw
✶ADAM

Some examples of genetic disorders that can be prevented and/or cured in the future with the help of genetic sequencing

My computational artifact represents the benefits of human genome sequencing. The human genome project uses highly distributed data acquisition and is in the process of converting to single-molecule sequencing technologies with much longer reads to handle the astronomical growth of the genomic big data. Once the human genome can be completely sequenced, we would be one step closer to preventing and curing genetic disorders[1], which is what is depicted by my artifact.
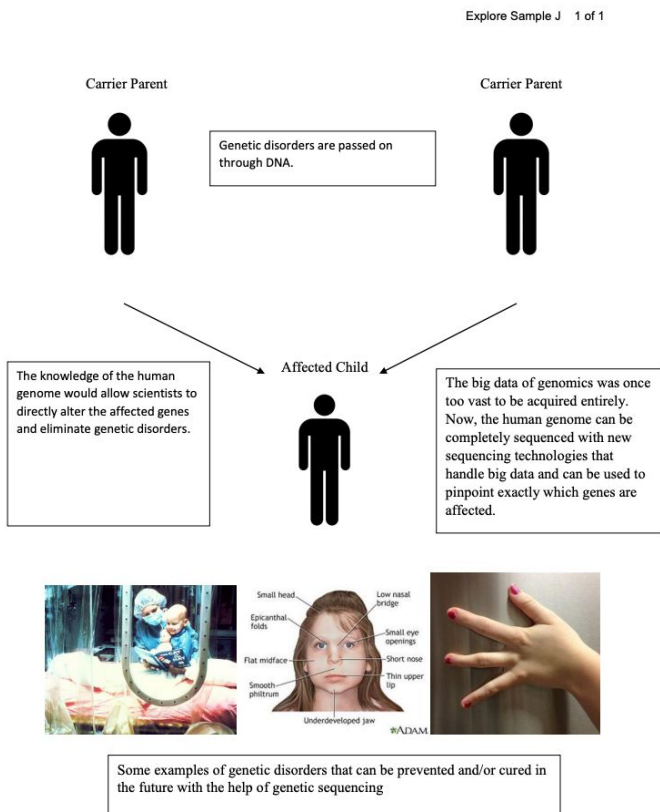
The response earned a point for this row. The artifact provides an illustration of the purpose for Human Genome Sequencing. Even though computing is involved in order to complete Human Genome Sequencing, it is not considered a computing innovation. The response can earn this row even though it isn't a computing innovation.

Row 2	**0**

The response DID NOT earn a point for this row. Even though in order to complete Human Genome Sequencing, computing is involved, it is not considered a computing innovation.

Computing Innovation

2c. 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.

(Must not exceed 250 words)

Scoring Guidelines	
Row and Task	**Decision Rules**
Row 3 - Response 2C Identifies at least ONE effect of the identified or described computing innovation.	The effect does not need to be specifically identified as beneficial or harmful. The effect must be identified, but it doesn't have to be described to earn the point. **Do NOT award a point if any one of the following is true:** ● the described innovation is not a computing innovation; ● the response does not state an effect (The purpose or function of the computing innovation is not the effect of the innovation.); or ● the identified effect is not a result of the use of the innovation as intended (e.g., a self-driving car is not intended to crash, therefore, its exposure to hacking is not an effect of its intended use).
Row 4 - Response 2C ● Identifies a beneficial effect of the identified or described computing innovation. AND ● Identifies a harmful effect of the identified or described computing innovation.	Responses that earn this point will also earn the point for Row 3. Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer. **Do NOT award a point if any one of the following is true**: ● the described innovation is not a computing innovation; ● the response is missing the adjectives harmful or beneficial (or synonyms thereof); ● the response is missing a plausible beneficial effect; ● the response is missing a plausible harmful effect; or ● the identified effect is not a result of the use of the innovation as intended (e.g., a self-driving car is not intended to crash, therefore, its exposure to hacking is not an effect of its intended use).
Row 5 - Response 2C Explains how ONE of the identified effects relates to society, economy, or culture.	Responses that earn the point for this row must have earned the point for Row 3. Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer. **Do NOT award a point if any one of the following is**

	true:
	● the described innovation is not a computing innovation; or
	● the explanation does not connect one of the effects to society, economy, or culture

Student Response A - [Artifact] [Written Response]	Scoring Guidelines	
A beneficial effect is that blockchain will save money on financial services infrastructure- since it's distributed, it is safer by design- and this security will allow the financial sector to decommission expensive systems that are currently used to secure transactions. It would reduce the amount of human resources that are necessary to audit and check the validity of transaction requests, and put that duty into the hands of the computer software. (di Gregorio). Banks and financial security companies would save a lot of money and time that would otherwise be spent training and paying human employees. This has an impact on the economy, because banks save a lot of money in transaction security. This creates more confidence in the US economy as a whole, as stock values for the major banks rise. A harmful effect is that blockchain technology uses a lot of energy. When the computers check with each other to see if they "agree," their verification process is more complex than any other. Going through the process uses a lot of computing power, and consequently, electricity. (Fairley). Everyone in the country is impacted, because we all use energy, and soon, we may all be using the blockchain. Society itself, namely the environment, is harmed. If a growing technology uses more energy, we are forced to burn more resources to create electricity. With the growing issue of climate change, this is an issue for all of humankind.	**Row 3**	**1**
	The response earned a point for this row. The response gives the effect: "blockchain will save money on financial services infrastructure ... to decommission expensive systems that are currently used to secure transactions."	
	Row 4	**1**
	The response earned a point for this row. The response gives the beneficial effect: "blockchain will save money on financial services infrastructure ... to decommission expensive systems that are currently used to secure transactions." The response gives the harmful effect that because blockchain uses a significant amount of energy, "Society itself, namely the environment, is harmed. If a growing technology uses more energy, we are forced to burn more resources to create electricity."	
	Row 5	**1**
	The response earned a point for this row. The response explains how the harmful effect relates to society: "Society itself, namely the environment, is harmed. If a growing technology uses more energy, we are forced to burn more resources to create electricity."	
Student Response B - [Artifact] [Written Response]	**Scoring Guidelines**	
Virtual reality has the potential to change many things about the way we interact with computers and our environment. Virtual reality exists in two forms: virtual reality creates a new, virtual world around you, while augmented reality enhances your surroundings to provide information (Charara). Augmented reality has significant potential to change the way we interact in the future, by providing us with beneficial information such as time, messages, directions, and other relevant or timely information with ease. By wearing a pair of glasses, one could read messages without holding his/her phone, reducing distractions. Since it is easier to focus on your surroundings when not looking at a phone, augmented reality has the potential to cut down on distracted walking-	**Row 3**	**1**
	The response earned a point for this row. The response identifies one effect of the innovation: "Virtual reality has the potential to change many things about the way we interact with computers and our environment. Since it is easier to focus on your surroundings when not looking at a phone, augmented reality has the potential to cut down on distracted walking — or cycling — related accidents."	
	Row 4	**1**
	The response earned a point for this row.	

or cycling-related accidents. However, a harmful effect virtual reality may have on society is that people may become absorbed in the virtual world, and only interact through it instead of through face-to-face communication. Some may see it as an alternative to visiting others, which could increase the problem of obesity, while also increasing isolation and mental health problems (LaMotte).	The response identifies both a beneficial and a harmful effect. A beneficial effect is that "Since it is easier to focus on your surroundings when not looking at a phone, augmented reality has the potential to cut down on distracted walking — or cycling — related accidents." The response identifies this as a benefit in the sentence prior when it states that it provides "us with beneficial information." A harmful effect is that "people may become absorbed in the virtual world, and only interact through it instead of through face-to-face communication."

Row 5	**1**

The response earned a point for this row.
The response explains how the harmful effect impacts the society by stating that "However, a harmful effect virtual reality may have on society is that people may become absorbed in the virtual world, and only interact through it instead of through face-to-face communication."

Student Response C - [Artifact] [Written Response]	**Scoring Guidelines**	

Through the use of Apple Pay, less people have access to the user's credit card number making it much more difficult to steal the user's credit card information, proving very beneficial for those who use Apple Pay. In addition, a person's fingerprint is required to pay, making it even more secure [1]. Unfortunately, Apple Pay exacerbates one of the problems of credit cards, which ease the pain of paying by dissociating people with the money they are spending [2]. This can prove harmful when it causes people use apple pay to buy things they cannot afford.	**Row 3**	**1**

The response earned a point for this row. The response identifies an effect of the innovation: "making it much more difficult to steal the user's credit card information, proving very beneficial for those who use Apple Pay."

Row 4	**1**

The response earned a point for this row.
The response states a beneficial and harmful effect of the innovation. The response identifies a beneficial effect of the innovation as "making it much more difficult to steal the user's credit card information, proving very beneficial for those who use Apple Pay." The response identifies a harmful effect of the innovation as "dissociating people with the money they are spending. This can prove harmful when it causes people [to] use apple pay to buy things they cannot afford."

Row 5	**0**

The response DID NOT earn a point for this row.
The response identifies that Apple Pay is "very beneficial for those who use Apple Pay" but doesn't further explain how the effect is related to this societal group.

Student Response D - [Artifact] [Written Response]	**Scoring Guidelines**	

The Microsoft HoloLens have many benefits. One benefit that the device can bring is that it can change how our society design cars and other products. According to Tom Warren from the Verge, car manufacturers like Ford are using the Microsoft HoloLens to "let designers quickly	**Row 3**	**1**

The response earned a point for this row. The response identifies one effect of the innovation; it can "speed up the design process" of cars and other products.

model out changes to cars" without the need of creating another clay model of the car. This allows car designers to immediately see the changes they have made and can potentially speed up the design process [6]. Another benefit it can change how our society learns. The device can allow students to see how the body works with 3D organ models and allows them to interact with the model [3]. However, with all that benefits, one of the harmful effect on society is gaming addiction. The Microsoft HoloLens allows you to play games like Minecraft on the device, making you feel like you are in the game with realistic holograms. However, Nick Summers, a reporter for Engadget who played Minecraft on the Microsoft HoloLens, described his gaming experience as "HoloLens can create unique and breathtaking experiences. Once I had my Minecraft world on the table, I didn't want to take it off" [5]. The fact that the Microsoft HoloLens can make the gaming experience so realistic can be a problem in the society as users of the Microsoft HoloLens can be addicted to it.	**Row 4** — **1** **The response earned a point for this row.** The response identifies both a beneficial and a harmful effect of the computing innovation. The beneficial effect is that it can "speed up the design process" of cars and other products. A harmful effect is that Microsoft HoloLens may cause gaming addiction. **Row 5** — **1** **The response earned a point for this row.** The response explains how the harmful effect impacts the society: "The fact that the Microsoft HoloLens can make the gaming experience so realistic can be a problem in the society as users of the Microsoft HoloLens can be addicted to it."
Student Response E - [Artifact] [Written Response]	**Scoring Guidelines**
One benefit of Bitcoin is that it can be used internationally and, with its recent popularity, can be used in many online retailers [2]. This is a fantastic trait for currency to have because of the many language barriers across the world and with all of the exchange rates including currency barriers in each and every country [3]. Economically this makes investors have another way to invest besides in the stock market. Drawing similarities to the stock market, Bitcoin has had exponential grown in the past month growing almost to $20,000 USD [4]. This has many people predicting the crash of the stock market along with the crash of the Bitcoin's acclaimed cost. This is a major downfall and defect of the system because as the price goes up, so does the difficulty of mining Bitcoins. With there only being a limited amount of Bitcoins in the market, this is cause for exponential price increases [1]. Another harmful effect of Bitcoin is that there are other more affordable legitimate virtual currencies within the marketplace now [1]. This is making Bitcoin look overpriced, although the other virtual currencies aren't as widely accepted as Bitcoin. Bitcoin's harmful effect to the investment market and stock market may cause a crash because of how fast the price has grown and how many investors have joined the cause [4]. If Bitcoin's value were to crash, there would be a large crisis among investors and it could lead to the stock market crashing along with it [1].	**Row 3** — **1** **The response earned a point for this row.** The response identifies an effect of the innovation as it "makes investors have another way to invest besides in the stock market," because it can be used internationally and doesn't have a language or exchange rate barriers. **Row 4** — **1** **The response earned a point for this row.** The response identifies a beneficial effect of the innovation as, "makes investors have another way to invest besides in the stock market," because it can be used internationally and doesn't have a language or exchange rate barriers. The response identifies a harmful effect of the innovation as "if Bitcoin's value were to crash, there would be a large crisis among investors and it could lead to the stock market crashing along with it." **Row 5** — **1** **The response earned a point for this row.** The response connects the beneficial effect: "Economically this makes investors have another way to invest besides in the stock market."
Student Response F - [Artifact] [Written Response]	**Scoring Guidelines**
The use of social media has tremendously made a huge impact on our society, economy, and culture. One of the main beneficial effects of social media is that it can be a	**Row 3** — **1**

very useful tool when seeking a job. First off, the nature of social media allows for the platforms to collect immense amounts of data about each individual user. As social media users, it is possible to feed the certain job in which you desire about your favorite hobbies, jobs, gender, age, location, etc. (2). Therefore, by giving the information and obtaining the job that the person had desired, they will benefit in an economic way. However, one harmful effect of social media is that social media can have terrible mental health impacts. According to a survey of 1,500 14 to 24 year olds in the UK, published by Royal Society for Public Health (RSPH) and the Young Health Movement (YHM), social media is the worst thing for children's health as it has been directed towards signs of depression and that there may also be links to an increase in cyberbullying, worsening sleep, and feelings of social isolation and anxiety(3). This is a problem as it is affecting our society in a way that can be harmful to the children and possibly adults through the use of social media.	**The response earned a point for this row.** The response identifies an effect of the innovation as it "is the worst thing for children's health as it has been directed towards signs of depression and that there may also be links to an increase in cyberbullying, worsening sleep, and feelings of social isolation and anxiety."

Row 4	0

	The response DID NOT earn a point for this row. The response does not identify a beneficial effect, but it does identify a harmful effect. The response states uses of the innovation (being able to find a job) without identifying beneficial effects. The statement "they will benefit in an economic way" does not identify the beneficial effect, such as being able to support oneself and make purchases. The response identifies a harmful effect of the innovation as "social media is the worst thing for children's health as it has been directed towards signs of depression and that there may also be links to an increase in cyberbullying, worsening sleep, and feelings of social isolation and anxiety."

Row 5	1

	The response earned a point for this row. The response connects the harmful effect explaining that the innovation is "affecting our society in a way that can be harmful to the children and possibly adults through the use of social media."

Student Response G - [Artifact] [Written Response]	**Scoring Guidelines**

	Row 3	1

The primary benefit EMG prosthesis has had on society is it's provision of limbs to those who were either born without limbs or lost them in an accident. Though there were earliewr forms of prosthetics that gave handicapped individuals limited range of motion and grip, EMG prosthesis unlocks the possibility for virtually natural motion and limited sensations for those missing limbs. Unfortunatly there might arise instances of accidental or unintended motion due to the open loop design of the prosthetics. Imagine a situation where an individual utilizing one of these prosthetics were to suddenly lose control of their arm while driving or operating any type of heavy machinery then suddenly lose control. The results of any error in the sensors or the user's muscles could lead to potential disaterous outcomes.	**The response earned a point for this row.** The response identifies in response 2a the effect of the innovation: "EMG prosthesis is meant to provide those who are missing limbs an opportunity to live a normal life." The benefit identified in response 2c, "provision of limbs to those who were either born without limbs or lost them in an accident," is not an effect of the innovation but rather the purpose for this innovation.

Row 4	0

	The response DID NOT earn a point for this row. The response identifies a harmful effect: "Unfortunately there might arise instances of accidental or unintended motion due to the open loop design of the prosthetics." The beneficial effect in response 2c, "… it's provision of limbs to those who were either born without limbs or lost them in an accident," represents a purpose for using this technology. The effect identified in 2a, "EMG prosthesis is meant to provide those who are missing limbs an

	opportunity to live a normal life," is not identified as beneficial or harmful.
	Row 5 · **0**
	The response DID NOT earn a point for this row. The beneficial effect identified in 2c, "The primary benefit EMG prosthesis has had on society is it's provision of limbs to those who were either born without limbs or lost them in an accident," is a purpose for using this computing innovation, rather than an effect of the innovation.

Student Response H - [Artifact] [Written Response]	**Scoring Guidelines**
One of the beneficial effect of iphone x is it's display. The iphone x has a Organic Light Emitting Diodes (OLED) display technology. It is much thinner, much lighter, fast response time, better viewing angle, better color accuracy, image contrast accuracy, and higher brightness (4). One of the harmful effect of iphone x is it's glass on the back and stainless steel frame which is very easy to scratch and break and repairing it is really expensive (2) . The glass back allow the phone to have wireless charging. Smartphone device insurer SquareTrade,Inc. Said in a youtube video, that it is the most breakable, highest priced, and most expensive to repair iphone ever. And they give a breakability score of 90 high risk (3).	**Row 3** · **0**
	The response DID NOT earn a point for this row. All the identified effects are features of the iPhoneX. For example, the OLED display, and the glass back are features of the phone.
	Row 4 · **0**
	The response DID NOT earn a point for this row. While the response attempts to describe a beneficial and a harmful effect of the iPhoneX, the response identifies features of the phone, not effects of the phone.
	Row 5 · **0**
	The response DID NOT earn a point for this row. The response does not relate any of the effects to society, economy, or culture

Student Response I - [Artifact] [Written Response]	**Scoring Guidelines**
One benefit is there is no sim card. They have no sim card because it needs to change. It also doesn't have a sim because before they would make the battery die fast. Now they have an LTE now. LTE is better because it has a high and faster connection. Tracks your health is another benefit because it helps you to see where you at. Tracking your health is important to see what food intake, workout routine, physical progress and weight. Apple was the one who said and change that thing for a reason. This is economy because it's for everyone. One harmful benefit is the battery drains fast. The battery will die fast because you don't charge it. It's a harmful benefit because if it keeps dying fast you can't use it all the time. Sometimes the battery can fire on your waist and that's harmful to people. "Lauren Goode took a walk for 1 hour and her battery was at 27%." Lauren Goode was the one how to put up a bad tweet and harmful one. It's a concern to people by people. People read the tweets to see if it's good to buy or not. It's all up to the what other people say not them. This is economic and social because	**Row 3** · **1**
	The response earned a point for this row. The response identifies in 2a one effect of the innovation as "to help people to not get in a car crash."
	Row 4 · **0**
	The response DID NOT earn a point for this row. The response explains the beneficial effect on society as tracking one's health. No harmful effect related to the innovation's intended purpose is presented. The harmful effect of the battery draining is not an effect but rather commentary regarding the product's design.
	Row 5 · **0**
	The response DID NOT earn a point for this row. The response does not connect "help people to not get in a car crash" to society, economy, or culture.

for Apple and the tweets. It's also economy because it's a thought of a group of people.		
Student Response J - [Artifact] [Written Response]	**Scoring Guidelines**	
This computing innovation would benefit the medical field. Complete human genome sequencing would make pinpointing specific genes that cause disorders more efficient as well as more accurate. If we know the cause, finding the solution will come soon after. It would take us one step closer to altering specific genes to not only eliminate genetic disorders but also to make people healthier, smarter, and more attractive. Physical limitations would lift and humans would achieve better in their ideal bodies. One negative consequence is the possibility of data misuse[2]. If all of our genetic information is recorded, there is no guaranteeing that the information would remain private. It could perhaps affect employment and insurance rates in the future if a person's genes are flawed and the wrong people get a hold of the private information. In many ways, genetic information is much more explicit than social security numbers. Releasing such information to others is obviously risky.	**Row 3**	**0**
	The response DID NOT earn a point for this row. The described innovation connected to the effect is not a computing innovation.	
	Row 4	**0**
	The response DID NOT earn a point for this row. The described innovation connected to the effect is not a computing innovation.	
	Row 5	**0**
	The response DID NOT earn a point for this row. The described innovation connected to the effect is not a computing innovation.	

2d. Using specific details, describe:
- the data your innovation uses;
- how the innovation consumes (as input), produces (as output), and/or transforms data; and
- at least one data storage concern, data privacy concern, or data security concern directly related to the computing innovation.

(Must not exceed 250 words)

Scoring Guidelines	
Row and Task	**Decision Rules**
Row 6 **Response 2D** ● Identifies the data that the identified or described computing innovation uses AND ● Explains how that data is consumed, produced, OR transformed.	Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer. **Do NOT award a point if any one of the following is true:** ● the described innovation is not a computing innovation; or ● the response does not state the specific name of the data or simply says "data"; or ● the response confuses or conflates the innovation with the data: response fails to explain what happens to the data; or ● the response confuses the source of the data with the data.
Row 7 **Response 2D** ● Identify one data storage, data privacy, OR ● data security concern related to the identified or described computing innovation.	Responses should be evaluated on the rationale provided in the response not on the interpretation or inference on the part of the scorer. Responses can earn this point even if they refer to the data in a general without specifically identifying the data being used. **Do NOT award a point if any one of the following is true**: ● the described innovation is not a computing innovation; or ● the response identifies or describes a concern that is not related to data

Student Response A - [Artifact] [Written Response]	Scoring Guidelines	
The system of blockchain operates with a distributed ledger. According to Coindesk, "a distributed ledger is a database held and updated independently by each participant (or node) in a large network." (Bauerle)The computers use metadata from transaction requests. Each block of data contains a pointer to the previous block, a	**Row 6**	1
	The response earned a point for this row. The response identifies the data: "Each block of data contains a pointer to the previous block, a timestamp, and transaction data." It then states that "It computes by taking	

timestamp, and transaction data. Then, this chain of blocks is held in the storage of each node. The data it produces is the blockchain itself, which is a stream of transaction data separated into blocks by set intervals of time. This data is kept in a ledger, which does not need to be verified by a central authority. (Siegel) It computes by taking the data and runs it through algorithms to verify the identity of the request. "In the case of blockchain technology, private key cryptography provides a powerful ownership tool that fulfills authentication requirements. Possession of a private key is ownership." (Bauerle). So essentially, the blockchain computes by running transaction data through algorithms that verify private key ownership. A privacy concern is that "Bitcoin relies on a public blockchain, a system of recording transactions that allows anyone to read or write transactions. Anyone can aggregate and publish those transactions, provided they can show that a sufficient amount of effort went into doing so." (Berke) This means that anyone who really wanted to could see transactions being made on the blockchain, and with a little effort and computing ability, they'd have access to transaction amounts, time, and other data	the data and runs it through algorithms to verify the identity of the request," which describes how the data is consumed.

	Row 7 — 1
	The response earned a point for this row. The response earned the point for this row. The response identifies the privacy concern: "Bitcoin relies on a public Blockchain, a system of recording transactions that allows anyone to read or write transactions."

Student Response B - [Artifact] [Written Response]	**Scoring Guidelines**
Virtual reality uses image, motion, orientation, and distance data to operate (Mullis). All this data is consumed by the headset to allow the headset to detect user input and its surroundings. This data is then transformed by the program running on the headset to determine what to show the user and is outputted to the user in the form of image and audio data. A data privacy concern associated with virtual reality is the potential ability for companies to access the video or other sensor data recorded by these headsets, which could be used for things without your consent. Since the headset has seen where one has been walking or driving, someone else with access could also see this and may have the ability to find them against his/her will.	**Row 6** — 1 **The response earned a point for this row.** The response identifies the data as "image, motion, orientation, and distance." The response explains how the data is consumed: "All this data is consumed by the headset to allow the headset to detect user input and its surroundings. This data is then transformed by the program running on the headset to determine what to show the user and is outputted to the user in the form of image and audio data." **Row 7** — 1 **The response earned a point for this row.** The response identifies a data privacy concern: " the potential ability for companies to access the video or other sensor data recorded by these headsets, which could be used for things without your consent." It goes on to say, "someone else with access could also see this and may have the ability to find them against his/her will."

Student Response C - [Artifact] [Written Response]	**Scoring Guidelines**
When adding a new card to the digital wallet, Apple creates a Device Account Number in place of the credit card number that is stored with the bank, on the device, and on Apple's servers, and then erases the credit card	**Row 6** — 1 **The response earned a point for this row.** The response identifies data by stating that "Apple creates a

number from its database. When paying with Apple Pay, the paying device transmits the user's Device Account Number over an encrypted NFC connection to the terminal. The Device Account Number is then sent to the bank and verified [1]. Although Apple Pay does allow increased security, it does have its own security concerns. When registering a new card on an unsecured public Wi-Fi network, a cybercriminal can spoof a user's mobile wallet registration system in which the user must enter their card's data. Malware is also a security concern as it can be used to steal credit card information [3].

Device Account Number in place of the credit card number that is stored with the bank, on the device, and on Apple's servers, and then erases the credit card number from its database."

The response explains how data is output from the device in that "When paying with Apple Pay, the paying device transmits the user's Device Account Number over an encrypted NFC connection to the terminal. The Device Account Number is then sent to the bank and verified."

Row 7	1

The response earned a point for this row. The response identifies a data security concern by stating that "When registering a new card on an unsecured public Wi-Fi network, a cybercriminal can spoof a user's mobile wallet registration system in which the user must enter their card's data."

Student Response D - [Artifact] [Written Response]	Scoring Guidelines

The Microsoft HoloLens inputs data by using different types of cameras, microphones, and a light sensor [7]. Then, the Holographic Processing Unit and Central Processing Unit takes in the data captured by the cameras, microphones, light sensor and transforms those data by projecting images onto the lens in the correct position in the device, creating the realistic 3D holographic image that the users see [1]. One of the data security concern is that the data captured by the cameras and the sensors may be altered by a malicious program on the device, making the device's Central Processing Unit and Holographic Processing Unit output realistic altered holographic images like a huge insect to suddenly scare the user and altering human facial features with holograms tricking the user into identifying people incorrectly when wearing the device [4].

Row 6	0

The response DID NOT earn a point for this row. The response does not identify the data, but rather lists data collection devices such as "cameras, microphones, and a light sensor."

Row 7	1

The response earned a point for this row. The response identifies a data security concern as "the data captured by the cameras and the sensors may be altered by a malicious program on the device, making the device's Central Processing Unit and Holographic Processing Unit output realistic altered holographic images."

Student Response E - [Artifact] [Written Response]	Scoring Guidelines

Bitcoin uses a hash generation system which leads users to unlock hatches. The hash is a randomly generated code that increases difficulty the more hatches that are opened. The user must generate this code before opening a hatch and receiving a reward in Bitcoin. The system of mining is a hard hobby to break into because of the difficulty of hashes now. The system puts out an output which is the randomly generated hash and the user must test many hashes before they ultimately guess the exact hash that the system created [4, 1]. A data privacy concern includes the user's names. There is a large ledger that is kept on an open server that can only be changed by transactions. A user makes an account and a username that will be seen on the transaction ledger. This ledger will include every transaction ever made with a

Row 6	0

The response DID NOT earn a point for this row. The response does not identify the data and explain how that data is consumed, produced, or transformed. The response describes how Bitcoin functions rather than the data and its use of the data.

Row 7	1

The response earned a point for this row. The response raises a data privacy concern that username data is maintained on "a large ledger that is kept on an open server that can only be changed by transactions. A user makes an account and a username that will be seen

Bitcoin. This ledger tracks every Bitcoin ever found and shows which users are in possession of them. The ledger also Explore Sample E 1 of 12 shows which user lost the Bitcoin and which user gained the Bitcoin in the transaction. The ledger is text but has a file size near 2 gigabytes [4]. The storage of this ledger is not a concern, nor is the security because of the level of encryption on the ledger itself. Privacy is an issue because there was a discovery of the federal government using Bitcoin to make transactions on the black market [4, 1]. The privacy of users rises an issue within the community.

on the transaction ledger. This ledger will include every transaction ever made with a Bitcoin."

Student Response F - [Artifact] [Written Response]	**Scoring Guidelines**	
Data is necessary for social media in an economic standpoint. First off, this innovation consumes knowledge based on what it learns. A majority of businesses with successful social media presence, utilize some sort of social listening, which are analytics tools that constantly gather useful customer data and track conversations about target brands or themes(2). Therefore the person who is being interviewed must tell them the necessary information in which the business will consume the data and see if that person will fit in well with their business. While this data may be useful to some, there can also be concerns for breach of data. If some people don't take actions on their privacy, such as sharing their profiles to the rest of the world, then they may allow other people to find out personal information about them such as gender, where they live, how old they are, and other possible information. This can be harmful to that person as someone who is unknown to them, will know a lot about them.	**Row 6**	**0**
	The response DID NOT earn a point for this row. The response does not identify data that the innovation uses, rather it simply states that "data is necessary," nor how it is consumed, transformed, or output.	
	Row 7	**1**
	The response earned a point for this row. The response does identify a concern "for breach of data" in that "If some people don't take actions on their privacy, such as sharing their profiles to the rest of the world, then they may allow other people to find out personal information about them such as gender, where they live, how old they are, and other possible information."	

Student Response G - [Artifact] [Written Response]	**Scoring Guidelines**	
These prosthetics utilizes myoelectric signals to simply activate mechanical motors in a prosthetic appendage. These prosthetics simply consumes the electromyographic data sent to specific muscles on the user's body from the brain. This data is received through the EMG sensors that are attached to the proper muscles on the wearer. These EMG signals, once received, are transmited to a signal processor that identifies which sensor is transmitting a signal then appropriately actuates a combination of cervos and motors in order to properly move the prosthetic as if an appendage was there.	**Row 6**	**1**
	The response earned a point for this row. The response identifies the data as myoelectric signals. The response explains how the data is consumed: "These prosthetics simply consumes the electromyographic data sent to specific muscles on the user's body from the brain. This data is received through the EMG sensors that are attached to the proper muscles on the wearer. These EMG signals, once received, are transmitted to a signal processor that identifies which sensor is transmitting a signal then appropriately actuates a combination of cervos and motors in order to properly move the prosthetic as if an appendage was there."	
	Row 7	**0**
	The response DID NOT earn a point for this row. The response does not identify a concern that is related to the data.	

Student Response H - [Artifact] [Written Response]	Scoring Guidelines	
The data that iphone x use is mobile data. Iphone x consumes as input as that there is touch screen, apps, games, etc and produces as output as that it uses audio, voice, power, etc. The iphone x's uses lots of data for the new feature, face ID. The data Explore Sample H 2 of 4 from the infrared camera is sent to A11 chip to process, in which it compare the information about you on the phone(5). Apple has analyzed over a billion images for data about faces(5). One of the data storage concern is that the there is limited space to store files for example, pictures and videos have bigger size because of improved cameras, so it require more data to store. The face ID has some security concerns, someones can crack the Face ID with a composite mask of 3-D-printed plastic, silicone, makeup, and simple paper cutouts, which in combination trick an iPhone X into unlocking (6). So there is concern about the security of face ID on iphone x.	**Row 6**	**0**
	The response DID NOT earn a point for this row. The input data is not identified. The response does mention audio and voice as output, which would be produced by the phone, not used by the phone.	
	Row 7	**1**
	The response earned a point for this row. A security concern is identified: "The face ID has some security concerns, someones [sic] can crack the Face ID with a composite mask of 3-D printed plastic, silicone, makeup, and simple paper cutouts, which in combination trick an iPhone X into unlocking"	

Student Response I - [Artifact] [Written Response]	Scoring Guidelines	
This Apple watches you can send messages, call, go underwater, and see your health. Apple watch gets its data from wifi and Bluetooth and also from the iPhone. Data is sending things to people and using it. The Apple watch use 16gb. An input is "Siri feels more useful, and Apple music streaming not ready yet." A transform is "it's a great gift, and you can use it if you don't have your phone." A produce is It can work with you all day long and helps you around. An Apple watch computes by "The Apple Watch Series 3 with cellular takes a major step forward in making Apple's wrist-worn device its own independent, connected computing platform." The Apple watch is storage and privacy. It's storage because you only have 16gb, you can only that much and no more. It's privacy because it's like your phone, you don't want anyone to go through your phone to see your message, photos, apps, and more. So, your Apple watch is private too so only you can use it and see what's on it.	**Row 6**	**0**
	The response DID NOT earn a point for this row. The response does not specify the specific name of the data but rather just refers to it as data.	
	Row 7	**0**
	The response DID NOT earn a point for this row. The response identifies storage size of the computing innovation and access to your device, but these are not related to the data.	

Student Response J - [Artifact] [Written Response]	Scoring Guidelines	
The Human Genome Project uses approximately 1 zetta-base per year. The innovation acquires data from highly distributed sources such as universities, hospitals, and research laboratories. There are currently more than 2,500 sequencing instruments made by different manufacturers that are distributed throughout different nations.The resulting big data is distributed in units as a few genetic comparisons or gene sequences or as bulk downloads from from central repositories. To reduce the computing resources necessary for large-scale analysis of the data, cloud computing is used so that only small sections of code are uploaded and highly processed data are downloaded. The data for genomics is enormous, and	**Row 6**	**0**
	The response DID NOT earn a point for this row. It is unclear whether the data that has been identified is connected to a computing innovation.	
	Row 7	**0**
	The response DID NOT earn a point for this row. Even though cloud computing is a computing innovation and mentioned in this prompt, it is unclear how this is connected to the data storage concerns.	

it's estimated that up to 40 exabytes will be needed by 2050. Efficient data compression is one solution but decompression time is also a concern. The data is medically sensitive information and must be carefully guarded. Homomorphic encryption can be used to allow only certain groups to view the data, but it is currently too expensive[2].	

Unit 6 Lesson 2

Explore PT - Make a Plan

Resources

Computing Innovation Brainstorm Activity (10 mins)

- Place a √ next to at least 3 innovations you think are *definitely* a good choice for the explore PT
- Place a **X** next to at least 3 that are *definitely NOT* a good choice for the Explore PT
- Start to jot down your own ideas for Computing Innovations you might want to use for the Explore PT

√ / X	"Innovations" / topics	*Your Ideas for computing innovations to use for the Explore PT* Note: you can use one of, or some aspect of, the items in the list for your own task.	
?	Self-driving car		
X	Fiber-optic cable		
X	TCP Protocol		
?	Smart watch		
√	Music Recommendation App (e.g. Pandora)	√	Probably a good choice. It's software with well known social implications
X	Bluetooth speakers	X	Probably a bad choice. It's hardware or just simply not actually a computational thing. Some hardware might be able to be finessed into a computing innovation if you can find the software that drives it or processes the data it collects or works with. It can lead to some tricky situations for an exam reader though.
X	Digital clock		
?	Backup camera on a car		
√	Facial recognition software		
X	Email		
?	Laptop computer		
√	A system for digitizing and sharing medical records	?	Maybe a good choice assuming you focus on the actual computational part for all aspects of the task and not simply the broader technology itself.

Some of these can be turned into great topics for the explore PT if done right. |
X	Wireless phone charging		
√	Instagram		
?	Police body cameras		
?	3D Printer		
√	Bitcoin		
?	Google glasses		
√	Snapchat		
?	GPS		
√	A phone app		
√	Video streaming service (e.g. Netflix)		

Notes:
- Many innovations you've studied or read about in this class are not good choices.
- Assume you'll need to do quick research on a few ideas before you land on an actual topic for this task.
- A common pitfall is to choose a technological innovation without identifying the computational aspect of it. For example: a self-driving car is a technological innovation. But a good choice for the performance task is to identify a particular aspect of a self-driving car that clearly involves computing.
- Hardware is often a gotcha - make sure you can identify the computing part.

Brainstorm: harmful effects v. data security concerns (10 mins)

One of the challenging things about the Explore PT in doing research is distinguishing between a Harmful Effect and a Data Security Concern. Computing innovations can lead to "bad stuff" happening but for the Explore PT is it a harmful effect or data storage, privacy, security concern? Here's how to think about it:

Harmful effects on society, economy, culture		Data storage, privacy, or security concern
Translation: *what are the unintended consequences* of this innovation on specific groups of people assuming the innovation works as intended? For harmful effect: who or what stands to lose from wide use of this innovation now, or in the future?	**v.**	Translation**:** *What are the risks? How could the data be misused? What are the security or privacy risks?*

Activity: Here's a list of "bad" stuff resulting from computing innovations. Identify which is a harmful effect and which is a data storage/security/privacy concern (following the Explore PT definitions)?

"Bad stuff" from computing	Harm	Data
Autonomous cars must constantly collect and store data about their location. Hacking this information could allow attackers to remotely track where drivers travel.		√
Autonomous cars will displace thousands or even millions of people currently employed as bus, taxi, and truck drivers.	√	
Digitizing and moving medical records online makes it significantly easier for attackers to access personal information about almost anyone in the country / world.		√
Music recommendation systems may inadvertently direct listeners towards a more narrow selection of music, decreasing the diversity of our cultural output and consumption.	√	
The growing use of facial recognition software makes it increasingly challenging to navigate society anonymously.	√	
Online advertising is so individualized that we can now operate within our own "filter bubbles". For example political discussion suffers as it becomes challenging to communicate based on a set of shared experiences or pieces of information.	√	
Data about things that you have "Liked" online can be used to make reasonable guesses about your age, gender, location, and many other pieces of personal information.		√
Car sharing apps like Uber or Lyft have contributed to a class of workers who may work full time but do not enjoy the typical social and economic benefits typically associated with full time work.	√	
Your location history in a mapping app can allow someone to know where you live, go to school, or spend time.		√

Rapid Research Activity - Harmful Effects (10 mins)

Now that you have a sense of what a harmful effect is you will practice doing some rapid research to see if you can quickly identify a harmful effect for some innovation. Remember that for the harmful effect you should:
- Assume the innovation is being used or works as intended
- Identify the impact on society, economy or culture
- Identify a specific group of people who are impacted

Research Tips: Since you need to identify harmful effects to specific elements of society and people, you might kick off your research by searching for things like:

- "The unintended consequences of _____"
- "pros and cons of _____"
- "the downsides of _____"
- "_____ economic impacts"

Rapid Research: Harmful Effects
Pick one of the computing innovations from the Computing Innovation Brainstorm Activity (either from the list or one that you wrote down) and see how quickly you can find a harmful effect that will work for the Explore PT. Fill in the table below with what you found

Computing Innovation:	
Harmful Effects I found:	**Group of people of people affected:**
Is this primarily an impact on… ☐ **Society** ☐ **Economy** ☐ **Culture**	
Search Terms I used:	**Sites / Articles I found:**

Notes on groups of people, society, economy, culture:
- **culture** - can be thought of as a group of people: example – football players are a culture, students that have asthma are a culture
- **economy** - can be thought of as a group of people with similar economic interests, or whose jobs or or industry are similar. Example: (Netflix put companies like Blockbuster and rental places out of business)
- **society** - try to avoid "society". It's too broad. Get specific: Which society? Whose society?

Explore PT Planning Organizer

Innovation Name:

Facts about purpose and function:

*Response **2a***
*Row **2***

Artifact Planning Ideas:

Explain one effect of the innovation.

*Response **2c***
*Row **3***

Explain one beneficial effect (and the group affected, provide source)

*Response **2c***
*Row **4, 5***

Explain one harmful effect. (and the group affected, provide source)

*Response **2c***
*Row **4, 5***

Description of data used by innovation (specific type; describe how below)

*Response **2d***
*Row **6***

Input (consume)

*Row **6***

Process (transform)

*Row **6***

Output (produce)

*Row **6***

Computational Artifact
*Row **1***

How does the artifact illustrate represent OR explain the innovation's purpose, function or effect?

Explain one data storage, privacy or security concern from misuse of innovation and/or its data

*Response **2d***
*Row **7***

References:

1)

2)

3)

*Response **2e***
*Row **8***

Explore PT Completion Timeline

Before you start you should think about how you are going to allocate your time for 8 hours provided for the task. Below is a sample timeline that you can use to plan out how you will complete the Explore Performance Task.

Hour	Suggested Activity	Your Plan
1	Brainstorm ideas for computing innovations ● Do rapid research to decide what to do ● Use the Explore PT Planning Organizer **Goal:** By the end of this day you should know what your innovation is and most of the sources you will cite	
2	Research and draft responses for prompts 2c, 2d: ● Use the Explore PT Organizer ● **2c** - Beneficial and Harmful Effects ● **2d -** How it uses data + security concern	
3	Continue work from Day 2 **Goal:** Finish responses **2c** and **2d**	
4	Create the computational artifact ● Use the PT Organizer to sketch an idea ● **Goal:** know what you're going to make for artifact and start it.	
5	● Continue work on computational artifact ● Draft response to **2a** - Intended purpose or function of innovation.	
6	Continue Comp. Artifact + **2a** **Goal:** Finish Comp. Artifact and response **2a**	
7	Review, clean up, touch up ● Complete **2e** - References ● Complete Response **2b** ● Make sure you have source cited for any fact or claim in **2a, 2c, 2d**	
8	Complete the task ● Review the submission materials ● Check your responses against the scoring guidelines ● Enter your responses into the digital portfolio ● Upload your computational artifact (and/or PDF of written responses to the the digital portfolio) **Goal:** At the end of this day, your Explore PT is submitted!	

Note: The timeline above is just a guideline. You may complete the performance task on a different schedule. Make sure to leave enough time to complete your computational artifact and write-up.

Explore PT Overview

Goal of the Task: Explore through research, then explain and represent the impact, function, and societal effects of a computing innovation.

What you Submit: (1) Computational Artifact (2) Written Responses to prompts 2a-e (with citations of sources for where you found the information).

How you get a good score: The AP committee wants to see that you can:
● identify a computing innovation
● demonstrate a basic understanding of how it works
● discuss the positive and negative effects this computing innovation on society
● cite those things with articles or other texts you found doing research.

Suggested Process in a Nutshell (see also: Sample Timeline on following pages)**:**
1. **Pick a good innovation…**
   ○ Make a list of potential computing innovations to use for the task (see below)
   ○ Do some "rapid research" to see if you can quickly figure out if its a good one to use for the task (criteria below)
   ○ Pick an innovation that works well and start the task!

2. **Do rapid research to find your answers for written prompts...**
   ○ Beneficial and harmful effects of the innovation on society, economy, culture (prompt 2c)
   ○ How it consumes, produces, or transforms data (prompt 2d)
   ○ Data storage, privacy, or security concern (prompt 2d)

3. **Make your computational artifact**
   ○ Make something that represents your responses to 2a and 2d

4. **Finalize written responses and submit!**

Picking a good Computing Innovation

Make your life easier: Choosing a good computing innovation from the outset will make completing the task easy. Choosing something that you're interested in and motivated to learn more about will also help. Do this by ensuring two things *before* you fully commit:

(1) You have identified an *actual* computing innovation
(2) You have a good idea of how to respond to the written responses about your innovation.

Evaluate Computing Innovations by asking these questions:

1. Does it use data? (input, transform, output)	2. Can I identify a group it impacts? (both positively and negatively)	3. Can I find published references about it?

If you can answer "yes" to these three questions you've likely identified a true computing innovation that will work well for the task. **Remember**: if the innovation is not a true computing innovation, you can only earn 1 point for the ENTIRE task. CHOOSE YOUR INNOVATION WISELY!

---

[1] *Much of the content of this this guide was borrowed and/or modified with permission from Jill Westerlund at the* [Abstracting CS](#) *blog. We are grateful for Jill's ingenuity and generosity.*

Computing Innovation Brainstorm Activity (10 mins)

- Place a √ next to at least 3 innovations you think are *definitely* a good choice for the explore PT
- Place a **X** next to at least 3 that are *definitely NOT* a good choice for the Explore PT
- Start to jot down your own ideas for Computing Innovations you might want to use for the Explore PT

√ / X	"Innovations" / topics	***Your Ideas for computing innovations to use for the Explore PT** Note: you can use one of, or some aspect of, the items in the list for your own task.*
	Self-driving car	
	Fiber-optic cable	
	TCP Protocol	
	Smart watch	
	Music Recommendation App (e.g. Pandora)	
	Bluetooth speakers	
	Digital clock	
	Backup camera on a car	
	Facial recognition software	
	Email	
	Laptop computer	
	A system for digitizing and sharing medical records	
	Wireless phone charging	
	Instagram	
	Police body cameras	
	3D Printer	
	Bitcoin	
	Google glasses	
	Snap Chat	
	GPS	
	A phone app	
	Video streaming service (e.g. Netflix)	

After you've finished, compare your list with a friend and discuss.

Notes:
- Many innovations you've studied or read about in this class are not good choices.
- Assume you'll need to do quick research on a few ideas before you land on an actual topic for this task.
- A common pitfall is to choose a technological innovation without identifying the computational aspect of it. For example: a self-driving car is a technological innovation. But a good choice for the performance task is to identify a particular aspect of a self-driving car that clearly involves computing.
- Hardware is often a gotcha - make sure you can identify the computing part.

Brainstorm: harmful effects v. data security concerns (10 mins)

One of the challenging things about the Explore PT in doing research is distinguishing between a harmful effect and a data security/privacy concern. Computing innovations can lead to "bad stuff" happening but how do you know if it's a harmful effect or data storage, privacy, security concern? Here's how to think about it for the Explore PT:

Harmful effects on society, economy, culture		Data storage, privacy, or security concern
Translation: *what are the unintended consequences* of this innovation on specific groups of people assuming the innovation works as intended? For harmful effect: who or what stands to lose from wide use of this innovation now, or in the future?	**v.**	Translation**:** *What are the risks? How could the data be misused? What are the security or privacy risks?*

Activity: Here's a list of "bad stuff" resulting from computing innovations. Identify which is a harmful effect and which is a data storage/security/privacy concern (following the Explore PT definitions).

"Bad stuff" from computing	Harm	Data
Autonomous cars must constantly collect and store data about their location. Hacking this information could allow attackers to remotely track where drivers travel.		
Autonomous cars will displace thousands or even millions of people currently employed as bus, taxi, and truck drivers.		
Digitizing and moving medical records online makes it significantly easier for attackers to access personal information about almost anyone in the country / world.		
Music recommendation systems may inadvertently direct listeners towards a more narrow selection of music, decreasing the diversity of our cultural output and consumption.		
The growing use of facial recognition software makes it increasingly challenging to navigate society anonymously.		
Online advertising is so individualized that we can now operate within our own "filter bubbles". For example political discussion suffers as it becomes challenging to communicate based on a set of shared experiences or pieces of information.		
Data about things that you have "Liked" online can be used to make reasonable guesses about your age, gender, location, and many other pieces of personal information.		
Car sharing apps like Uber or Lyft have contributed to a class of workers who may work full time but do not enjoy the typical social and economic benefits typically associated with full time work.		
Your location history in a mapping app can allow someone to know where you live, go to school, or spend time.		

After you've finished, compare and discuss with a partner.

Rapid Research Activity - Harmful Effects (15 mins)

Now that you have a sense of what a harmful effect is you will practice doing some rapid research to see if you can quickly identify a harmful effect for some innovation. Remember that for the harmful effect you should:
- Assume the innovation is being used or works as intended
- Identify the impact on society, economy or culture
- Identify a specific group of people who are impacted

Research Tips: Since you need to identify harmful effects to specific elements of society and people, you might kick off your research by searching for things like:

- "The unintended consequences of ____"
- "pros and cons of ____"
- "the downsides of ____"
- "____ economic impacts"

Rapid Research: Harmful Effects
Pick one of the computing innovations from the Computing Innovation Brainstorm Activity (either from the list or one that you wrote down) and see how quickly you can find a harmful effect that will work for the Explore PT. Fill in the table below with what you found
Computing Innovation:

Harmful Effects I found:	**Group of people of people affected:**

Is this primarily an impact on… ☐ **Society** ☐ **Economy** ☐ **Culture**	
Search Terms I used:	**Sites / Articles I found:**

Notes on groups of people, society, economy, culture:
- **culture** - can be thought of as a group of people: example – football players are a culture, students that have asthma are a culture
- **economy** - can be thought of as a group of people with similar economic interests, or whose jobs or or industry are similar. Example: (Netflix put companies like Blockbuster and rental places out of business)
- **society** - try to avoid "society". It's too broad. Get specific: Which society? Whose society?

Explore PT Planning Organizer

Innovation Name:

Facts about purpose and function:

Artifact Planning Ideas:

Explain one effect of the innovation.

Explain one beneficial effect (and the group affected, provide source)

Explain one harmful effect. (and the group affected, provide source)

Description of data used by innovation (specific type; describe how below)

Input (consume)

Process (transform)

Output (produce)

How does the artifact illustrate represent OR explain the innovation's purpose, function or effect?

Explain one data storage, privacy or security concern from misuse of innovation and/or its data

References:

1)

2)

3)

Explore PT Completion Timeline

Before you start, you should think about how you are going to allocate your time for the 8 hours provided for the task. Below is a sample timeline that you can use to plan out how you will complete the Explore Performance Task.

Hour	Suggested Activity	Your Plan
1	Brainstorm ideas for computing innovations ● Do rapid research to decide what to do ● Use the Explore PT Planning Organizer **Goal:** By the end of this day you should know what your innovation is and most of the sources you will cite	
2	Research and draft responses for prompts 2c, 2d: ● Use the Explore PT Organizer ● **2c** - Beneficial and Harmful Effects ● **2d -** How it uses data + security concern	
3	Continue work from Day 2 **Goal:** Finish responses **2c** and **2d**	
4	Create the computational artifact ● Use the PT Organizer to sketch an idea ● **Goal:** know what you're going to make for artifact and start it.	
5	● Continue work on computational artifact ● Draft response to **2a** - Intended purpose or function of innovation.	
6	Continue Comp. Artifact + **2a** **Goal:** Finish Comp. Artifact and response **2a**	
7	Review, clean up, touch up ● Complete **2e** - References ● Complete Response **2b** ● Make sure you have source cited for any fact or claim in **2a, 2c, 2d**	
8	Complete the task ● Review the submission materials ● Check your responses against the scoring guidelines ● Enter your responses into the digital portfolio ● Upload your computational artifact (and/or PDF of written responses to the the digital portfolio) **Goal:** At the end of this day, your Explore PT is submitted!	

Note: The timeline above is just a guideline. You may complete the performance task on a different schedule. Make sure to leave enough time to complete your computational artifact and write-up.

Explore PT Guidelines

To actually write your responses go to the Code.org Explore PT [Written Response Template](#)

Computational Artifact
Your computational artifact must provide an illustration, representation, or explanation of the computing innovation's intended purpose, its function, or its effect. The computational artifact must not simply repeat the information supplied in the written responses and should be primarily nontextual. Submit a video, audio, or PDF file.

Use computing tools and techniques to create one original computational artifact (a visualization, a graphic, a video, a program, or an audio recording). **Acceptable multimedia file types include .mp3, .mp4, .wmv, .avi, .mov, .wav, .aif, or .pdf format. PDF files must not exceed three pages. Video or audio files must not exceed 1 minute in length and must not exceed 30MB in size.**

Advice: The reality is that the computational artifact is a media artifact that you make on a computer that helps communicate information about what the innovation is and how it works. It doesn't need to be a static image/graphic but that's certainly the easiest and fastest thing to create and you need to consider time for this task. Try to capture the purpose *and* the functionality with whatever you create. At the very least, you should demonstrate what the innovation is or does, but you should be aiming to clarify the purpose and function of your innovation. You want to make something you can point to for your selected innovation, and say: *here is what it is, here is what it does, and here is how it works.*

Definition of Computational Artifact from the scoring guidelines: *A computational artifact is something created by a human using a computer and can be, but is not limited to, a program, an image, an audio, a video, a presentation, or a Web page file. The computational artifact could solve a problem, show creative expression, or provide a viewer with new insight or knowledge.*

A strong artifact will represent your written responses to 2a and 2d.
- In **2a** you describe the innovation's purpose - think: how can I represent that visually? (or with audio, video, etc.)
- In **2d** you describing how the innovation uses data, which is *really* describing its function - think: how can I represent that visually (or with audio, or video, etc.)
- After you make your artifact you can refer to it from your responses to 2a and 2d if that would help strengthen your explanation.

A few different types of artifacts
- Create a simple diagram, infographic, or flowchart that clarifies the way your innovation works
- Make a simple chart of information about your innovation that highlights its purpose
- Find (and cite) images of your innovation being used in a variety of contexts
- Make an animation or video using screen capture that demonstrates the purpose and function of the innovation
- Make a 1-minute audio recording (e.g. "podcast") about your innovation.

Computational Artifact Checklist:
- ❏ Name of innovation appears in the artifact
- ❏ Shows the purpose of the innovation
- ❏ Shows the function of the innovation
- ❏ Primarily non-textual (Labels on a diagram: ok. A slide with bullet list of text: not ok).
- ❏ Uses an acceptable file type. One of: .mp3, mp4, .wmv, .avi, .mov, .wav, .avi, .aif, or .pdf format.
  - ❏ PDF files must not exceed **3 pages** -- **Video** or audio files must not exceed **1 minute** in length
  - ❏ File is less than 30 Megabytes

Tips on software
- ❏ If at all possible, stay away from a .wav file for audio because they tend to be larger files.
- ❏ Also stay away from .aif files because they often aren't readable on PC's without specific paid plugins.

Prompt 2a. 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.

(Must not exceed 100 words)

Advice: This prompt requires you to state multiple pieces of information in only 100 words. Keep each section short and consider using a bulleted list.

Purpose and function are not the same. The purpose is the goal or objective that the innovation is designed to accomplish. The function is how the innovation accomplishes the purpose. The function is the actual "computing" done by the innovation, as in how it consumes, produces, or transforms data, to accomplish the purpose. Features of an innovation alone like "faster speeds" or "bigger screens" often do not fit well in either category.

Your computational artifact should should speak to and clarify the purpose or function of the innovation in some way, preferably with diagrams, images, or in other primarily non-textual ways. This written response should explain HOW your computational artifact goes about this.

You should cite references used for these responses, in particular the purpose and function of your innovation which were likely important parts of your research.

Potential Research Terms
- "How it works: _____"
- "The science behind _____"
- "The history of _____"
- "How does _____ work?"

2a. Response Checklist
- ❏ Name of Computing Innovation
- ❏ The purpose of innovation - the intended goal or objective of the innovation
- ❏ The function of innovation - how the innovation works (for example, consumes and produces data)
- ❏ How artifact describes purpose, function and / or effect of the innovation
- ❏ Not exceed 100 words
- ❏ Cite any references used

2b. 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 the tools and techniques will understand your process
(Must not exceed 100 words)

Advice: NOTE: This response is not scored, but you can use this section to cite any sources used in the creation of your computational artifact.
- All images, diagrams, or information that appears in your computational artifact and that you yourself did not make should appear both in your citations and within this response.
- Also, by briefly describing the tool used to make the artifact and how you went about it can further help verify that you are the author of your artifact and did not merely submit someone else's work.

2b. Response Checklist
❏ Describe the tool you used
❏ Describe the development process
❏ Mention if it's a new artifact or combining artifacts
❏ Cite sources for artifacts used
❏ Must not exceed 100 words

2c. Explain at least one beneficial and one harmful effect the computing innovation has had, or has the potential to have, on society, economy, or culture.
(Must not exceed 250 words)

Advice: Usually the beneficial effect is easy to identify - it's often the reason the innovation was created in the first place. A "harmful effect" should be an *unintended consequence* of the innovation being used the *way it was intended*. Focus on how the innovation, even when used correctly, will negatively impact some group of people, either culturally or economically. And cite sources to back up these claims.

Understand and focus on society/economy/culture (think about a group of people who may be impacted):
● **culture** - can be thought of as a group of people: example – football players are a culture, students that have asthma are a culture
● **economy** - can be thought of as a group of people with similar economic interests, or whose jobs or or industry are similar. Example: (Netflix put companies like Blockbuster and rental places out of business)
● **society** - try to avoid saying "impacts to society...". It's too broad. Get specific: Which society? Whose society?

Data security and privacy concerns are NOT "harmful effects" by this definition. The fact that autonomous cars, online banking, or social media can be hacked is NOT an example of a harmful effect since these are examples of the innovations being used differently than they were intended.

You also must explicitly use the terms "beneficial" and "harmful" (or words close to those) in your response. Do not make the grader guess - just directly state the benefits and harms and the groups affected. You must explicitly tie each effect to a group of people and say what the effect is on society, economy, or culture.

Research Tip: Since you need to identify the beneficial and harmful effects to specific elements of society and people, you might kick off your research by searching for things like:

● "The unintended consequences of ____"
● "pros and cons of ____"
● "the downsides of ____"
● "____ economic impacts"
● "The ethics of _____"
● "Legal concerns about _____"

NOTE: you may find articles with these searches that are also a fit for security concerns below.

2c. Response Checklist
❏ Use maximum of 250 words. (Try 2 paragraphs: 1 for the beneficial and 1 for the harmful effect)
❏ Clearly stated one beneficial effect AND one harmful effect
  ❏ Why it is a beneficial or harmful effect
  ❏ Who (the group) benefiting or being harmed
❏ Is the harm *really* a data security/privacy/concern? If so, rethink.
❏ DO NOT USE THESE for harmful or beneficial effects: (1) Hacking (2) Cost (3) Your personal opinion
❏ Cite your sources for where you found the beneficial and harmful effects.

2d. Using specific details, describe:
- The data your innovation uses;
- How the innovation consumes (as input), produces (as output), and/or transforms data; and
- At least one data storage concern, data privacy concern, or data security concern directly related to the computing innovation.

(Must not exceed 250 words)

Advice: If you have identified an actual computing innovation, then it's using data somehow — you just need to describe it. Think: what is actually being computed here? Think about or find through research: at the deepest level, what is the actual data (the actual numbers) that the innovation uses to do its thing? Don't just say what data is collected or how it's collected, but describe how it *uses* the data and *what it does with the data,* what it *computes* to achieve some effect. Your response should allow a reader to fill in the blanks: *it takes this ____ data, and does ____ to produce ____.*

Avoid describing the *device* that captures data. A camera is not data. A digital image is.

For a data security concern, think: what could happen if this data fell into the wrong hands, or were used for something besides the intended use. Could individuals be identified without their knowing it? Could someone or some organization in possession of all this data do something bad with it?

Research Tips

For how it uses data try searching:
- "How it works: _____"
- "How does ____ work"
- "The science behind _____"

For security concerns try searching:
- "____ and your privacy (or security)"
- "Risks of using _____"

2d. Response Checklist

- ❏ Describe the data the innovation uses as input
    - ❏ Make your description of the data as specific and digital as possible. Explain the actual file types (e.g. .mp3 or .jpg) used by the innovation or the type of binary data used (e.g. numeric, string, rgb pixel)
- ❏ Describe how the innovation transforms data and produces output
    - ❏ Make your description as specific as possible. Describe the way the input data is used in calculations or transformed (e.g. by an algorithm).
    - ❏ Make your description of the output data as specific and digital as possible. Explain the actual file types (e.g. .mp3 or .jpg) produced by the innovation.
    - ❏ If the output of the innovation is user-facing (e.g. images on a screen, sound from a speaker, a message sent to a phone) you may SEPARATELY include that information as well.
- ❏ Describe one data security, data privacy, or data storage concern
- ❏ Cite a source for where you found info about (1) how it works (2) security concern
- ❏ 250 word limit

2e. Provide a list of at least three online or print sources used to create your computational artifact and/or support your responses through in-text citation 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 complete and 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.
- Include in-text citations for the sources you used.
- Each source must be relevant, credible, and easily accessed.

Advice: It's most likely you're doing research on the web and you'll need to cite a bunch of websites as your sources. You can use any citation format you like, or prefer (especially if your teacher has a particular preferred style). We recommend listing citations as a numbered list with a standard MLA format that includes the website URL (see below for template in: *Draft Your Response Here*)

There are a number of websites out there that will generate citations for you, but just make sure they're actually including all the info you need. If you need to cite or print other sources, generally the format is roughly the same but you should look up a good way to do it. Here is a decent guide http://www.bibme.org/mla The task requires a minimum of 3 sources, but it shouldn't be hard to include more.

Make sure that after you created your numbered citation list, that you go back into your written responses and add the correct number at the end of a sentence or paragraph to indicate the source of the information. **You should cite any fact or claim** that you make in written responses. You may use the same source for some of these but there are roughly at least 6 claims you need to make *plus* anything included in your computational artifact:

1. Purpose of the innovation
2. Function of the innovation
3. Beneficial effect (including group affected)
4. Harmful effect (including group affected)
5. How it uses data
6. Data security/privacy concern
7. Computational artifact sources

Wherever you state your claim in the written response you should have a citation at the end of the sentence or paragraph. Something like:

> *This innovation has a potentially harmful economic impact for workers in the _____ industry because it encourages consumers to _____ rather than _____* **[5]**

2e. Response Checklist
- ❏ You have at least 3 sources cited
- ❏ You've cited the source for *any* image or other element you used in your computational artifact (and list which ones in response 2b).
- ❏ You've included references to your sources from *within* the text of the written responses 2a-d where appropriate.

Unit 6 Lesson 3

Explore PT - Complete the Task (8 hours)

Resources

Explore PT - Teacher Guidelines for Completing the Through-Course Assessment

Student Guidelines

You must:
- be aware of the task, timeline, components and scoring criteria.

It is recommended that students:
- follow a timeline and schedule for completing the performance task;
- seek clarification from your teacher or AP Coordinator pertaining to the task, timeline, components, and scoring criteria;
- seek clarification from your teacher or AP Coordinator regarding submission requirements;
- allow your own interests to drive your choice of computing innovation and program;
- as needed, seek assistance from your teacher or AP Coordinator in defining your focus and choice of topics;
- use relevant and credible sources to gather information about your computing innovation when completing the Explore performance task;
- seek assistance from your teacher resolve technical problems that impede work, such as a failing workstation or difficulty with access to networks, or help with saving or making movie;

Students may not:
- submit work that has been revised, amended, or corrected by another individual, with the exception of cited program code;
- submit work from a practice performance task as your official submission to the College Board to be scored by the AP Program; or
- seek assistance or feedback on answers to prompts.

Administering the Task: Role of the Teacher

Teachers must:
- provide 8 classroom hours to complete this task; and
- ensure students are aware of the task, timeline, components, and scoring criteria.

To meet these requirements, it is recommended that teachers:
- suggest a timeline and schedule for students for completing the performance task and monitor students' progress;
- clarify directions for a component of a performance task when students do not understand the directions;
- remind students about submission requirements;
- allow students' interests to drive their choice of computing innovation;
- assist students in defining their focus and choice of topics prior to them beginning their investigation without making selections for them (e.g., by asking questions);
- remind students to use relevant and credible sources to gather information about their computing innovations;
- assist in resolving technical problems that impede work, such as a failing workstation or difficulty with access to networks, or to help with saving files;
- wait until after students' performance tasks have been completed and submitted to the AP Digital Portfolio before providing feedback on those tasks if they are being considered as part of the class grade;
- advise students that they may not revise their work once they have completed and submitted their work to the AP Digital Portfolio; and
- inform students that the scoring process that occurs in the AP Reading is different from the one that may be used in a classroom setting; the AP score that students receive may be different than their classroom grade.

These guidelines are adapted from the 2016-17 Course and Exam Description for CS Principles

Explore PT - Teacher Guidelines for Completing the Through-Course Assessment

C O D E

Teachers may not:
- assign, provide, or distribute specific topics to students;
- write, revise, amend, or correct student work;
- allow students to submit computational artifacts from practice performance tasks as a submission for AP scoring; or
- suggest answers or provide feedback on answers to prompts.

In addition, teachers should:

- Provide students with the meaning and purpose of creating a computational artifact. A computational artifact is a visualization, a graphic, a video, a program, or an audio recording that students create using a computer. The creation of an artifact could solve a problem, show creative expression, or provide the viewer with new insight or knowledge.
- Discuss the criteria for a well-chosen computing innovation (i.e., an innovation that depends on computing [or computing tools] to de ne its functionality).
- Guide students in clearly de ning bene cial and harmful effects of various computing innovations.
- Inform students that a computing innovation that has a meaningful personal or community emphasis is an appropriate choice, as long as it ful lls the requirement to have an impact on society, economy, and culture.
- Provide instruction and multiple opportunities for students to practice searching and evaluating sources relevant to computing innovations. All sources cited must be relevant, credible, and easily accessible.
- Instruct students to ensure their written responses are based on relevant and credible sources. Students can search for print or nonprint sources as part of their investigation. In addition, students should ensure appropriate citation of sources being quoted in a written response. Students can reference a journal, Web page, or expert that is being quoted as part of a written response.
- Instruct students to ensure appropriate citation of sources used in the creation of their computational artifact. Sources that should be cited include images, graphs, and program code that are used in the creation of their artifact.
- Discuss the use of computational tools that can be used to create effective computational artifacts.
- Discuss artifacts that are effective and ineffective.

Explore PT - Written Response Template

[Assessment Overview and Performance Task Directions for Students](#)

Computational Artifact

Prompt 2a. 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.

(Must not exceed 100 words)

2b. 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 the tools and techniques will understand your process

(Must not exceed 100 words)

Computing Innovation

2c. Explain at least one beneficial and one harmful effect the computing innovation has had, or has the potential to have, on society, economy, or culture.
(Must not exceed 250 words)

2d. Using specific details, describe:
- The data your innovation uses;
- How the innovation consumes (as input), produces (as output), and/or transforms data; and
- At least one data storage concern, data privacy concern, or data security concern directly related to the computing innovation.

(Must not exceed 250 words)

References

2e. Provide a list of at least three online or print sources used to create your computational artifact and/or support your responses through in-text citation 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 complete and 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.
- Include in-text citations for the sources you used.
- Each source must be relevant, credible, and easily accessed.

Export or save this document as a PDF and turn in to the AP Digital Portfolio.