**Mod C.7 Heroes Of Computing**

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

1. Who was Charles Babbage?

a. When and where was he born?

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

b. What was his main contribution to computer science?

Charles Babbage’s main contribution to computer science was the Difference Engine which was completed in 1830’s. He was also known for the Analytical Engine. His computers were one of the first in history.

2. What is the "Difference Engine" proposed by Charles Babbage?

a. What did it do?

The Difference Engine was an automatic mechanical calculator. . It was able to do simple calculation like addition and multiplication, but it was also able to do more complex functions. The machine could create tables of results of up to seven-degree polynomial functions. It was designed to calculate and tabulate polynomial functions.

b. How did it work?

The question would be put into the machine, the lever would be turned and the answer would come out.

c. How was it similar to modern computers?

The Difference Engine and todays computers can both do complex math function and solve polynomials.

3. Who was Ada Lovelace?

a. When and where was she born?

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

b. What was his main contribution to computer science?

Ada Lovelace’s main contribution was that she worked further to improve Charles Babbage’s machine. Although, it was him who made the Analytical Engine she was the one who worked on it to make it into the best it could be.

c. What is the computer language that is named after her?

The computer language named after Ada Lovelace was called ‘Ada’. The language was developed for the U.S. Department of Defense for large-scale programming in the early 1980’s.

4. What is the "Analytical Engine" worked on by Ada Lovelace?

a. What did it do?

The Analytical Engine was a general-purpose computing machine. The machine is capable of performing any calculation set before it.

b. How did it work?

The machine was made up of four parts; the mill, the store, the reader and the printer. The mill was the calculating unit, the store was where the data was, the reader was the input and the printer was the output. The machine was stem-driven and run by one attendant.

c. How was it similar to modern computers?

The four parts of the Analytic Engine then are all parts that are in a computer today. The mill is today's CPU, the store is todays storage and memory, the reader and printer are today's input and output.

**Level 2: Alan Turing**

1. Who was Alan Turing?

a. When and where was he born?

Alan Turing was born on June 23, 1912 in Maida Vale.

b. What was his main contribution during World War II?

During WWII Alan Turing developed a computer that helped break the German Enigma code.

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

He created the Turing Test, which examined a computer's ability to perform and communicate like a human.

2. What is the "Enigma" that Alan Turing worked on during World War II?

a. What was the "Enigma code" used by the Germans and how did it work?

It was a machine developed by Arthur Scherbius, which the Germans used to send secret messages to each other during the second World War. Since they thought it was unbreakable it was used for all types of communication, such as by their military on battlefields, the navy in the sea, the air force in the sky and by their secret services. It was designed in a way that only they would be able to understand it. One would type a message into the machine, which would then be scrambled using 3 to 5 notched wheels or rotors, this displayed different alphabetical letters. Everyone would be aware of the setting that is being used that day so that they can reconstruct the code and get the message.

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

It was important for Britain to crack the Enigma code because they were losing the war and this was the only to win. They could use this as an advantage because once they broke it they would know what the Germans were planning and the British would always be a step ahead and prepared for the German’s every move.

c. How did Alan Turing solve the puzzle?

Alan Turing and his team invented a machine known as the Bombe. One day he found a flaw in the German encrypted messages, this flaw helped encrypt every Enigma message.

“Suppose you wanted to encrypt a message that contained a total of 3 words. The first word of the message was, let’s say, ‘SCIENCE’. Now, the first letter that you would want to encrypt is ‘S’, so when you press the ‘S’ key on the keyboard of the Enigma Machine, an electric signal was generated that traveled through a lot of wires and rotors and ultimately lit up a different letter (say, ‘M’). So the ‘S’ in ‘SCIENCE’ would be encrypted as ‘M’.

Similarly, the other words would be encrypted as different letters than they actually were. On one end of the Enigma Machine, you typed ‘SCIENCE IS AWESOME’, but the encrypted output might have looked something like ‘MKSQER PO QAPEKRQ’, or something entirely different.”

<https://youtu.be/V4V2bpZlqx8>

**https://www.scienceabc.com/innovation/cracking-the-uncrackable-how-did-alan-turing-and-his-team-crack-the-enigma-code.htm**

d. Why was Turing's work kept top secret?

Alan Turing's work was kept top secret because the British did not want the Germans to know that they had caught onto them and that the reason they won the war was because they broke the Enigma code.

3. 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.

The reason Alan Turing is called the “Greatest Unknown Hero of World War ll” is because he made a huge contribution to the war which was not recognized until years after. If he had not of used his mathematic and other skills to break the code we would not have won the war and the results would have been completely different. He basically turned around the face of the world that day. It was due to the messages tegh Germans were communicating that the British could stop them before they did something which would cause the British and its allies to lose the second world war and many other things.

4. How did being gay affect Alan Turing's life and work as a computer scientist?

a. How did being gay affect his work during World War II?

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

In 1952 Turing was arrested because homosexuality was illegal in Britain and Turing was in a relationship with a 19 year old man. He was given the option to either serve a year in prison or undergo a treatment which would “fix” his sexual orientation. He took the treatment but was left with many side effects. His reputation was greatly damaged which lead him to being disqualified from his government position as a code-breaker.

c. How did Alan Turing's life end?

Turing was shown as a horrible man in the public and the government cut all ties with him this drove him to take in own life on june 7, 1954 by taking cyanide.

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

Alan Turing is called “Father of Computer Science” because of his groundbreaking work. He broke one of the most important code for the british, the Enigma code. He also invented one of the first computers which helped break the code in World War II. He wrote a lot of artificial intelligence and came up with a test that tested an AI computer’s human abilities.

**Level 3: Other Great Contributors**

1. Who was John von Neumann?

a. When and where was he born?

He was born on December 28, 1903 in Budapest, Hungary and passed away on Feburary 8, 1957, Washington, D.C., U.S.

b. When and why did he move to America?

John von Neumann moved to America in 1930 due to its various job opportunities. He began to work as a mathematics professor at Princeton, New Jersey where he began his job in 1933 and continued until death.

c. What was his contribution to mathematics & science?

He developed a field of cellular automata with any use of computers. He spread colorants on the polar ice caps and enhance absorption of solar radiation, which raised global temperature, which came from his idea of manipulating the environment.

He contributed the minimax theorem of 1928 to mathematical economics. He also had a part in post-war economic theory. His publishment of“Theory of Games and Economic Behaviour” in 1944 talked about the mathematical theory of economic and social organization, which was based on a theory of games of strategy.

d. What was his contribution to computer science?

Von Neumann contributed a new understanding of how practical fast computers should be organized and built; these ideas, often referred to as the stored-program technique, became fundamental for future generations of high-speed digital computers and were universally adopted. The von Neumann architecture is a design model for a stored-program digital computer that uses a processing unit and a single separate storage structure to hold both instructions and data.

2. What was the "ENIAC" computer and the "von Neumann Machine"?

a. What did it do and how did it work?

The ENIAC was the first programmable general purpose electronic digital computer. It came out during WWII on the U.S. government orders. The computer was made for the government and for their projects. The von Neumann Machine was a stored program computer and is the basic design of all modern computers.

b. How is it related to modern computers?

They are related because the contain the same but more basic components of computers today.

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

The von Neumann Machine uses a many components that are in modern computers,such as a processing unit and a single separate storage structure to hold both instructions and data. This is why it is said that modern computers are related to the machine, they used the same concept storage programs.

3. Who was Grace Hopper?

a. When and where was she born?

She was born on December 9, 1906 in New york City, New York, United States.

b. What were some of her contributions to computer science?

She invented a compiler, the intermediate program that translated the English language instructions into the language of the target computer. This was what led to the COBOL language. She also assisted with the ENIC under ARMY contracts and the UNIVAC (Universal Automatic Computer).

4. What was the "COBOL" computer language that Hopper helped to develop?

a. How was COBOL different from other computer languages of the time?

It was different because it was written in a language close to English, making it a bit easy to understand.

b. Is COBOL still in use today? Explain your answer.

Cobol is still used today in business, finance and administrative systems for companies and governments. It is used in legacy applications that are already existing. It is in applications that are deployed on mainframe computers.

5. Who is Tim Berners-Lee?

a. When and where was he born?

He was born on June 8, 1955 in London, United Kingdom.

b. Why was he knighted by Queen Elizabeth II?

He was knighted because of his work toward developing the internet on a global basis.

c. What is his contribution to computer science?

He invented the World Wide Web (www), which was created in 1989. It is an Internet-based hypermedia, where information can be shared globally while at CERN, he created this in the the European Particle Physics Laboratory.

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

We might not be able to use the internet universally and contact people across the globe. This may limit us to using only our national web browsers. Communication may be limited and important news events may reach some people very late depending on where the event occurred and how far you are. Our information resources would also be limited, which limits the knowledge and information one receives. This would also impact our understanding of other people, cultures, religions and nations.

**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.