

# Computer Pioneers

**Instructions:** Match the following questions with the letter of the person who best fits the question. All the letters can be used more than once or not at all.



- \_\_\_\_\_ 1. Who designed the Mark I computer?
- \_\_\_\_\_ 2. Who wrote the Operations Manual for the Mark I?
- \_\_\_\_\_ 3. In whose garage was the first Apple computer manufactured?
- \_\_\_\_\_ 4. For whom is the computational laboratory at Harvard University named?
- \_\_\_\_\_ 5. Who first introduced the idea of calculating using a computer program?
- \_\_\_\_\_ 6. Who sold his Volkswagen to obtain money to start a computer company?
- \_\_\_\_\_ 7. What high ranking Navy Officer played a major role in developing COBOL?
- \_\_\_\_\_ 8. What computer pioneer said "I am a simple man and I want simple answers"?
- \_\_\_\_\_ 9. What Indianapolis native approached IBM with an idea for their first computer?
- \_\_\_\_\_ 10. What computer pioneer retired from the US Navy in 1986 at the rank of Rear Admiral?
- \_\_\_\_\_ 11. Who sold his Hewlett-Packard calculator to obtain money to start a computer company?
- \_\_\_\_\_ 12. What early computer pioneer worked on the Manhattan Project to build an atomic bomb?
- \_\_\_\_\_ 13. What computer pioneer was one of Princeton University's first professors in their new School of Mathematics?
- \_\_\_\_\_ 14. What two computer pioneers found a common interest in computers at the Homebrew Computer Club?
- \_\_\_\_\_ 15. What computer pioneer spent three years developing a new computer language while working for IBM?
- \_\_\_\_\_ 16. Who was the programmer who went to work for IBM in 1950 and who played a major role in developing FORTRAN?
- \_\_\_\_\_ 17. Whose 1945 description of a computer included a central processing unit, memory and a connection between the two?
- \_\_\_\_\_ 18. What Columbia University graduate developed the first system to translate near-English instruction into a machine language?
- \_\_\_\_\_ 19. What Vassar College Graduate encouraged innovation and has been known to advise, "It is easier to apologize than ask permission"?
- \_\_\_\_\_ 20. What computer inventor went back to college to earn a BS degree in Computer Science after he made millions of dollars inventing & selling computers?

- A. Howard Aiken
- B. John Backus
- C. Grace Hopper
- D. Steven Jobs
- E. John Von Neumann
- F. Stephen Wozniak

# Computer Pioneers

Note: Though this article was first published in 1991, most of the history is still factual and relevant.



**Howard Aiken (Circa 1945)**  
Aiken was the designer & builder of the Mark I, the first significant computer. Courtesy of Harvard University



**The Mark I (Circa 1943)**  
This huge computer operated electro-mechanically using electrical relays instead of electronic components. Courtesy of the Smithsonian Institute



**John VonNeumann (Circa 1952)**  
Pictured at right in front of an electronic computer that superseded the ENIAC, Von Neumann is shown here with J. Robert Oppenheimer head of the Manhattan Project that resulted in the first atomic bomb. Von-Neumann was the implosion expert on the project. Courtesy of the Smithsonian Institute



**Grace Hopper (Circa 1953)**  
Shown here with some manuals for the Univac Computer. Hopper was one of the first computer programmers & worked on the Mark I also. Courtesy of the Smithsonian Institute



**The ENIAC (Circa 1950)**  
Early computers such as the ENIAC were programmed using cables & switches. Courtesy of the Smithsonian Institute



**The IBM SSEC-Selective Sequence Electronic Calculator (Circa 1950)**  
Designed by John VonNeumann in 1948, the SSEC, built by IBM, operated through the use of 13,000 vacuum tubes, some of which can be seen against the back wall (left in this photo). Courtesy of IBM - International Business Machines

**Evolution Of The Personal Computer**  
Today's *desktop computers* are such a common part of everyday life that often we forget computers weren't always small & convenient to use. Early computers were large and very slow in calculating. We've come a long way since the first computer, the big as a house *Mark I*, was built by *Howard Aiken & IBM* during the dark days of World War II. Today, the *Intel Corp's 80860 microprocessor chip* could outperform the Mark I by a factor of over a million, & it is only one quarter inch square in size. The calculating power contained in inexpensive silicon chips has made the *personal computer (PC)* affordable & available to nearly everyone. About 12 million PCs were sold in the U.S. last year alone.

**Early Computer Programing**  
Before computers were invented, even the most complex machines were externally controlled. In the early 1940's *programming* was a brand new idea. It suggested a machine could have a *built-in intelligence*, one that could operate on its own. *Computer programming* in those days included twisting dials, flipping switches, and connecting cables. Typewriter-like machines punched holes in paper for data entry. It was a complicated and *highly technical operation*. Few people knew how to do it and even fewer could do it well. Those who could, were highly respected and thought of as *magicians* or *wizards*.

**The First Programmer Finds "Bug"**  
One of the earliest programmers was *Grace Hopper*, an officer in the U.S. Navy. Hopper programmed the *Mark I* computer by adjusting up to 1400 dials and plugging in hundreds of cables. Data was read from a long, three-inch wide strip of punched, paper tape. One morning when the Mark I stopped running, Lt. Hopper went behind it and found a dead moth covering several holes in the paper tape. She scraped it off and said: "*Now that I've debugged the program, it should operate satisfactorily.*" Like the moth, the word stuck. *Debug* now means to remove errors from a computer program. Later Hopper was the driving force behind the development of *COBOL* (Common Business Oriented Language), the first computer language for business applications.

### From War To Computers

In 1948 John Von Neumann designed and help build IBM's *Selective Sequence Electronic Calculator* (SSEC). It was the first computer to operate from stored programs and for this reason many people consider it to be the *first true computer*.

Earlier during World War II, Von Neumann worked on the "Manhattan Project" that resulted in the creation of the first atomic bomb. He later became involved with the creation of the *ENIAC* computer at the University of Pennsylvania and was the first to introduce the idea of calculating using computer programs.

### Further Development

#### Of Programming Languages

In 1957 a team of IBM programmers led by *John Backus* introduced *FORTRAN* (Formula Transition) the first system to translate near-English instructions into machine language.

In the early 1960s, amateur programmers wanted a program that was simpler, something more basic than the *COBOL* language used by scientists & engineers and the *FORTRAN* language used by the business community. Determined to do something about it, Dartmouth College mathematics teachers *John Kemeny* and *Thomas Kurtz* started working on a new computer language in 1956. On May 1, 1964 at 4:00 a.m. they successfully ran their first program with it. When searching for a word to describe their new programming language Kurtz & Kemeny wanted "a word that was simple but not simple minded." They named the language *BASIC*, or Beginners All-purpose Symbolic Instruction Code. Among the 200 programming languages commonly used today, *BASIC* is the most popular.

### The First Personal Computers

While *Howard Aiken* & *IBM's Mark I* was the first significant computer, the *first PC* was the little know *Altair 8800* made by Micro Instrumentation and Telemetry Systems (MITS) of Albuquerque, New Mexico. It was designed by *Edward Roberts* & *William Yates* in 1975. The computer was named after the *Star Trek* episode *A Voyage To Altair*. Its kit price was \$395, or you could get it fully assembled for \$650.

The *Altair 8800* was not easy to use. Its 256 byte (1/4K) memory was very small & it had no keyboard & no software. All programming was done in complex *machine lan-*

*guage* using switches. Although several thousand were sold, MITS went out of business in 1979.

### An Apple For The Teacher

While still in their 20's, *Stephen Wozniak* and *Steven Jobs* established the *Apple Computer Company* in Jobs garage in Cupertino, California, in 1976. In 1977, they introduced the \$1195 *Apple II* with a 16K memory. It was the first widely accepted personal computer. The two young men chose the name *Apple* for their company because it was a simple word and Jobs had once spent a summer picking the fruit in Oregon. Their *Macintosh* computer came out in 1984 and was named after *Wozniak's* favorite type of apple, the *McIntosh*.

## Timeline to Computer Development

- 1943- Mark I, first significant computer.
- 1945- ENIAC, first electronic computer.
- 1948- SSEC, first stored-program computer.
- 1956- E-101, first desk-sized computer.
- 1957- FORTRAN by John Backus.
- 1958- COBOL by Grace Hopper.
- 1964- BASIC by J. Kemeny & T. Kurtz.
- 1970- Floppy Disks for data storage.
- 1971- Intel 4004, first microprocessor or "computer on a chip."
- 1973- IBM introduces the hard drive.
- 1975- Altair 8800, first PC.
- 1977- Apple II microcomputer.
- 1979- WordStar & WordPerfect word processing programs; VisiCalc spreadsheet program.
- 1981- IBM introduces its first PC.
- 1982- Microsoft introduces MS-DOS, a disk operating system that becomes the industry standard.
- 1985- True BASIC by J. Kemeny & T. Kurtz.
- 1989- Intel 80860 microprocessor, contains one million transistors.
- 2000- Electronics industry is expected to be second only to agriculture in the world economy.

### The Apple II Microcomputer (Circa 1984)

The Apple II been a popular educational computer due to it's easy-of-use, inexpensive cost & extensive selection of software. Courtesy of Apple Computer Inc.

### John Backus (Circa 1957)

The author of FORTRAN, Backus once said "I'm in the business of failing. You work on something and it fails, so you try again". Courtesy of Jim Backus



### John Kemeny & Tom Kurtz (Circa 1964)

Author's of the programming language BASIC, Kemeny & Kurtz spent 8 years developing the language that is the most popular today. Courtesy of True Basic, Inc.

### ALTAIR 8800 Computer (Circa 1975)

The world's first PC (personal computer) was named after an episode from Star Trek, the television series. Courtesy of Popular Electronics Magazine



## Computer Pioneers

The six computer pioneers featured here represent just a few of the many, many people who have been involved in the development of the modern computer.

### John Von Neumann (1903-1957)

Using only pencil and paper, Hungarian-born *John Von Neumann* had perhaps a greater impact on computer development than anyone else.



*Von Neumann* first went to work at Princeton University in 1930 as one of the original six professors in their School of Mathematics. While working on the "Manhattan Project" to build the first atomic bomb during World War II, he was eager to find faster ways to compute. It was at this time that *Von Neumann* became involved with the *ENIAC* computer being built at the University of Pennsylvania. In an effort to assure that computers would not become just glorified calculators, *Von Neumann* worked on developing a programming technique & a memory storage system.

After first introducing the idea of calculating by using computer programs, in 1945 *Von Neumann* described a computer as having a central processing unit, a memory section and a connection between them to use and store data. All modern PCs operate much this same way today.



### Howard Aiken (1900-1973)

Born in Indianapolis, *Howard Aiken* earned his engineering & physics degrees before teaching at *Harvard University*. The pressure to build powerful calculators during World War II encouraged him to approach *IBM* with an idea for a computer.

His proposed *Mark I* design included several modified, punched card tabulators of the type *IBM* made. After convincing both *IBM* & the *U.S. Navy* to pay for the project, the *Mark I* was built at the *IBM* plant in Endicott, N.Y. & assembled at *Harvard U.* Often incorrectly called the first "electronic brain", the *Mark I* was operated *electromechanically*, not electronically. When *Aiken* first demonstrated the computer in 1943, its 3000 clicking relays sounded like a room full of people knitting.

*Aiken's* often said, "I am a simple man & I want simple answers." It wasn't true, *Aiken* was no simple man. He was a dynamic leader & the mental giant who helped make *IBM* the largest private employer in New York state. *Harvard University's Aiken Computation Laboratory* is named in his honor.

### Grace Hopper (1906- still living)

*Grace Hopper* earned mathematics degrees from *Vassar College* & *Yale University* before joining the *U.S. Navy* in 1943. Assigned to *Howard Aiken's Mark I* project, she became one of the worlds first programmers & soon compiled the *first manual for computer sub-routines*. Using her manual, several small subroutines which had been checked for errors could be combined to



make an error-free computer program. Later she also wrote the *Manual of Operations* for the *Mark I* & worked on the *UNIVAC*, or *Universal Automatic Computer*.

One of the first to recognize the commercial and business applications for computers, *Hopper* & five others met at the *U. of Pennsylvania* in 1959 to discuss the lack of a business computer language. Several months later *COBOL* was introduced. The most popular "business" language used today, *COBOL* (Common Business Oriented Language) was based on *Hopper's* 1957 *Flowmatic* language.

Few photos of camera shy *Hopper's* early career exist today because she shunned publicity. She was the person who coined the term "debug" & before she retired in 1986, "Amazing Grace" was appointed *Rear Admiral Hopper*, the highest ranking woman in the *U.S. Navy*. *Hopper* has always encouraged people to be innovative, saying "It is easier to apologize than to get permission."

### John Backus (1924 - still living)

Before the creation of computer language, all programming had to be done in complicated *machine language*. This was a difficult and time consuming process. A graduate of *Columbia University* named *John Backus*, who went to work in 1950 at *IBM* as a programmer, developed the first system to translate near-English instructions into machine language. He called it *FORTRAN* (Formula Translation). *FORTRAN* utilized the language of algebra, plus some rules of grammar and was designed for scientists & engineers who used mathematical formulas.

Though the development of *FORTRAN* took three years, it was introduced in 1957 and soon became the most widely used programming language. *FORTRAN* has been used to design cars & skyscrapers and to put men on the Moon.

### Steven Jobs (1955 - still living)

&

### Stephen Wozniak (1950 - still living)

*Wozniak* & *Jobs* found a common interest in computers through meetings at the *Homebrew Computer Club*. *Wozniak* helped organize the club in 1975 and it is considered to be the first PC "Users Group." Together they designed & assembled the *Apple I* computer in *Jobs's garage* in 1976. To obtain money to market the computer, *Jobs* sold his *Volkswagen* and *Wozniak* sold his *Hewlett-Packard calculator* and they sold their first computer for \$666.00. It had no keyboard and was designed for developing programs by advance amateurs.

With *Jobs* serving as business agent & *Wozniak* the real mastermind behind the *Apple I* computer, it quickly became so popular that the two were able to use the profits to finance their next computer, the *Apple II*. Introduced in 1977 the *Apple II* allowed the average person to afford to own & use a PC for the first time. Both *Jobs* and *Wozniak* left the company in 1985 to pursue other opportunities. For *Wozniak*, it gave him the opportunity to go back to college and earn his BS degree in computer science.

