Name

Directions: Read the Article about Computer Chronicles and answer the questions at the end of the article in your own words based on the information you have just read.

The Computer Chronicles

*I*n the beginning ...

A generation refers to the state of improvement in the development of a product. This term is also used in the different advancements of computer technology. With each new generation, the circuitry has gotten smaller and more advanced than the previous generation before it. As a result of the **miniaturization**, **speed**, **power**, and **memory** of computers has proportionally increased. New discoveries are constantly being developed that affect the way we live, work and play.

*T*he First Generation: <u>1946-1958</u> (The Vacuum Tube Years)
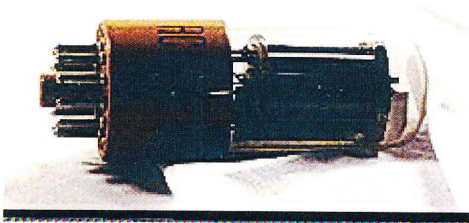
The first generation computers were huge, slow, expensive, and often undependable. In **1946** two Americans, Presper **Eckert**, and John **Mauchly** built the **ENIAC** electronic computer which used vacuum tubes instead of the mechanical switches of the **Mark I**. The ENIAC used thousands of vacuum tubes, which took up a lot of space and gave off a great deal of heat just like light bulbs do. The ENIAC led to other vacuum tube type computers like the **EDVAC** (Electronic Discrete Variable Automatic Computer) and the UNIVAC I (UNIVersal Automatic Computer).

The vacuum tube was an extremely important step in the advancement of computers. Vacuum tubes were invented the same time the **light bulb** was invented by Thomas Edison and worked very similar to light bulbs. It's purpose was to act like an *amplifier* and a *switch*. Without any moving parts, vacuum tubes could take very weak signals and make the signal stronger (*amplify it*). Vacuum tubes could also stop and start the flow of electricity instantly (*switch*). These two properties made the ENIAC computer possible.

The ENIAC gave off so much **heat** that they had to be cooled by gigantic air conditioners. However even with these huge coolers, vacuum tubes still overheated regularly. It was time for something new.

*T*he Second Generation: <u>1959-1964</u> (The Era of the Transistor)

The transistor computer did not last as long as the vacuum tube computer lasted, but it was no less important in the advancement of computer technology. In 1947 three scientists, **John Bardeen**, **William Shockley**, and **Walter Brattain** working at **AT&T's Bell Labs** invented what would replace the vacuum tube forever. This invention was the **transistor** which functions like a vacuum tube in that it can be used to relay and switch electronic signals.
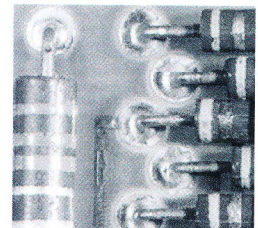
There were obvious differences between the transistor and the vacuum tube. The transistor was faster, more reliable, smaller, and much cheaper to build than a vacuum tube. One transistor replaced the equivalent of <u>40 vacuum tubes</u>. These transistors were made of solid material,

some of which is **silicon**, an abundant element (second only to oxygen) found in beach sand and glass. Therefore they were very cheap to produce. Transistors were found to **conduct electricity faste**r and **better** than vacuum tubes. They were also much **smaller** and gave off virtually **no heat** compared to vacuum tubes. Their use marked a new beginning for the computer. Without this invention, space travel in the 1960's would not have been possible. However, a new invention would even further advance our ability to use computers.

he Third Generation: 1965-1970 **(Integrated Circuits - Miniaturizing the Computer)**
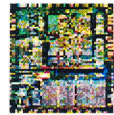
Transistors were a tremendous breakthrough in advancing the computer. However no one could predict that thousands even now millions of transistors (circuits) could be compacted in such a small space. The **integrated circuit**, or as it is sometimes referred to as **semiconductor chip**, packs a huge number of transistors onto a single **wafer** of **silicon**. **Robert Noyce** of **Fairchild Corporation** and **Jack Kilby** of **Texas Instruments** independently discovered the amazing attributes of integrated circuits. Placing such large numbers of transistors on a single chip vastly increased the power of a single computer and lowered its cost considerably.

Since the invention of integrated circuits, the number of transistors that can be placed on a single chip has **doubled** every **two** years, shrinking both the size and cost of computers even further and further enhancing its power. Most electronic devices today use some form of integrated circuits placed on printed **circuit boards**-- thin pieces of **bakelite** or **fiberglass** that have electrical connections etched onto them -- sometimes called a **mother board**.

These third generation computers could carry out instructions in billionths of a second. The size of these machines dropped to the size of small file cabinets. Yet, the single biggest advancement in the computer era was yet to be discovered.
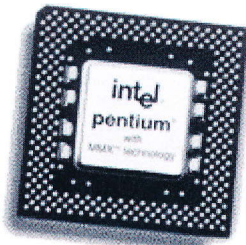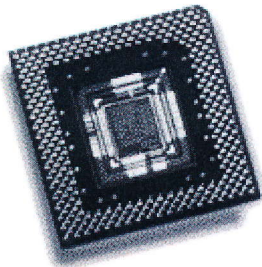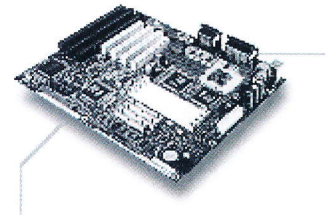
he Fourth Generation: 1971-Today **(The Microprocessor)**

This generation can be characterized by both the jump to **monolithic integrated circuits**(**millions** of **transistors** put onto one integrated circuit chip) and the invention of the **microprocessor** (*a single chip that could do all the processing of a full-scale computer*). By putting millions of transistors onto one single chip more calculation and faster speeds could be reached by computers. Because electricity travels about a foot in a billionth of a second, the smaller the distance the greater the speed of computers.

However what really triggered the tremendous growth of computers and its significant impact on our lives is the invention of the **microprocessor**. **Ted Hoff**, employed by **Intel** (**Robert Noyce's** new company) invented a chip the size of a pencil eraser that could do all the computing and logic work of a computer. The microprocessor was made to be used in calculators, not computers. It led, however, to the invention of personal computers, or microcomputers.

It wasn't until the 1970's that people began buying computer for personal use. One of the earliest personal computers was the **Altair 8800 computer kit**. In **1975** you could purchase this kit and put it together to make your own personal computer. In **1977** the **Apple II** was sold to the public and in **1981 IBM** entered the **PC** (*personal computer*) market.

Today we have all heard of **Intel** and its **Pentium**® Processors and now we

know how it all got started. The computers of the next generation will have millions upon millions of transistors on one chip and will perform over a **billion calculations** in a single **second**. There is no end in sight for the computer movement.

Questions for Computer Chronicles

1. In each of the **4 generations** what was the cause for the increase of **speed**, **power**, or **memory**?

2. Why did the **ENIAC** and other computers like it give off so much **heat**? (Be very specific)

3. What **characteristics** made the **transistors** better than the **vacuum tube**?

4. What did the *microprocessor* allow the computers to do? and What was the *microprocessor's* original purpose?

5. When was the **first computer** offered to the public and what was its name?

6. What was **Robert Noyce** and **Jack Kilby** known for?

7. **Intel** was started by who?

8. What is **monolithic integrated circuits**?

9. How do you think society will be different if scientists are able to create a chip that will perform a **trillion** operations in a **single second**?

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Next assignment is "The Internet"