PART 1  An Introduction to Computers and Educational Technology

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**Computer Literacy**

It is only by studying our past that we gain perspective and are able to prepare for the future. In reading this chapter, you will learn what led to the development of modern-day computers, and what part education played in this history. What are the current educational milestones? Why are educational technology standards important?

*Using the computer, students and teachers can do the following:*

**students can**
- do library investigations on the Internet,
- get math tutorial help,
- create electronic portfolios,
- view science simulations,
- write research papers, and
- do desktop publishing.

**teachers can**
- create an electronic spreadsheet grade book,
- find lesson plans and instruction material,
- use technical Internet chat rooms,
- create PowerPoint presentations,
- communicate with students by e-mail, and
- create newsletters for parents.

**Before the Modern Computer**

Before the modern computer primitive people found it necessary to count using their fingers as a natural instrument. With their fingers, they could show how many animals they had killed on a hunt or the number of people in a village. To indicate large numbers, they used all 10 fingers; since humans have 10 fingers, 10 became the basis of our number system.

As time passed, life became more complex, and people needed a more sophisticated way to keep track of their possessions. Some of the instruments that they used during this period were the abacus, the pascaline, and the stepped reckoner. These calculating devices preclude the introduction of computers.

Though not a calculating device, Jacquard’s loom (Figure 1.1), invented in 1804, was a significant invention in the development of computers. Joseph Maria Jacquard used punched cards to create patterns on fabric woven on a loom. This device was a forerunner of the keypunch machine.

However, it wasn’t until 1854, nearly two centuries later, that George Boole devised what became known as **Boolean algebra**, a system of logic based on the binary system. In the late 1930s, inventors were then able to build a computer that used this binary system, the standard internal language of today’s digital computers.
Chapter 1  Historical Past

The official beginning of the computer can be traced to Charles Babbage, a mathematics professor, when he constructed the Analytical Engine in 1835 (Figure 1.2).

A close personal friend of Babbage, Augusta Ada Byron, Countess of Lovelace, the only legally recognized daughter of Lord Byron, raised money for his invention and wrote a demonstration programmer for the Analytical Engine. Because of this program, she is considered the first computer programmer, and the programming language Ada was named after her.

Babbage designed a system with provision for printed data, a control unit, and an information storage unit, but the Analytical Engine was never completed because construction of the machine required precision tools that did not exist at the time. For this achievement he is called the “father of computers,” and historians have even said that all modern computers were descended directly from Babbage’s Analytical Engine. In his day, however, Babbage was considered a failure, and he died in poverty.

A mere 19 years later, the punched-card element of the Analytical Engine (Figure 1.3) appeared in a working machine, a tabulator built by Herman Hollerith, an American inventor.

Because of Hollerith’s invention, the census was completed in just two years, compared to the seven years it took for the 1880 census. Eventually, Hollerith organized his own company, called the Tabulating Machine Company. In the 1900s, he leased out his more sophisticated tabulating machines for the census. His business prospered and merged with other companies. The company went through a series of name changes, and the last name change came in 1924 when it became known as International Business Machines, or IBM. Table 1.1 summarizes the achievements of the inventors.

In the 20th century, the Census Bureau bought a machine designed by James Powers, which replaced Hollerith’s machines. The machines being produced were primarily for the business community. The scientific community’s need for more complex processing remained unmet.

The Modern Computer

In 1944, the age of the modern computer began. World War II created a need for better data handling, which encouraged advances in technology and the development of computers.

Table 1.1  Computing Devices Before the 20th Century

<table>
<thead>
<tr>
<th>Inventor</th>
<th>Invention</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td>Abacus</td>
<td>approx. 3000 B.C.</td>
</tr>
<tr>
<td>John Napier</td>
<td>Napier’s Bones</td>
<td>1617</td>
</tr>
<tr>
<td>Blaise Pascal</td>
<td>Pascaline</td>
<td>1642</td>
</tr>
<tr>
<td>Gottfried Leibniz</td>
<td>Stepped Reckoner</td>
<td>1674</td>
</tr>
<tr>
<td>Joseph Marie</td>
<td>Punched Card Loom</td>
<td>1804</td>
</tr>
<tr>
<td>Jacquard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charles Babbage</td>
<td>Analytical Engine</td>
<td>1835</td>
</tr>
<tr>
<td>Herman Hollerith</td>
<td>Tabulating Machine</td>
<td>1887</td>
</tr>
</tbody>
</table>

Check online at http://www.wiley.com/college/sharp for a PDF file on early calculating devices.

1 Powers founded a company called Powers Accounting Machine Co., which merged with others to become know as Remington Rand and then Sperry Rand. Today, these companies are part of the Unisys conglomerate.
MARK I

During the war, a brilliant team of scientists and engineers (among them Alan Turing, Max Newman, Ian Fleming, and Lewis Powell) gathered at Bletchley Park, north of London, to work on a machine that could solve the German secret code. They designed the Colossus, an electronic computer that was used to break the German Enigma cipher. Much of their innovative work remains classified.

In 1937, Howard Aiken was to complete his research for his PhD at Harvard University. Faced with tedious calculations on nonlinear, differential equations, he decided that he needed an automatic calculating machine to make the chore less arduous. Initially, Aiken found little support at Harvard for his machine, so he turned to private industry. IBM was impressed with Aiken’s idea and agreed to back him in his effort. Aiken headed a group of scientists whose task was to build a modern equivalent to Babbage’s Analytical Engine. In 1943, the Mark I, also called the IBM Automatic Sequence Controlled Calculator, was completed at IBM Development Laboratories in Endicott, New York. The Mark I (Figure 1.4) could perform three calculations per second, weighed 5 tons, was 51 feet long, and printed its results on an electric typewriter. The first electromechanical computer was responsible for making IBM a giant in computer technology. After the completion of the Mark I, IBM produced several machines that were similar to the Mark I, and Howard Aiken also built a series of machines (the Mark II, Mark III, and Mark IV).

Figure 1.4
Harvard Mark I
(Source: Courtesy of the Computer History Museum)

In 1945, the Mark II was housed in a building without air conditioning. Because the computer generated tremendous heat, the windows were left open. One day this giant computer suddenly stopped working, and everyone tried frantically to discover the source of the problem. Grace Hopper and her coworkers found the culprit: a dead moth in a relay of the computer. They removed the moth with tweezers and placed it in the Mark II logbook. When Aiken came back to see how things were going with his associates, they told him they had had to debug the machine, thus coining the term for fixing a computer problem.²

THE ABC

While Aiken was working on his Mark I in 1939 at Iowa State University, John Atanasoff designed and built the first electronic digital computer with Clifford Berry, a graduate student. Atanasoff and Berry then went to work on an operational

² Today the Mark II logbook is preserved in the Naval Museum in Dahlgren, Virginia.
model called the ABC, the Atanasoff-Berry Computer. In 1941, John Mauchly, a physicist and faculty member at the University of Pennsylvania, stayed five days as Atanasoff’s houseguest. During his stay, he had an opportunity to read and study Atanasoff’s handbook explaining the electronic theories and construction plans of the ABC (Mollenhoff, 1990).

The First Generation of Computers

With the start of World War II, the military needed an extremely fast computer that would be capable of performing the thousands of computations necessary for compiling ballistic tables for new naval guns and missiles. John Mauchly and J. Presper Eckert, an electrical engineer, believed the only way to solve this problem was with an electronic digital machine, so they worked on this project together. In 1946, they completed an operational electronic digital computer called the ENIAC (Electronic Numerical Integrator and Calculator), derived from what Mauchly had gleaned from Atanasoff's unpatented work. The ENIAC worked on a decimal system and had all the features of today’s computers. The ENIAC, shown in Figure 1.5, was tremendous in size, filling up a very large room and weighing 30 tons. It conducted electricity through 18,000 vacuum tubes.

The ENIAC was the first to introduce vacuum tube technology (Figure 1.6) and it was classified as the first generation of computers. The ENIAC’s limitation was a small memory and difficulty shifting from one program to another, which required rewiring the machine. Maybe it took the ENIAC two minutes to compute a result, but it took individuals days to set up the problem. There needed to be a way to store the computer’s program in the computer’s memory. The EDVAC, completed in

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3 In 1973 Judge Earl R. Larson invalidated the ENIAC patent when he said that Eckert and Mauchly had derived some of their ideas from Atanasoff’s unpatented work. Atanasoff then received recognition as one of the fathers of computing.

4 Since its inception, the computer has gone through several stages of development. Generally, these technological advances are classified by generations, a marketing term. Even though there is some overlap among generations, it is convenient to view the computer’s technological development terms of this classification.
1952, could store information in memory in the same form as data and was one of the first machines to use binary notation. Before 1951 the computer was not manufactured on a large scale. In 1951, with the arrival of the UNIVAC, the era of commercial computers began.

The Second Generation of Computers

We perceive the second generation of computers as beginning when the transistor (Figure 1.7) replaced the vacuum tube in the late 1950s. In 1947, John Bardeen, Walter H. Brattain, and William Shockley, a team of physicists working at Bell Labs, invented the transistor. They shared the Nobel Prize for this invention in 1956. The transistor, an electrically operated switch similar to an old-fashioned relay, was a landmark in the development of the computer. Transistors conduct electricity more efficiently, consume less energy, need less space, and generate less heat than vacuum tubes. In addition, they do not burn out as tubes do. The computer with transistors became smaller, more reliable, faster, and less expensive than a computer with vacuum tubes. Small- and medium-size businesses now found it more economical to buy computers.

The Third Generation of Computers

The third generation of computers uses integrated circuits, online terminals, and disk storage. The beginning of the third generation of computers is marked by the 1964 introduction of the IBM 360, the computer that pioneered the use of integrated circuits on a chip. In that year, computer scientists developed tiny integrated circuits and installed hundreds of these transistors on a single silicon chip, which was as small as a fingertip (Figure 1.8.) The computer became smaller, more reliable, and less expensive than ever before.

They were almost a thousand times faster than the first generation of computers, and manufacturers mass-produced them at a low price, making them accessible to small companies.

The Fourth Generation of Computers—The Microcomputer

The development of microprocessor technology launched the fourth generation of computers. The microprocessor chip (Figure 1.9) is a central processing unit, the brains of the computer, built on a single chip.
Edward “Ted” Hoff designed the microprocessor in 1968 while working at Intel. Three years later, Intel introduced the Intel 8080 microprocessor version, which was capable of running the processing unit of a computer. The journal *Radio Electronics* published an article in 1974 on a home-built computer that used this technology. In June 1975 *Popular Electronics* ran a story on Altair, a microcomputer that ran on the 8080 chip. The article mentioned that Micro Instrumentation Technology Systems (MITS) was selling kits for this computer. The public response and interest in Altair kits was overwhelming, and they inspired other companies to develop similar products.

Bill Gates and Paul Allen were just college students when they wrote the first BASIC interpreter for the Intel 8080 microprocessor. The language they created, called MBASIC, was licensed to MITS and sold with the Altair computer. In 1975 Bill Gates and Paul Allen (Figure 1.10) founded Microsoft. Years later, Microsoft became a leader in programming languages by supplying IBM PCs with DOS (Disk Operating System) and non–IBM PCs with the MS-DOS operating system.

At about the same time that Gates and Allen were launching Microsoft, Steve Wozniak and Steve Jobs were working inside a garage selling their Apple computers for $666.66 (Figure 1.11). Figure 1.11 shows the Apple I. Steve Wozniak and Steve Jobs placed ads in hobbyist publications with the money that they raised by selling their personal possessions. They provided software for their machines free of charge. In 1977 a historic movement for computers occurred when Wozniak and Jobs introduced a new fully assembled version of their Apple machine called the Apple II. The Apple II was the first computer widely accepted by business users because of its spreadsheet simulation program, VisiCalc. In addition, it was compact, it came with 4 kilobytes (4K) of memory, and it was priced at $1,298.

Four years later, IBM entered the personal computer market with the IBM PC. This computer quickly became a best seller. Because of IBM’s successful entrance in the field, other computer makers chose to capitalize on its popularity by developing their own “clones.” These personal computers had many of the same features as the IBM machines and could run the same programs. With the IBM PC, widespread use of personal computers became a reality. In 1977, computers even began appearing in schools. The following timeline shows these important events.
MODERN COMPUTER TIME LINE

1935

British Scientists designed the Colossus to break the German codes.

1940

John V. Atanasoff and Clifford Berry built the first electronic digital computer, the ABC, the Atanasoff-Berry Computer.

1945

The Universal Automatic Computer (UNIVAC), the first commercial computer was created.

1950

William Shockley, John Bardeen, and Walter H. Brattain Labs invented the transistor.

1955

Edward "Ted" Hoff, at Intel Corporation, developed the Intel 404, a microprocessor.

1960

The IBM 650 pioneered the use of integrated circuits on a chip.

1965

Bardeen, Shockley, and Brattain

1970

Steve Jobs and Steve Wozniak built the first Apple Computer.

1975

Micro Instrumentation Technology Systems (MITS) sold kits for the first microcomputer, the Altair.

1980

Bill Gates, Microsoft's co-founder, was offered the chance to develop the operating system for IBM computers.

1985

IBM PC entered the personal computer field and became popular in business.

(Source: Courtesy Iowa State University Library)

(Source: Hulton Archive/Getty Images)

(Source: Bettmann/©Corbis)

(Source: Bettmann/©Corbis)

(Source: Hulton Archive/Getty Images)
The Fifth Generation of Computers

The fifth generation of computers, marked from the mid-1990s to now, heralded super-fast computer chips capable of carrying out trillions of calculations per second. IBM’s Blue Gene/L supercomputer is capable of 280 trillion operations a second during continuous operation (CNETNews.com).

Computers now feature voice recognition, natural and foreign language translation, fiber optic networks, and optical discs. Computers are smaller with increased data storage and memory. Many systems now have touch screens and handwriting recognition software that let the user employ a pencil-like stylus as the input device. There are developments in artificial intelligence, logical inference, and parallel processing. Today, the voice synthesizers that are used in computers sound more human than those used a few years ago. Navigation systems in cars use voice synthesizers to tell us in what direction to travel.

Presently, printers and computers are communicating through wireless networks. In addition, machines employ parallel processing; that is, a computer performs two or more operations simultaneously. Computers come with flat-panel displays that are larger, in color, and detachable. The Internet, a worldwide system for linking small computer networks, is exerting an increasingly pervasive influence on our everyday lives.

Teachers and students are finding new ways to work from their homes and in schools. Through the use of wireless telecommunication services, they are spending less time in the classroom and more time on the Internet via voice, data, and video conferencing. Teachers and students are using Internet’s research tools, and many communicate through online course software almost exclusively. Exciting new technologies will deliver huge increases in bandwidth capacity, making Internet access occur with lightning-fast speed. With these exciting new developments come new forms of interactive content, realistic 3-D virtual reality\(^5\) multiplayer games, and interactive education video forums. In Chapter 17, we will discuss the many new advances in computer technology and speculate on its future.

Computers in Education

For years, scientists and engineers used computers, but it wasn’t until the 1950s that the computer came into the schools. As an avid computer enthusiast, I watched the computer evolve and adopted it as an instructional tool early. In the following paragraphs, I discuss the history of educational computing through an ordinary teacher’s perspective.

AN EDUCATOR’S PERSPECTIVE

We have come a long way from the 1940s when computers consisted of vacuum tubes, data were recorded on magnetic tapes and magnetic drums, and primarily scientists and engineers used the machines. In 1950, this all changed when the first documented instructional use of the computer occurred at Massachusetts Institute of Technology (MIT). Teachers used a computer flight simulator to train pilots. Nine years later, the first documented instructional use of computers with elementary school students occurred in New York City when an IBM 650 computer was used to teach schoolchildren binary arithmetic. I was an elementary school student myself and this event went unnoticed. During the 1960s, computers were inaccessible to most students, including me. This situation changed in 1964 when John Kemeny and Thomas Kurtz, both at Dartmouth College, designed BASIC (Beginners All-Purpose

\(^5\) Virtual reality (VR) is a computer system that can immerse the user in the illusion of a computer-generated world. The user can navigate throughout this world at will (Pfaffenberger, 2003). See Chapter 11 for further discussion.
Symbolic Instruction Code), which required minimal instruction to learn. After BASIC’s introduction, word spread about the new language designed for Dartmouth’s time-sharing system. **Time-sharing** permitted several students to interact with a machine at the same time.

During this time period, Patrick Suppes and Richard Atkinson, at Stanford University, did some research and development on **computer-assisted instruction (CAI)** in reading and mathematics. CAI involves students in instructional activity on a computer. Suppes and Atkinson produced math drill-and-practice software on mainframe computers. The computer would display a problem, the student would respond, and the computer would give immediate feedback.

In 1969, when I was working on my PhD, I used a keypunch machine to type on cards that were then read by a mainframe computer that filled a large room. Also that year was famous for the Department of Defense (DOD) creating ARPAnet, which later became known as the **Internet**. The ARPAnet was a large network of computers with links to smaller computer networks, which connect the Pentagon with defense researchers in academia and business.

In the early 1970s, when I started teaching at the University, Seymour Papert (Figure 1.12), an MIT professor, utilized a different approach to computers in education. Papert developed a programming language called Logo to encourage thinking about mathematics. As a beginning college teacher I really wasn’t involved with Logo until the microcomputer came into my life. During this time period, Don Bitzer, along with a team of specialists, developed an instructional system called Programmed Logic for Arithmetic Teaching Operations (PLATO). This system featured a terminal with a plasma screen, a specially designed keyboard, and an authoring system called Tutor. This authoring system developed tutorial lessons and complete courses. Some of my colleagues experimented with Tutor and then dropped it.

In 1977, Steve Jobs and Steve Wozniak introduced a fully assembled version of their Apple computer, called the Apple II. I thought this small desktop computer with its 4K of memory, priced at $1,298, was a marvel. At California State University, we had an Apple II in a special room next to the administrative offices. We were excited about this computer with its two 5-1/4 inch disk drives (Figure 1.13). My colleagues and I learned how to use this machine and how to program in BASIC. There was a scarcity of software and BASIC was built into the old Apple IIs so it was convenient to teach our students programming. While we were working on our Apple II computer, software publishers emerged. The Minnesota Educational Computing Consortium (MCC) was the largest microcomputer software provider and others followed in its footsteps.

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6 In the early 1960s all computers were called mainframes in reference to the cabinet that held the central processing unit. As time progressed, very large computers began to be called mainframe computers.
In the early 1980s I wanted to bring computers to elementary teachers, so I bought 35 pocket Sharp PC-1211 computers and taught programming off campus. Using the Apple IIe as a demonstration machine, I showed how to use software such as Lemonade Stand and use a word processor program called Bank Street Writer. At that time, educational software was limited and inadequate, and the focus was still on teaching the programming language BASIC, followed shortly thereafter by Logo. Many teachers wanted to design their own software language using authoring programs such as Pilot and SuperPilot. Over time, interest in this type of software waned as we discovered how much time and expertise were needed to develop good courseware. Instead, many of us decided it would be more productive to purchase packaged software programs.

Networking emerged in the 1980s and 1990s when administrators and school districts began to see the value of connecting computers and users. Networking consists of connecting a group of computers and peripherals to a communication system. School districts realized that computers networked to a central server could provide instruction more efficiently and at a lower cost than stand-alone machines.

In 1992, I was using the Internet with UNIX commands to do library research. This type of usage made the Internet difficult for my students. Around this time, Swiss researchers developed the World Wide Web, a system that enables the user to move smoothly through the Internet, jumping from one document to another. Software tools called browsers were developed that made access to Internet resources uncomplicated. With the introduction of Mosaic browser Figure 1.14 in 1994, the Internet became easy for everyone to use. This browser allowed users to view pictures and documents by simply clicking on a mouse. Educators all over the world quickly became interested in the computers and began to see the potential for this powerful technology. Also with the production of quality software, the computer’s role had changed from a device used for computer programming to an instrument that could efficiently be integrated into the curriculum. We used computers for word processing, database management, spreadsheets, graphics generation, and desktop publishing.

In the last half of the 1990s the emphasis has once more shifted and teachers and students began using the Internet as a huge library resource, and electronic mail proliferated. (In fact, my colleagues and students communicate by e-mail to

![Figure 1.14](Image)

**Figure 1.14**

Mosaic
*(Source: Credit NCSA/University of Illinois)*

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7“The World Wide Web is made up of “Web servers” that store and disseminate “Web pages,” which are “rich” documents that contain text, graphics, animations, and videos to anyone with an Internet connection.” (Freedman, 2008)
such an extent that I am relieved when our server breaks down.) Because of the interest in technology, in 1998, the International Society for Technology in Education (ISTE) developed the National Educational Technology Standards (NETS) for teachers, students, and administrators. These standards discuss what students should know and be able to accomplish with technology. Furthermore, accreditation standards for teacher education institutions discussed expectations for teacher competency in preparation programs. You will find this document at ISTE’s Web site, http://cnets.iste.org/teachers/t_stands.html. The following timeline shows these important educational milestones. The National Educational Technology Standards for Students are listed on the back inside cover

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955</td>
<td>Computers first used in schools.</td>
</tr>
<tr>
<td>1960</td>
<td>Department of Defense creates ARPAnet, later called the Internet.</td>
</tr>
<tr>
<td>1965</td>
<td>PLATO, an instruction system, grows</td>
</tr>
<tr>
<td>1970</td>
<td>The first microcomputer appears in schools.</td>
</tr>
<tr>
<td>1975</td>
<td>MECC begins courseware development</td>
</tr>
<tr>
<td>1980</td>
<td>Logo is taught in the schools.</td>
</tr>
<tr>
<td>1985</td>
<td>Use of Web becomes widespread</td>
</tr>
<tr>
<td>1990</td>
<td>ISTE develops computer standards.</td>
</tr>
<tr>
<td>1995</td>
<td>Video conferencing &amp; distance learning</td>
</tr>
</tbody>
</table>

(Source: Courtesy of International Business Machines Corporation)
(Source: Courtesy Apple Computer, Inc.)
(Source: Bill Pierce/Time Life Pictures/Getty Images)
(Source: Credit NCSA/University of Illinois)

**TIME LINE OF EDUCATIONAL MILESTONES**
In the 21st century computers are being used to help students with special needs realize their potential. Presently, there are more online and distance learning courses in higher education and the K–12 schools. Students and teachers are increasingly using computerized electronic organizers such as the Palm and Blackberry. I am presently showing my students how to do Podcasts, and my colleagues are delivering their lecture notes through this media. We are doing video conferencing and the iPod is being used as a hard drive, music, and lecture note delivery system. I can only speculate on what the next generation of educational computers will bring (see Chapter 17).

**SUMMARY**

The origin of computers can be traced back to inventors who were interested in processing information and developing devices to simplify tedious arithmetic calculations. In the 1900s, inventors constructed the earliest electromechanical computer, quickly replaced by the faster electronic computer. At first the computers filled large rooms and electricity was conducted using vacuum tubes. Transistors then replaced the vacuum tubes, which were replaced by integrated circuits and then large-scale integrated circuit chips. Recently there have been developments in artificial intelligence, logical inference, and parallel processing and radical changes in the Internet. Along the way, computers have become an indispensable tool for teachers, students, and administrators—starting with PLATO, an instructional system, and recently the widespread use of the World Wide Web. Like a snowball rolling down a hill, expanding as it speeds up, the use of the computer in education is certain to avalanche.

**CHAPTER 1 ONLINE RESOURCES**

In the student section of the book’s online site at [http://www.wiley.com/college/sharp](http://www.wiley.com/college/sharp), you will find PDFs on BASIC, Logo, and calculating devices along with top-rated Web sites and a chapter quiz. (To read or print the PDFs, open them with Adobe Reader.) Watch the video tutorial online and learn how to conduct an Internet search.

**CHAPTER MASTERY TEST**

Lets check for chapter comprehension with a short mastery test. Key Terms, Computer Lab, and Suggested Readings and References follow the test.

1. Discuss briefly the contributions made to the computer field by the following individuals: (a) Howard Aiken, (b) Charles Babbage, (c) Herman Hollerith, and (d) John Atanasoff.
2. Identify and place in correct order two of the major inventions in the field of computing.
3. Explain the importance of transistors and microprocessors in the development of modern computers.
4. What computer opportunities would a sixth grader have in 1953 as opposed to a sixth grader in 2008?
5. Why was Hollerith’s Tabulating Machine developed for the 1890 census significant for the future of computing?
6. Explain the discovery that made personal computers possible.
7. Explain why Charles Babbage might be considered to have been born at the wrong time.
8. What are Steve Jobs’s and Steve Wozniak’s major achievements in the computer field?
9. Explain why Ada Lovelace deserves an important place in the history of computers.

10. What spearheaded the development of the electronic digital computer?

11. What are Bill Gates’s and Paul Allen’s major achievements in the computer field?

12. What was George Boole’s lasting contribution to computer history?

13. Why did the Internet suddenly become popular?

14. Name two major events that increased the use of the computer in education.

15. Why did programming suddenly fall out of favor?

16. What are the Educational Technology Standards for teachers and students?

17. Why did BASIC become so popular in the 1980s?

18. Name two ways that teachers can integrate the computer into their classrooms.

**KEY TERMS**

Ada p. 4
BASIC p. 8
Boolean algebra p. 3
Commercial computer p. 7
Computer-assisted instruction (CAI) p. 11
Debug p. 5
Fifth generation of computers p. 10
First generation of computers p. 6
Fourth generation of computers p. 7
Integrated circuits p. 7
Internet p. 11
Mainframe p. 11
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Networking p. 12
PLATO p. 11
Second generation of computers p. 7
Third generation of computers p. 7
Time-sharing p. 11
Transistor p. 7
World Wide Web p. 12

**COMPUTER LAB: Activities for Mastery And Your Portfolio**

1.1 Interactive Time Line: The Modern History of Computers
Test your knowledge of the history of computers with this time line.

1.2 Prepare a paper on the 1973 court trial between Sperry Rand and Honeywell. In this case, Judge Larson ruled that “Eckert and Mauchly did not themselves invent the electronic digital computer, but instead derived the subject matter from one John V. Atanasoff.”

1.3 Using a computer time line program such as Tom Snyder’s TimeLiner 5.1, list at least 10 significant computer events from 1863 to 2008.

1.4 Prepare an in-depth research report on the life of an important inventor and his or her contribution to the history of computers. Watch the video tutorial online and learn how to conduct an Internet search.

1.5 Write three biographical sketches on important women in the computer field, discussing their achievements.

1.6 Use three magazines to investigate developments in educational computing that occurred during the last five years. Write a brief summary of the findings.

**SUGGESTED READINGS AND REFERENCES**


