**Level 1: Charles Babbage & Ada Lovelace**

1. **Who was Charles Babbage?**
   1. When and where was he born?

Charles Babbage was born December 26, 1791 in London, United Kingdom

* 1. **What was his main contribution to computer science?**

He designed the first automatic computer engines. He invented the computers but failed to put them together. The first complete Babbage computer was built in 2002 (153 years later).

1. **What is the "Difference Engine" proposed by Charles Babbage?**
   1. **What did it do?**

It was a like a basic calculator using polynomials and coefficients but was only able to find the difference between equations.

* 1. **How did it work?**

Numbers had to be entered manually and the user had to turn a crank to get the answer.

* 1. **How was it similar to modern computers?**

It is similar to basic calculators that can also be looked at as smaller or less powerful computers. Both are able to get answers for basic math equations but you have to enter the numbers manually in the difference engine and you just push buttons in a calculator. A calculator can also solve more complex equations than the difference machine.

1. **Who was Ada Lovelace?**
   1. **When and where was she born?**

Ada Lovelace was born on December 10, 1815 in London, United Kingdom

* 1. **What was his main contribution to computer science?**

She contributed to help develop and finish Charles Babbage’s Analytical Engine after his death in 1871.

* 1. **What is the computer language that is named after her?**

The computer language named after her is Ada. It can be used for a wide variety of things like missile control to payroll processing to air traffic control.

1. **What is the "Analytical Engine" worked on by Ada Lovelace?**
   1. **What did it do?**

It was the world’s first general purpose computer and had basic computer concepts that are still used today. It was made to be able to answer more complex equations compared to the difference machine. It was also able to make basic t-shirt designs by entering text or shapes through and receiving it printed. It was meant to be the second generation or version to the difference engine but more complex and better.

* 1. **How did it work?**

Basic input and output devices were made. Babbage also invented a basic printer as an output device. It also included basic computer components that are used today (CPU, memory). A “reader” was a basic input device to enter information.

* 1. **How was it similar to modern computers?**

It included similar add-ons and components that are used today such as a printer, CPU and memory. It also included basic input and output devices. basic designs or art was also made on the analytical engine similar to applications on computers like paint or Photoshop.

**Level 2: Alan Turing**

1. **Who was Alan Turing?**
   1. **When and where was he born?**

Alan Turing was born June 23, 1912 in Maida Vale, United Kingdom

* 1. **What was his main contribution during World War II?**

During WWII the Germans created a communication machine (enigma) and thought it was an unbreakable code. They thought it was a secret way to communicate without letting their enemy or an outsider know about their plans and intentions and tried to hide it for as long as possible. Alan Turing along with code breaker Gordon Welchman created a machine known as the Bombe. Using the Bombe, the 2 code breakers were able to decipher the enigma code.

* 1. **What were his main contributions to computer science after World War II?**

He theorized Artificial Intelligence. He thought of the idea whether machines can think or not. Turing was thinking ahead of his time because general computers were just released and machines thinking was the future. After Turing’s death, his thoughts and ideas were still thought about by others. In 1951, Turing created the imitation game, a test that an AI would have to pass in order to be considered good or well-functioning. He predicted that by 2001, AI will be able to pass the test.

1. **What is the "Enigma" that Alan Turing worked on during World War II?**
   1. **What was the "Enigma code" used by the Germans and how did it work?**

The Enigma was a type of enciphering machineused by the German forces to send messages securely and secretly. Inside the enigma machine, the alphabet is listed and the user types their message. Each letter is encrypted to a different letter of the alphabet so the user would have to type different letters to make a clear word. For example, if someone wanted to type hello, they might have to spell it anffe.

* 1. **Why was it so important for Britain to "crack" the Enigma code?**

The Britain were able to find out the plans the Germans had without the Germans knowing so they were one step ahead of them.

* 1. **How did Alan Turing solve the puzzle?**

Alan Turing joined forces with another code breaker, Gordon Welchman and they created a machine known as the Bombe. Using the Bombe, the 2 code breakers were able to decipher the enigma code.

* 1. **Why was Turing's work kept top secret?**

Churchill anticipated the cold war and he didn’t want any advanced code breaking methods get into the hand of the soviet or other enemies. If the news was released to the public, the Germans would also receive it and try to advance their methods or change the enigma code into something more complex.

1. **Many people call Alan Turing the "Greatest Unknown Hero of World War II". Provide some examples of the impact of his work that would support this claim.**

Most of his work was unknown or hidden from the public until after his death. For example, when he decoded the enigma, it was hidden from the public and they didn’t realize or know how much he helped allies. Without the enigma hack, the Germans probably would be one step ahead of the allies. Because of his most famous or biggest accomplishment in his life being secret until after his death, his work was unknown for a couple of years.

1. **How did being gay affect Alan Turing's life and work as a computer scientist?**
   1. **How did being gay affect his work during World War II?**

Turing married hut-8 colleague Joan Clarke in 1941. Their marriage didn’t last long after Turing admitted to being gay and that he couldn’t go through it because of the marriage. In the 40’s, being homosexual wasn’t really accepted in society and laws prohibited it. Turing decided to admit his homosexuality because he felt guilty hiding the truth.

* 1. **How did being gay affect his work after World War II?**

Turing wasn’t really accepted in society and was probably targeted more because of his homosexuality. On January 23, 1941, Turing’s house was robbed. After reporting it to the police, they arrested him and the thieves and they were charged with gross indecency. Turing’s conviction his security clearance being removed and he was unable to work with the cryptographic consultancy for the government communications headquarters. he was also denied entry into USA because of his conviction.

* 1. **How did Alan Turing's life end?**

Alan Turing committed suicide on June 8, 1954, to cyanide poising. It is still unknown whether he inhaled fumes from the lab next to him or if he had eaten a poisoned apple because a half-eaten apple was right next to him.

1. **Many people call Alan Turing the "Father of Computer Science". Provide some examples of the impact of his work that would support this claim.**

Turing started algorithms and computations with his invention, the Turing machine, created in 1936. The Turing machine can simulate any sort of computer algorithm. This formed a base for modern computer designs because of how easily they can solve problems. He also developed a machine during WWII to crack the enigma code. He also set the base for modern style artificial intelligence

**Level 3: Other Great Contributors**

1. **Who was John von Neumann?**
   1. **When and where was he born?**

John von Neumann was born on December 28, 1903 in Budapest, Austria-Hungary

* 1. **When and why did he move to America?**

He moved to America in 1933 when he was offered a lifetime job at the faculty of the institute for advanced study in New Jersey. He was offered the job because the offer to the previous worker fell through and they needed a worker

* 1. **What was his contribution to mathematics & science?**

The gaming theory field was his main contribution. He also worked on important steps with the nuclear physics and involving thermonuclear reactions and hydrogen bombs.

* 1. **What was his contribution to computer science?**

He contributed important ideas to the US army’s ENIAC computer. He helped modify the computer to run as a stored program machine. He also helped Alan Turing work on artificial intelligence.

1. **What was the "ENIAC" computer and the "von Neumann Machine"?**
   1. **What did it do and how did it work?**

The ENIAC is short for electro numerical integrator and computer. It was the world’s first programmable electronic digital computer. It was created during WWII in USA. It was originally designed for computing values of artillery range. It was also used for communicating using plug boards. This was better because it was quicker and more efficient.

* 1. **How is it related to modern computers?**

It is fully electronic and can complete complex sequences of operations through programming similar to modern computers.

* 1. **Explain how a "von Neumann Machine" applies to modern PCs.**

A von Neumann Machine is referring to the early computers created by Neumann. It had three components that are still used today, a CPU, a hard drive and a RAM. A Neumann Machine was basically the base of modern computers in a way

1. **Who was Grace Hopper?**
   1. **When and where was she born?**

Grace Hopper was born on December 9, 1906 in New York City, USA

* 1. **What were some of her contributions to computer science?**

She was a pioneer in the development of Computer technology. She also helped with the UVINAC I, the first commercial electronic computer, she helped with naval applications for COBOL (common business oriented language)

1. **What was the "COBOL" computer language that Hopper helped to develop?**
   1. **How was COBOL different from other computer languages of the time?**

It was the first computer language similar to English. It was mostly for business use

* 1. **Is COBOL still in use today? Explain your answer.**

COBOL is still active today. In 2012, surveys found that 60% of organizations still use COBOL and half of those have COBOL as for their internal software.

1. **Who is Tim Berners-Lee?**
   1. **When and where was he born?**

Tim Berners-Lee was born on June 9, 1955 in London, England

* 1. **Why was he knighted by Queen Elizabeth II?**

He was knighted in 2004’s new year honors for the global development of the internet.

* 1. **What is his contribution to computer science?**

He proposed an information management system in March 1989, and he implemented the first successful communication between a hypertext transfer protocol (HTTP)and a server using the internet in November 1989.

1. **List some ways that your life would be different if Tim Berners-Lee did not invent the World Wide Web.**

* Information
  + No online websites
  + We would still rely on books
* Communication
  + No social media
  + No class sites
* No websites
  + Billions of websites on the internet with all types of information wouldn’t be here

**Level 4: Presentation**

Pick one of the above "heroes" of computer science and prepare a brief presentation about their life and contributions.

Your presentation will be shared with other students in the class in a "trade show" format. (When we return form Christmas break.)

Your presentation should be shared with Mr. Nestor through Google Docs or via email at p0079141@pdsb.net.