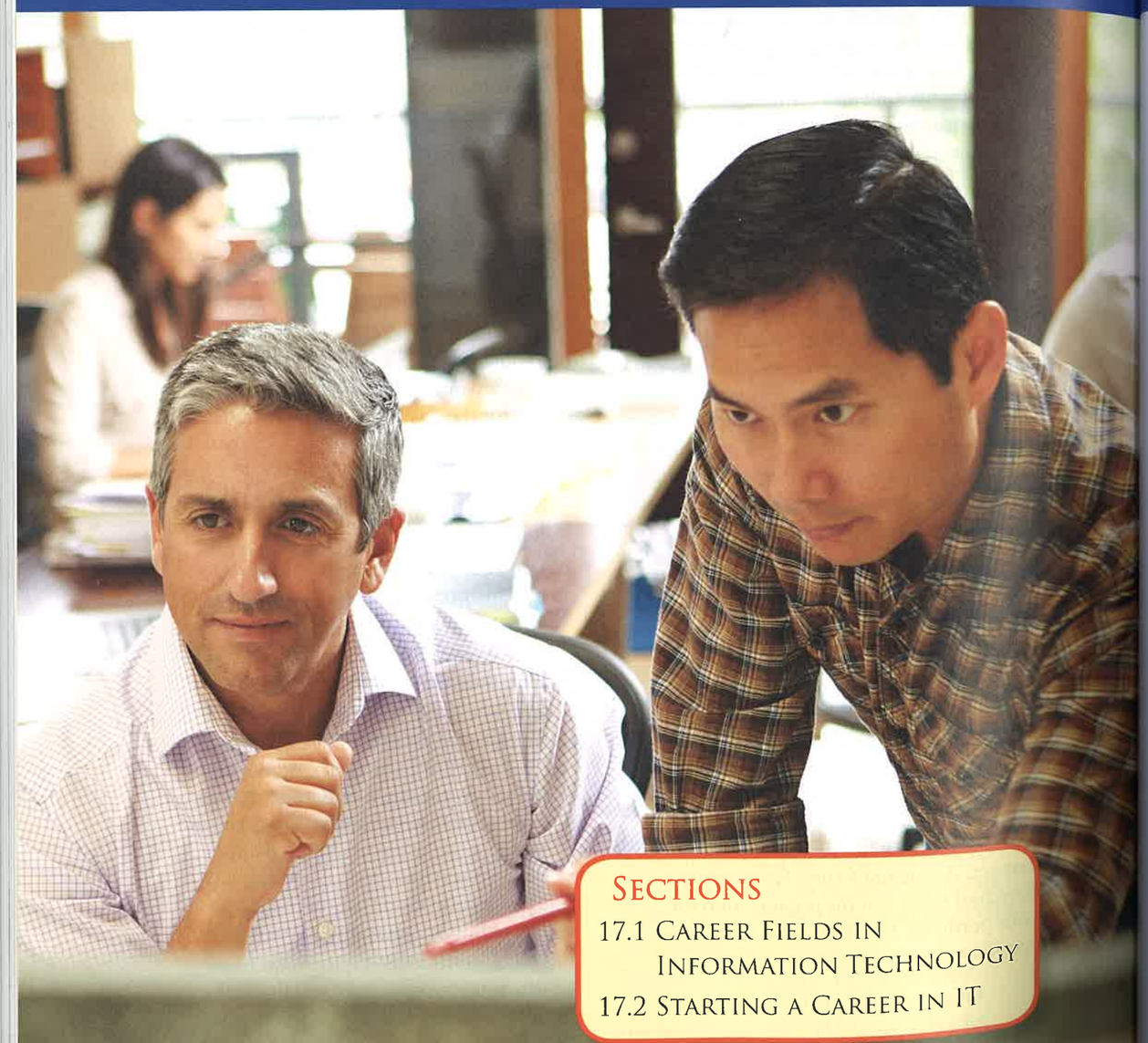
17

Careers in IT



Sections

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Check Your IT IQ

Before you begin this chapter, see what you already know about information technology by scanning the QR code to take the chapter pretest. If you do not have a smartphone, visit www.g-wlearning.com.

Information technology is an exciting and rapidly changing field in which to consider a career. Few in this field can predict exactly what their jobs will look like in the future. Nonetheless, professionals must make reasonable forecasts about the time ahead to prepare for changing career choices. Many new kinds of jobs are being created as hardware and software innovations expand the functionality of computers.

A good source of data on the future of IT jobs is the United States Department of Labor's Bureau of Labor Statistics (BLS). The BLS examines data and makes projections about many different fields of employment. It reports that two out of the top 15 fastest-growing occupations are in computer technology. The BLS also reports data on average salaries for various careers. This chapter covers some of the common careers in the IT field and what is required to find employment in these careers.

College and Career Readiness

Reading Prep. The summary at the end of the chapter highlights the most important concepts. Read the chapter and write a summary of it in your own words. Then, compare your summary to the summary in the text.

IC3 Certification Objectives

GS4

Key Applications

Domain 1.0 Common application features

Objective 1.2 Formatting

Living Online

Domain 3.0 Digital communication

Objective 3.1 E-mail communication

SECTION 17.1

Career Fields in Information Technology

Essential Question

Why is the information technology field an important part of our economy?

The speed with which computer hardware is changing is dramatic. It is happening so fast that it must be represented exponentially, which is described by Moore's law. There are several areas of information technology currently seeing the most growth. These include data storage, the Internet, and supercomputers.

There are many areas of employment affected by changes in the IT field. These include project management, security, networking, mobile applications, and data centers, among many others. Specific jobs in the IT field include software developer, computer systems analyst, security analyst, and a host of others. This section discusses areas of growth in the IT field, areas affected by innovations in IT, and careers in the IT field.

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Terms

chief information officer (CIO)
cloud architects
computer programmer
computer support technician
computer systems analyst
database administrator
IT manager
project management
security analyst
software developer
technical support
virtualization
web developer

Learning Goals

After completing this section, you will be able to:

- Identify areas of growth in the IT field.
- Describe employment areas affected by IT innovations.
- Explain various careers available in the IT field.

Areas of Growth

Four areas in computer science are changing the most rapidly. They are computer forensics, data storage, the Internet, and supercomputers. Because they are experiencing the most growth, many of the careers available in IT will be found in these fields.

Computer Forensics

Computer forensics includes identifying, discovering, preserving, and documenting evidence from computer devices. This evidence is collected to use in court. Devices are obtained by law enforcement officials who have been granted permission in the form of warrants. Then the cybersecurity scientists begin investigating. They preserve the data exactly as they were discovered by making copies. These scientists analyze all data, including hidden files and files that the user may have deleted. They are trained to open encrypted files and to log every step of the process.

Many biometric devices can be used in human identification through fingerprints. They can capture ten prints from a subject and then transmit those prints to an automated fingerprint identification system (AFIS) for near-real-time identity verification. Some devices can perform instantaneous comparisons using a database contained within the device.

The Department of Homeland Security (DHS) recruits many hundreds of cybersecurity professionals each year, as shown in Figure 17-1. The following are the types of careers DHS offers related to computer forensics:

- cyber incident response
- cyber risk and strategic analysis
- vulnerability detection and assessment
- intelligence and investigation
- networks and systems engineering
- digital forensics and forensics analysis
- software assurance

Cybersecurity positions are also available in the Department of Defense and other governmental agencies as well as schools and private companies. For example, the University of Maryland tells prospective cybersecurity students that there are 19,000 openings just in the state of Maryland.

Data Storage

The miniaturization of electronic components has progressed dramatically over the past 50 years and will probably continue to do so. This miniaturization has particular application in the field of data storage. The first computer-storage device was manufactured in 1956 by IBM. It had a hard disk drive that weighed over one ton and used fifty 24-inch disks stacked in a closet-like device. The total storage capacity of this device was only about 4.4 MB. In 1973, IBM produced a model with removable disks that could each hold 200 MB. Home PCs with 100 GB

Career Skills

Programmable Logic Controller Programmer

Programmable logic controllers (PLC) originated in the automotive industry to control automated processes in the vehicle assembly line. Now they are used to control a variety of engineering processes, such as offshore oil platforms. These PLCs improve the efficiencies and effectiveness of a technical process. A PLC programmer sets the parameters and monitors the processes that operate the machinery.

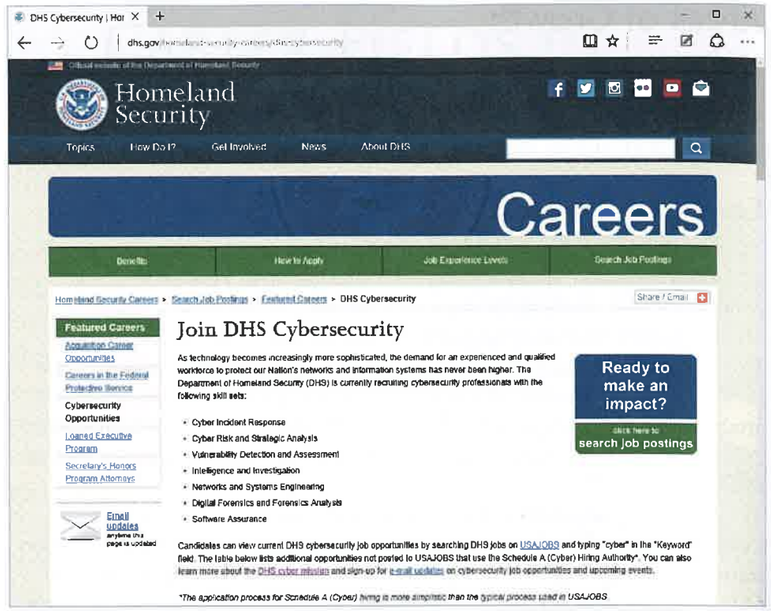

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Figure 17-1. Many governmental agencies, such as the Department of Homeland Security, offer careers related to computer forensics.

FYI

Each innovation in data storage was revolutionary in its time, but many have been obsolete for years or decades.

hard drives were common by 2005, and 1 terabyte (TB) hard drives were common by 2010.

The revolution in data storage occurred with the invention of the floppy disk. As the size of these disks decreased from 8 inches, to 5¼ inches, and eventually to 3.5 inches, the capacity of each version increased. Floppy disks were replaced by CDs, DVDs, Blu-ray discs, and flash drives.

Then came the revolution caused by secure digital (SD) cards. They were first introduced in the early 2000s. These provide storage on a thumbnail-sized unit for digital cameras, cell phones, MP3 players, and other handheld devices. SD cards are three million times lighter and cost over 10,000 times less than an equivalent storage device of 30 years ago.

The future looks exciting for careers in the invention, production, and maintenance of data-storage devices. It may seem that the limit of miniaturizing components has been reached. However, based on history, new formats will be invented that lead to new models and even higher capacities.

Internet

The combination of decreasing cost and exponential improvements in technology have led to the rapid growth in Internet use. It is estimated that by the year 2020 the number of Internet users will reach five billion. To put that in perspective, five billion was the world population in 1987!

A very large number of people in developing countries acquire Internet access every day. This explosive growth is due to the use of mobile telephone technology. The percentages of users in Africa, Asia, and the Middle East are small when compared to North America, as shown in Figure 17-2. This means the estimated increase in Internet usage by 2020 will have two big effects. First, the Internet will reach more and more remote locations. Second, it will need to support more languages and character sets.

The Internet will not just include humans using computers and cell phones. It is expected that by 2020 the number of Internet-connected devices will be greater than the actual number of human users. Internet "users" will include devices, particularly sensors. Most of these devices will be security related. They will be located on buildings and bridges, in airports and train stations, and along highways. These devices will collect high-definition images. Such images require large capacities for storage and transmission. Installation of these devices leads to more jobs in formatting, maintaining, transmitting, and archiving image files.

High-speed data networking technology will see a dramatic increase in use. The Internet is currently becoming wireless. The number of mobile broadband subscribers is rapidly increasing. Asia and Latin America have the highest percentages of wireless subscribers. Meeting the demands of setting up and running data networks will have a significant effect on existing jobs. Many people will be needed to manage the hardware and software necessary to run these networks.

FYI

Developing countries are often seen as areas of great potential investment not only in technology, but many other types of industries.

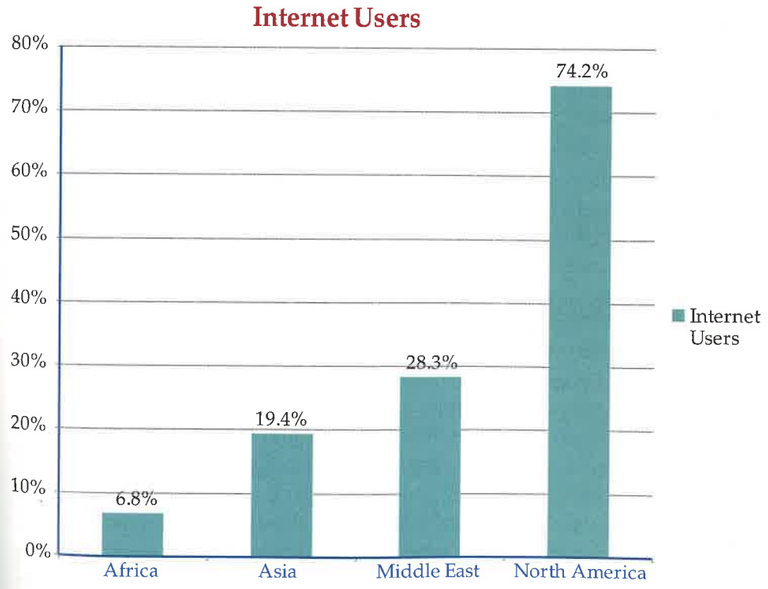

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Figure 17-2. The percentage of people using the Internet in North America is very high when compared with the rest of the world.

The Internet architecture currently in use assumes that all users have an "always on" connection. With more users in remote locations and more users depending on wireless communication, that can no longer be taken for granted. Instead, researchers are looking into communication techniques that can handle delays and interruptions of service. They are also investigating new ways of forwarding communication from one user to another.

Hackers are serious threats to the Internet and its users. Experts predict that by 2020 hacker attacks will be more targeted, more sophisticated, and more widespread. That will result in the creation of more jobs in IT to combat and reduce these threats. Computer scientists are now working on redesigning the Internet to improve its security. Unfortunately, security cannot be an add-on feature in a redesign of the existing Internet. A new Internet must be built from the ground up to provide a secure method of communication. More computer scientists will be needed to make the Internet of 2020 a system that is totally safe and private.

HANDS-ON EXAMPLE 17.1.1

WORLDWIDE INTERNET USE

The increase in the number of Internet users is greater than the increase in world population. This can be seen by creating a chart to compare the world population with global Internet usage over a twenty-year span.

1. Launch Microsoft Excel or other spreadsheet software, and begin a new spreadsheet.
2. Enter these data into the spreadsheet.

	Internet Users (billions)	World Population (billions)
2000	.2	6.1
2010	1.6	6.9
2020	5	7.6

3. Use the data to create a 3D area chart. Notice that while the increase in world population is close to a straight line, the increase in Internet users is not a straight line.
4. Change the title of the chart to Internet Growth vs. Population Growth.

Supercomputers

As discussed in Chapter 2, supercomputers have processing power that can handle complex jobs beyond the scope of other computer systems. Supercomputers perform highly intensive calculations. Some examples include problems involving quantum mechanics, weather forecasting, climate research, astronomy, molecular modeling, and physical simulations.

Supercomputers were first developed in the 1960s by Seymour Cray at Control Data Corporation. Cray's own company, Cray Research, took over the supercomputer market in the late 1980s. Today, supercomputers are typically one-of-a-kind designs custom produced by traditional companies such as Cray, IBM, and Hewlett-Packard.

FYI

The computing power of early supercomputers was less than that of most commonly available computers today.

For decades, the increase in supercomputer power has followed a smooth and predictable path. Should this trend continue, it could be that complete simulations of the human brain and all of its neurons will be possible by the year 2025. In the early 2030s, supercomputers could be able to predict weather over a two-week period with 99 percent accuracy. By the 2050s, they may be able to simulate millions of human brains at one time. Along with developments in artificial intelligence and brain-computer interfaces, this could allow creating virtual worlds similar to those seen in today's science fiction movies.

Many new jobs are needed for the development of supercomputers to continue at the current rate. These will be in hardware and software development. Jobs will also be needed to support and maintain supercomputers.

Employment Areas Affected by IT Innovations

All companies have IT needs regardless of the field. Health care, manufacturing, agriculture, entertainment, transportation, governmental administration, and hospitality are some of the fastest growing fields. Companies in these and all other parts of the economy need trained individuals to oversee their computer systems, as shown in Figure 17-3.

Surveys of companies looking to hire IT professionals in the near future show that many of the positions reflect the developments in the IT field. These positions did not exist just a few years ago. There are many areas in non-IT fields that hold promise for IT positions. In many cases, the specific jobs have yet to be defined.

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Figure 17-3. The health care field uses computers in many different ways, from tracking patient data and records to computer-assisted surgeries. IT professionals are needed to oversee these systems.

Programming and Application Development

Companies need programming and application development to solve problems that need to be automated. Workers in programming and application development design, create, and modify general computer software or specialized programs. A person in this position must be able to analyze user needs and develop software solutions. He or she may analyze and design databases, working individually or coordinating development as part of a team.

Companies hiring in this area seek to improve productivity, lower costs, and create a better web presence. They need staffers to create new and better technology to do those things. Experience with high-level programming languages, such as Java, J2EE, C++, and Visual Basic.Net, is needed.

Peter Bernik/Shutterstock.com

Figure 17-4. A project manager must apply the available tools and his or her skills to meet the objectives of the project.

Project Management

Project management is applying tools and skills to the tasks in a project in order to meet the objectives of the project, as shown in Figure 17-4. The ongoing need for project management skills correlates with the continuing need for programmers. Both are responses to the demand for new applications that businesses need to have to compete in the economy. If there are more projects, then more project managers are needed. The demand for project managers is strong, in part because projects are becoming more complex.

Successful candidates need to have proven track records of completed projects. They need to be organized, show leadership, know how to follow up, and be attentive to details.

Technical Support

Technical support is providing assistance to others with setting up, running, or fixing technical systems, such as computer systems. Working in technical support is the starting point for many people interested in an IT career. Staffing firms specializing in technical careers report that *help desk technician* is the job title companies most often seek help filling. These jobs are very interactive with users.

FYI

Technical support is often referred to as a help desk or simply tech support.

Many new systems are being set up and have to be used by employees who are not IT-oriented. For example, a technical support person at a hospital could be working with a new radiology system, genome sequencing, or electronic health record application. Companies are looking not only for people to build and implement the systems, but also for technical support to help employees use them.

Security

Security has long been a concern of IT leaders. IT security ensures a stable, safe computing environment. Businesses are increasingly dependent on computer systems and the Internet. Systems are becoming larger. Hackers are becoming more intrusive. As a result, demand for specialized security is growing.

Candidates for IT security positions must show that they know how a given company does business. They will also have expertise in deploying firewalls, using threat-detection tools, and installing encryption technology. The **chief information officer (CIO)** is the person in charge of data security for a company. He or she has a staff to combat cyber criminals.

The Internet Crime Complaint Center is a partnership between the FBI and the National White Collar Crime Center. It processes more than a quarter of a million complaints related to Internet crime each year.

Most complaints deal with fraud. These crimes included nondelivery of ordered items, credit and debit card fraud, and advanced-fee scams.

Business Intelligence and Analytics

As businesses collect more and more data, understanding how to process these data grows in importance. An example is the enormous amount of information collected and transmitted by Twitter. Twitter currently handles about five hundred million tweets per day. Twitter and many other companies analyze all of these tweets to find trends. News media follow social media trends to locate stories. Business intelligence and analytics involves processing data and locating trends.

Hiring staff to evaluate all of the collected data is one of the top priorities for many companies. IT managers have found that getting the right people to analyze all that information is challenging. The best candidates have technical know-how, business knowledge, and a strong background in both statistics and math. This is an uncommon combination of skills to find in one person. As a result, some companies hire statisticians and then teach them about technology and business. If interested in this field, a good background in statistics as well as computer technology is a benefit.

FYI

The vast amount of data collected by businesses and organizations is often called *big data*.

Cloud Computing

Knowledge of cloud computing was not on the list of needs for most companies as recently as 2015. Now cloud computing is a real option for data-storage requirements. Cloud computing also offers many application software solutions. As a result, companies find a need to hire cloud architects.

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Figure 17-5. A cloud architect establishes cloud-computing solutions for a company.

Cloud architects are experts in establishing cloud-computing solutions for a company, as shown in Figure 17-5. They must be smart businesspeople and know how to economically build a system. In addition, they need to know where the system can be hosted and how it should be configured. Their responsibilities will also include knowing how to negotiate with all of the people responsible for its implementation. Finally, they must make sure all of the company's data are properly backed up.

Virtualization

Virtualization is a process that allows multiple operating systems to simultaneously share a processor's resources in a safe and efficient way. It hides the real physical characteristics of a computing platform from users. Instead, it lets them see a simpler, simulated environment. Virtualization allows different operating systems to take turns running the system. This is very helpful in conserving the use of expensive hardware.

A virtualization administrator manages the computer system used for virtualization. The successful candidate for this position must understand the storage and clusters behind the virtual server. Previously, network connections consisted of devices and wires. Now, the CPUs handle virtualization. Therefore, experts in this field must be more knowledgeable in software rather than hardware.

Networking

Computer networking expertise is near the top of most companies' desired employee skills. Networks exist in almost all businesses. They require constant updates and maintenance. The successful candidate will be familiar with wired and wireless hardware components. He or she will also be an expert in the types of networks and their related software. A person who chooses this career path should enjoy troubleshooting and problem-solving. Network administrator is a position often in demand.

FYI

The increase in use of mobile devices has been dramatic over the past five years, now exceeding the use of desktop computers.

Mobile Applications

Mobile technology has created many jobs. Consumers and businesses use smartphones and tablets more and more. Employers need workers who can support these devices. Companies want individuals who can assess business needs and write mobile apps to meet them. This requires expertise in hardware capabilities and skill in the various operating systems of each type of mobile device.

Data Center

A data center houses computer systems and related hardware. Handling the functions of a data center requires core technical skills. Experience in storage and data backup is a concept learned in the early phases of computer hardware courses. These skills still remain in high demand. Database management and administration is the most requested need of companies looking to hire IT professionals.

Careers Available in IT

FYI

After reading about career responsibilities, required training, and predicted salary, begin focusing on mapping out a career plan.

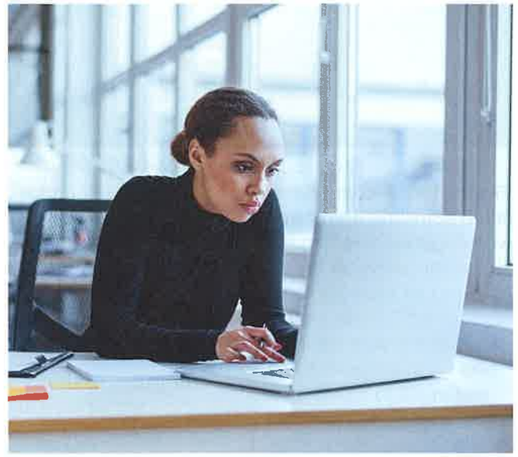
IT professionals can earn a very good living. They may start out doing technical support with an annual salary of about $40,000. The salary depends on many factors, from where the job is located to the size of the company. From there, an IT technician can be promoted into a variety of positions.

An interesting example of an IT career is the position of Vice President of Trust and Safety at Twitter. Twitter processes over 15 billion tweets each month. About 150,000 of them are dangerous. This vice president has a huge responsibility: to root out risky activity that might put users in harm's way.

There is a wealth of information on the Internet related to careers. Many websites list the education, skills, and experience needed to apply for a job in the field. Create a search string that names the career and includes the keywords of education, skills, experience: "software developer career" education skills experience. Results include a number of websites, many from schools offering education in the career. Sites offer career preparation advice for getting the proper education, developing the needed skills, and gaining experience in the field. Be sure to evaluate each site to see if it is providing reliable information.

Software Developer

A **software developer** writes specifications for programs, applications, and other software, as shown in Figure 17-6. These are the people who make Minecraft entertaining and keep users spelling out Words with Friends on their smartphones. A software developer designs computer software, databases, and games. Or, he or she may be responsible for writing operating systems. Being able to write programs is the most important skill for this position. Testing and debugging the code are also important skills. However, the software developer hands off the project to computer programmers to create the final software.



Ammentorp Photography/Shutterstock.com

Figure 17-6. Software developers write specifications for programs, which are then given to programmers to create the programs.

Growth for both types of software developers will expand. The Bureau of Labor Statistics (BLS) predicts there will be nearly 140,000 new positions created before 2022. It projects 22.8 percent employment growth for software developers between 2012 and 2022. This is much faster growth than average for all occupations. The BLS reports the median salary for software developers is between $90,000 and $95,000 per year.

FYI

The median salary is the salary above which half of the group earned and below which half of the group earned. It is *not* a starting salary.

After software is in operation, developers have to maintain and improve it. If a software developer is working with a business, he or she must know how the company does business. The developer must be able to interview the client and create a list of specifications for a new system. Software developers work with many other people in a company including the managers and other developers. Developers are often natural problem-solvers who possess strong analytical skills and the ability to think outside of the box.

A bachelor degree is usually required for software developer positions. In some cases, practical experience may be enough to land an entry-level job. Developers can enhance their careers by staying up-to-date on the latest programming tools and languages.

Computer Systems Analyst

A **computer systems analyst** makes recommendations to organizations for the best systems to use, as shown in Figure 17-7. He or she must understand not only the software, but the computer hardware, networks, and how they work together. The computer systems analyst

wavebreakmedia/Shutterstock.com

Figure 17-7. A computer systems analyst must understand software, hardware, networks, and how they work together.

has a big responsibility. How these key areas are integrated determines how efficiently the company operates. He or she does not need to know all details of specific technologies, but must understand how the systems interact.

Computer systems analysts are tech-savvy professionals who can visualize the big picture of how a company operates. They must keep the three aspects of an organization working together smoothly: employees, workflow, and computer systems. With employees and priorities constantly changing, a computer systems analyst must be in a problem-solving mode at all times.

Businesses increasingly rely on IT. Therefore, the demand for computer systems analysts is predicted to escalate at a steady pace. The BLS predicts 24.5 percent employment growth for this job by 2022, faster than the average of all occupations. About 127,000 new jobs will be created by then. The BLS reports the median salary for a computer systems analyst is about $80,000 per year.

Web Developer

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Figure 17-8. A web developer must create a website's color scheme, layout, text, images, and user experience.

A **web developer** is responsible for creating websites, as shown in Figure 17-8. This involves developing the website's color scheme, layout, text, images, and user experience. A web developer must work with the client to set the objectives for the website and then meet those objectives. Websites should be functional and visually appealing with user-friendly navigation.

Web developers have to be artistic as well as technical. Knowledge of software programs, web applications, and programming languages such as HTML and Java are essential. They must also have a solid understanding of design principles.

This type of position offers much freedom for an employee. Work environments for web developers vary widely, from large corporations or governmental agencies to small businesses. Developers may be full- or part-time employees. Many work on a contract basis as freelancers, while many others are self-employed.

About 28,500 new jobs will need to be filled by 2022 in an industry that already has roughly 140,000 positions. Increased use of mobile technology will stimulate the industry's employment growth, particularly with new opportunities to create websites for mobile devices. The BLS considers this another example of a fast-growing profession. It estimates employment should

increase at a rate of about 20 percent by 2022. The BLS also reports the median salary for web developers as between $60,000 and $65,000.

Security Analyst

The stories of security breaches at retailers and governmental agencies fill the news. With the rise in cyber attacks, there is a greater need to keep personal, corporate, and top-secret information safe. A **security analyst** is responsible for protecting the computer networks of a company, organization, or governmental agency, as shown in Figure 17-9. He or she works hard to stay ahead of cyber attackers. Candidates for this field need strong problem-solving and analytical skills. They also need to understand computer systems. Some information security analysts must be familiar with security regulations and standards.

Security analysts focus on three main areas:

- risk assessment, which is identifying problems an organization might face
- vulnerability, which is determining an organization's weaknesses
- defense planning, which is installing protections such as firewalls and data encryption programs

An entry-level position in this field may involve operating software to monitor and analyze information. A senior-level job may require investigative work to determine whether a security breach has occurred.

There is a high demand for someone with the right skills to protect data and information. The Washington, D.C., area has a high employment level for this occupation, likely due to the needs of governmental agencies that require security clearances. The BLS estimates 27,400 new jobs

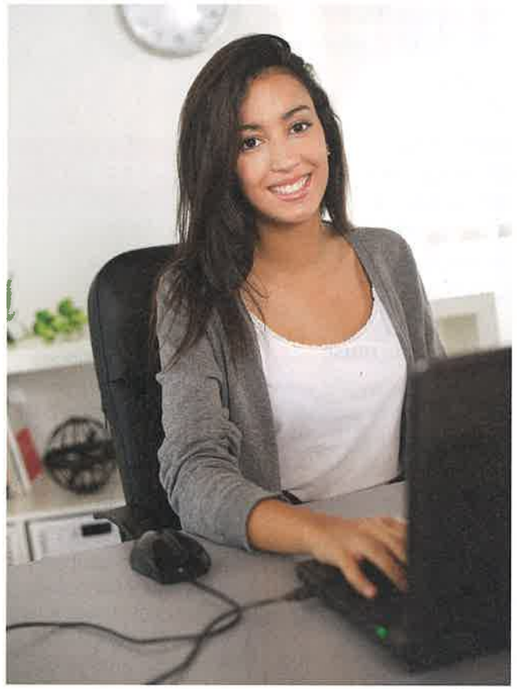
erwinova/Shutterstock.com

Figure 17-9. A security analyst works hard to stay ahead of cyber attackers and must have strong problem-solving and analytical skills.

STEM

Engineering

According to the Americans with Disabilities Act (ADA), wheelchair ramp slopes should be between 1:16 and 1:20. The ramp should be at least 36 inches wide, and level landings must be provided at both ends. The landings must be at least as wide as the ramp and a minimum of 60 inches long. All businesses must comply with accessible-design standards when constructing or altering facilities.



Jean-Philippe WALLET/Shustterstock.com

Figure 17-10. A database administrator must set up the security procedures to ensure sensitive data do not fall into the wrong hands.

with 36.5 percent employment growth for this profession by 2022. This is the highest growth rate among technology jobs. Information security analysts earn a median annual salary of between $85,000 and $90,000.

Database Administrator

Data have become the most valuable assets that companies must protect. A **database administrator** sets up databases to track a company's information and maintains those operations, as shown in Figure 17-10. This is a very fast-growing profession.

Database administrators are viewed as the guardians of data. They have to set up the security procedures to ensure sensitive data do not fall into the wrong hands. At the same time, they have to make the data available to those who need it. Along with problem-solving skills, the job involves resolving complex issues and attention to detail. Many companies run on a schedule that is 24 hours a day and seven days a week. That means many database administrators work more than 40 hours a week.

The successful candidate for this position will have previous IT experience. Most employers require a bachelor degree in a computer-related field, such as computer science or management information systems. Certification on specific database platforms is a plus, if not a requirement. MySQL, Oracle, and Microsoft Certified Database Administrator are examples of certification.

The BLS predicts this field will add 17,900 new positions with 15.1 percent employment growth by 2022. It reports the median salary for a database administrator is between $75,000 and $80,000.

IT Manager

An **IT manager** coordinates technology-related matters, plans upgrades of existing software or hardware, and negotiates with service providers, as shown in Figure 17-11. He or she must be technically competent, but will spend most time dealing with management, vendors, users, and other IT professionals. The IT manager must know the short- and long-term needs of the company's technology.

Almost all organizations need IT managers. Financial and insurance companies, manufacturing firms, health care facilities, and federal, state, and local governments all have particular needs for IT managers. In a medium-sized company, the IT manager generally reports to the CIO.

IT managers typically need a bachelor degree in computer or information science. This should include courses in computer

iofoto/Shustterstock.com

Figure 17-11. Almost all organizations need IT managers. IT managers must be technically competent, but will spend most time dealing with management, vendors, users, and other IT professionals.

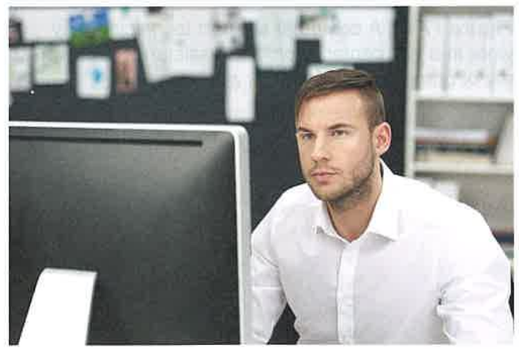
programming, software development, and mathematics. Many organizations also require their IT managers to have a graduate degree, such as a Master of Business Administration. Most candidates spend five to 10 years in an IT job before being promoted to IT manager.

The BLS predicts strong employment growth of 15.3 percent and an estimated 50,900 new positions to be filled by 2022. IT managers earn a median salary of about $120,000.

Computer Programmer

Substantial knowledge of programming languages and enjoying solving puzzles is essential for those interested in computer programming. A **computer programmer** writes, rewrites, debugs, maintains, and tests the software essential to key computer functions, as shown in Figure 17-12. He or she encodes instructions provided by software developers. The programmer refines the ideas and solves problems while converting the directions into code to create a final software application.

Computer programmers write instructions in one of the many computer languages. The most commonly used languages are C++ and Python. Other popular languages are C, Perl, Java, Ruby, and VB.Net. Programmers must be able to learn on the job. The programming language you know today may change tomorrow. Programmers must



racorn/Shutterstock.com

Figure 17-12. A computer programmer encodes instructions provided by software developers.

stay current on the languages they currently know as well as learn the newest languages.

Many computer programmer jobs require at least a bachelor degree. In some cases, a two-year degree or certificate may be enough to gain an entry-level position. Large computer and consulting firms often train new employees in intensive, company-based programs. Students interested in computer programming can improve their employment outlooks with internships.

The BLS predicts 28,400 new jobs with growth of 8 percent by 2022. This is considered about average growth. The median salary for a computer programmer is about $75,000.

FYI

Many IT professionals begin their careers as computer support technicians.

Computer Support Technician

The primary goal of a **computer support technician** is to quickly diagnose and solve computer issues for others in a friendly and effective manner, as shown in Figure 17-13. Tasks may include assistance with log-in difficulties, operating system problems, and a variety of software malfunctions. This assistance may be provided by phone, e-mail, and online chat. On-site meetings may be required. Some computer support technicians specialize in network matters.

Potstock/Shutterstock.com

Figure 17-13. A computer support technician may work in a call center to provide assistance for a variety of computer problems for customers.

Computer support technicians may work in traditional offices or call centers. Candidates for this position must display excellent communication skills. A bachelor degree is usually required along with familiarity with the company's basic hardware and software. Sometimes, a two-year degree or certificate may be enough, especially if the candidate continues to work on a higher-level degree.

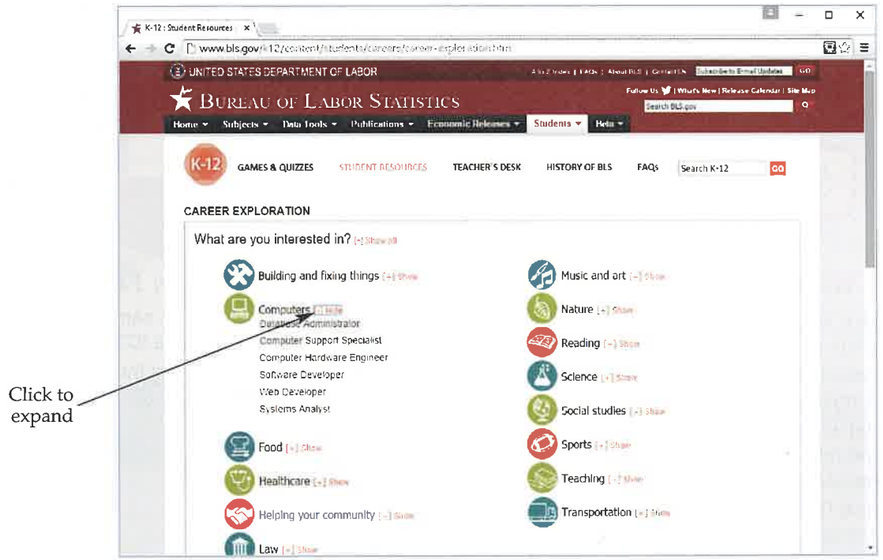
The BLS projects 123,000 new jobs will be created with 17 percent employment growth for computer support specialists by 2022. The industry already numbers close to three-quarters of a million workers. Computer support specialists earn a median salary of about $50,000.

HANDS-ON EXAMPLE 17.1.2

EXPLORING IT CAREERS

The Bureau of Labor Statistics website provides data related to many different careers, including the IT field. The site provides statistics on the current number of jobs, projected growth, and median salaries.

1. Launch a browser, and navigate to the BLS website (www.bls.gov).
2. Click the **Students** menu at the top, and click **Student Resources** in the drop-down menu.
3. Click **Career Exploration** on the new page that is displayed.
4. On the Career Exploration page, click **Computers** to expand it, as shown.



5. Click one of the careers displayed. The summary page of the Occupational Outlook Handbook for the career is displayed.
6. Click the **Work Environment** link.
7. What industries generally need employees in this career?
8. Click the browser's **Back** button to return to the Career Exploration page, select a different computer career, and find out what industries generally need employees in the career.

Titans of Technology

Jeffrey C. Taylor is the founder of the online career site Monster.com. It was created in the early days of the World Wide Web. It was the 454th registered domain on the web. Monster.com quickly became one of the first well-known dot-com companies. Taylor's "monster idea" was to revolutionize the way in which people look for employment. He shifted searches from the "want ads" in the backs of newspapers to the web. Monster.com was the first publically accessible employment search engine on the web. It is now one of the world's leading online career site. Taylor left Monster.com in 2005 to pursue other interests. He founded and was the CEO of Eons.com. This website connected adults in an online community, but is no longer active. He is also the founder and chairman of Tributes.com. This website is a source for national and local obituaries.

17.1 Section Review

Check Your Understanding

1. Which four areas of computer science are changing the most rapidly?
2. What are the duties and tasks of a chief information officer?
3. What would be a good search string to use when researching the job opportunities for a web developer?
4. Which IT career involves writing the code to create programs, applications, and other software?
5. What does a database administrator do?

IC3 Certification Practice

The following question is a sample of the types of questions presented on the IC3 exam.

1. Which of the following is the program used to create and send an e-mail message?
   A. e-mail server
   B. message header
   C. e-mail client
   D. ISP

Build Your Vocabulary

As you progress through this course, develop a personal IT glossary. This will help you build your vocabulary and prepare you for a career. Write a definition for each of the following terms and add it to your IT glossary.

chief information officer (CIO)
cloud architects
computer programmer
computer support technician
computer systems analyst
database administrator
IT manager
project management
security analyst
software developer
technical support
virtualization
web developer

Starting a Career in IT

Section 17.2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Essential Question

How has the digital revolution changed the way in which jobs are found?

Preparation for a career in IT requires knowledge in a specific set of skills. A candidate for this field must have formal training. Certifications from various technical exams can also command respect for the job-seeker. For example, Microsoft A+ certification in networking is a measure of success.

Most employers require a college degree, some sort of technical certification, or some related experience. Some will require a combination of all three. However, when asked, most employers say personal-success skills are among the most important qualities in a potential employee.

Learning Goals

After completing this section, you will be able to:

- Identify personal-success skills.
- Research a career.
- Describe the education, certification, training, and experience needed for a career.
- Create a résumé and portfolio.

Terms

529 plan
career and technical student organizations (CTSOs)
career plan
certification
formal education
Gantt chart
goal
informational interviewing
networking
portfolio
postsecondary education
résumé
scholarship
self-assessment
SMART goals
storyboarding

Personal-Success Skills

Employers are looking for employees with the personal skills needed to be successful in the workplace. These skills are commonly called *soft skills*. Good communication skills are required: writing, speaking, and listening. Beyond that, employers expect employees to have good attendance and to be at work at the assigned time. Employees should follow the dress code established by the employer, keep their work areas neat and clean, and take pride in their work. Employees should be able to solve problems by analyzing a situation and finding the best resolution.

Time-Management and Team Skills

Time-management skills are critical in 21st century jobs. The ability to determine how much time a task will take and then completing it on time is a skill everyone must master. Closely related to this is project management. When called on to work on multiple projects, the successful employee must be able to manage the tasks for each project to keep all projects on schedule. Storyboarding projects is a way to help manage them. **Storyboarding** is breaking a project down into its tasks and then arranging the tasks in an order that allows the project to stay on schedule. A storyboard can be used along with a Gantt chart. A **Gantt chart** is like a bar graph that tracks tasks, which tasks are dependent on others, and the completion percentages of each task, as shown in Figure 17-14. Time lines, deadlines, resource allocation, time management, delegation of tasks, and collaboration are all important aspects of time management and project management.

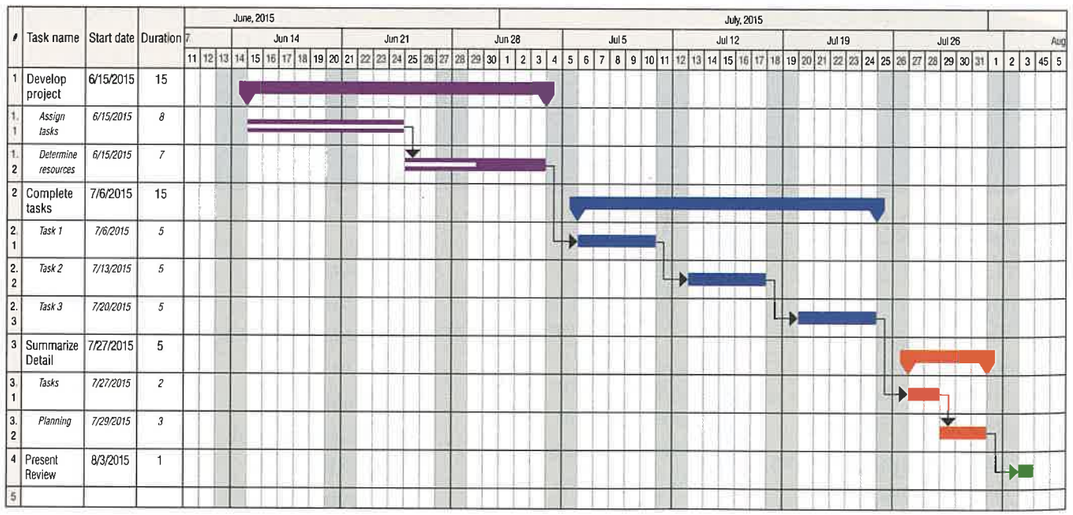

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Figure 17-14. A Gantt chart shows how long each task will take and which tasks must be completed before other tasks.

When managing a project, it is important to first plan the project. With planning complete, the project can be started (initiated) and placed in process (executed). While the project is in process, be sure to monitor it to ensure it stays on time and within its scope. Once the project is complete, close it by writing any needed follow-up reports or announcements. Also review the project to see if it met the goals set by the plan.

Employees should be flexible and be able to work with others in a team, responding to multiple priorities. All managers are looking to diversify their workplaces and encourage an atmosphere of acceptance and sensitivity. They want people with good moral fiber who are honest, hardworking, loyal, dependable, and responsible. Employers want happy, productive, life-long learners who will grow with new skills in the 21st century.

Constructive Criticism and Conflict Management

When working with others, it is important to be able to accept constructive criticism. Constructive criticism is feedback provided to you by others with the intent of improving your work. Be understanding while receiving the feedback. Always thank the person for the feedback. When responding to constructive criticism, try not to act on your first impulse. It is natural to be defensive about your work, but the person is trying to help by providing feedback. Take a few seconds or minutes to evaluate the feedback. Determine if the feedback identifies something that should be changed. If you need an explanation, ask for more information.

Even in the best of situations, a conflict may arise. If this happens, be sure to apply appropriate strategies to manage and resolve the conflict. Start by talking to the person. Focus on what happened, not what the *person* did. Be respectful of what the person has to say. Listen without interrupting and wait for a pause in the conversation to respond. When he or she has finished speaking, summarize or restate what was said. If anything is not clear to you, ask follow-up questions. Identify areas where you agree with the person and areas where you disagree. Be sure to ask if the other person agrees these are the areas of agreement and disagreement. Then that work with the person to decide which areas are the most important, and address those areas first. Create a plan that both agree on to resolve the issue. Be sure to follow through with the plan. Meet with the person again as needed to ensure a successful resolution to the conflict.

Verbal and Nonverbal Communication

Verbal communication is speaking words to communicate. It is also known as oral communication. In the course of a workday, most people spend at least some portion of time talking with coworkers, supervisors, managers, or customers. *Nonverbal communication* is an action, behavior, or attitude that sends a message to the receiver. It may send a message that is different from what you speak.

Interpersonal Skills

Interpersonal skills are those skills that help people communicate and work well with each other. The business or organization you will work for expects you to have good interpersonal skills. These skills are necessary to complete the job duties and ensure a positive working environment. The ability to communicate well, showing respect for others, and teamwork are skills all employers want in their employees.

Giving and receiving information efficiently is the key to effective communication. Time is limited in the workplace, and all employees have many duties and responsibilities. Others appreciate it when a person gets to the point quickly and in a positive manner. Being able to state your needs or intentions clearly to others can be learned through practice.

Careful listening and responding are also hallmarks of good communication. If you do not understand what someone wants, ask the person to clarify the request. Make sure to carefully follow directions. Always ask questions when you do not understand how to do a certain task. As in every part of life, communicating in a positive manner gets better results than communicating negatively or with a bad attitude.

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Your working environment will likely be diverse. It is important to be respectful of the beliefs and cultural backgrounds of your coworkers.

Respect is the feeling that someone or something is good, valuable, and important. Respect coworkers. A smile and a few minutes of friendly conversation are good ways to promote good working relationships.

Work environments are usually diverse. There will be people of many different cultures, beliefs, and ages. Regardless of personal differences, show respect to your supervisors, coworkers, and anyone else you interact with on the job. Make sure to remember the golden rule: treat others as you would like to be treated.

Skills for the Workplace

Employers look for potential employees who can help make their companies successful. There are many criteria used to sort through the hundreds of résumés submitted for open positions. Finding a potential employee with the required educational background and experience are usually the first criteria employers use when screening applications. For example, an employer looking to fill a position in cybersecurity will confirm the candidate is truly qualified for the position. The applicant's education and work experience will be reviewed to confirm the individual has job-specific skills. A *skill* is something an individual does well. *Job-specific skills* are critical skills necessary to perform the required work-related tasks of a position. Job-specific skills are acquired through work experience and education or training. Without them, the individual would be unlikely to successfully perform the job.

When applying for a position, the employer will ask questions related to your employability skills. *Employability skills* are applicable skills used to help an individual find a job, perform in the workplace, and gain success in a job or career. Employability skills are also known as foundational or transferrable skills. You have already acquired many of these skills in school. However, some of these skills are gained through life experience, such as working at a job or interacting with others in social situations. These skills are not specific to one career, but rather transferrable to any position.

Finding a candidate with employability skills is crucial in today's workplace. Employability skills can be categorized as basic skills, thinking skills, people skills, and personal qualities.

Basic Skills

Basic skills are the fundamental skills necessary to effectively function in society. These skills include:

- reading;
- writing;
- speaking;
- listening;
- applying mathematics; and
- applying technology skills.

Reading involves acquiring meaning from written words and symbols and evaluating their accuracy and validity. Reading skills allow you to comprehend and locate information in various forms, including in books, on the Internet, and in pictures such as graphs. Reading also helps you evaluate material to ensure understanding and form judgments.

Writing is using written words to express your ideas and opinions. Writing skills enable you to communicate effectively on paper or through electronic means. Writing requires you to edit and revise the message for accuracy, emphasis, and the audience. Effective business writing is required in the workplace.

Speaking is verbally communicating ideas. Speaking skills enable you to verbally present information in a clear manner, maximize word choices, control your tone of voice, and adjust the message for the audience.

Listening is hearing what others say and evaluating their messages for information. When you use listening skills, you pay attention to what other people are saying and understand the points being made.

Mathematics is the study of numbers and their relationships. Mathematical skills enable you to use numbers to evaluate information and detect patterns so that decisions can be made.

Technology skills include how to use social media, software, and basic computer systems. Using technology skills is necessary to be productive in the workplace.

Thinking Skills

Thinking skills are those skills that help people solve problems. Even if you are unable to find a solution, thinking skills help you assess a situation and identify the options. Examples of thinking skills include:

- decision-making;
- creative thinking;
- problem solving;
- visualization; and
- reasoning.

Decision-making is the process of analyzing a situation and evaluating possible outcomes in order to choose the best solution. Decision-making skills enable you to weigh pros and cons in order to solve problems.

Creative thinking involves developing or designing unusual and clever ideas about a given topic or situation. When you use creative-thinking skills, you develop unique or different ways to solve a problem.

Problem solving is identifying a solution and implementing it in the most efficient manner. Problem-solving skills help you carry out a plan or implement new processes to achieve a desired outcome.

Visualization is the ability to form mental images. Visualization skills allow you to imagine how something will function or appear prior to an actual process.

Reasoning is the ability to combine pieces of information or apply general rules to specific problems. Reasoning skills enable you to reach conclusions based on what you already know.

People Skills

People skills are the skills that enable people to develop and maintain working relationships with others. These skills have a significant impact on your relationships with others in the workplace. Examples of people skills include:

- social perceptiveness;
- negotiation;
- leadership;
- teamwork; and
- cultural competence.

Social perceptiveness is being aware of the feelings of others and understanding why others may act a certain way. Socially perceptive people exhibit kindness and understanding. They take an interest in their coworkers and who they are. However, it is important to balance social perceptiveness with the ability to assert yourself in a polite and professional manner when appropriate.

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Having good people skills is important to success in the workplace. Many jobs require communicating with customers, but even communicating with coworkers requires good people skills.

Negotiation is discussing various positions of an issue and working out the differences of opinion. The key to negotiating is being able to pinpoint the common goals among each position. This prepares everyone to argue the facts from his or her point of view and reach a compromise.

Leadership is the ability to influence or inspire other people. In the workplace, leaders encourage others and coordinate activities to reach goals.

Teamwork is working cooperatively with other people. Important aspects of teamwork include encouraging each other, building mutual trust and respect, and cooperating with team members.

Cultural competence is respecting all people regardless of age, national origin, gender, ability, or other differences. Being culturally competent enables you to effectively interact with all people in the workplace.

Personal Qualities

Personal qualities are the characteristics that make up an individual's personality. Examples of personal qualities include self-esteem, self-management, and responsibility. Having self-esteem is having confidence in yourself and your abilities. Self-management is the ability to work independently without supervision. Responsibility is being trusted to complete duties or tasks.

Employers look for employees who are flexible and can adjust in a positive manner to work situations as they change. This includes being

professional, having a positive attitude, and, above all, being ethical. Positive ethics are an important work quality that all employers expect their employees to possess.

HANDS-ON EXAMPLE 17.2.1

IDENTIFYING PERSONAL-SUCCESS SKILLS

To be successful in your chosen career, you will need to have knowledge and skills related to the field. However, you will also need to have certain personal-success skills.

1. Launch a browser, and navigate to a search engine.
2. Enter the search phrase personal success skills employers seek.
3. Visit several of the sites in the search result. Be sure to evaluate each site for validity of information.
4. Collect ten soft skills that an employer wants in a prospective employee.
5. Bring your list to class for a discussion. Be prepared to explain each skill and why you believe the skill is important or why not.

Researching a Career

It is important to know how to find information about career opportunities. You will need to know what education, skills, and experiences are needed to be successful. However, before beginning research, think about yourself and what types of work you might enjoy. Then, develop a career plan.

Career Plan

Planning for your career can be exciting. Your career choice will direct many other decisions in life. It will affect decisions about your education and even where you will live. To determine the careers that will be enjoyable for you, you must first learn about yourself.

A **career plan** is a list of steps on a time line to reach each of your career goals. It is also known as a *postsecondary plan.* A career plan should include options for education. Options include four-year colleges, two-year colleges, and technical schools. It should also address current job opportunities in your career of interest.

There is no set format for writing a career plan. Many free career plan templates can be found on the Internet. Figure 17-15 illustrates action items for a career plan. To create a career plan, you should first conduct a self-assessment and then set SMART goals. SMART goals are discussed later in this chapter. You will continue revising the career plan as you achieve your goals and set new ones.

A **self-assessment** is an evaluation of your aptitudes, abilities, values, and interests. By conducting a self-assessment, you can focus your energy on what is necessary for you to become a successful in a career. Some self-assessment techniques are thinking or writing exercises. Others are in the

Action Items for a Career Plan: IT Specialist

	Extracurricular and Volunteer Activities	Work Experience	Education and Training
During Middle School	• Help nonprofit groups and local youth groups with information technology needs • Prepare IT components and electronics for fairs and competitive events	Choose a part-time job or volunteer position that allows application of information technology skills	• Participate in a CTSO • For optional or extra credit work, select topics and projects related to computer service, maintenance, repair, or design
During High School	• Volunteer in school IT lab or seek out co-op opportunities • Perform computer service and repair for nonprofit organizations	Work as an intern at a local electronics or computer repair business	Take classes in information technology along with required coursework
During College	Help student, nonprofit, or local groups identify the best solutions for their computing and electronic needs	Work as a part-time service technician for an electronics or computer repair business	Follow the bachelor degree path for information technology
After College	• Obtain certification in your specialized area • Attend local information technology professionals and chamber of commerce events	Work as a technician	• Participate in appropriate professional development opportunities • Consider obtaining a master degree in computer science

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Figure 17-15. This is an example of a career plan.

form of tests, such as a personality test. Your career counselor can help you conduct a self-assessment.

Consider what you like to do and what you do well. This can give you clues to aid your self-assessment. If you are very organized and can handle several projects at once, you may find success as a manager. On the other hand, if you do not do well in math class, computer programmer may not be a good career for you. Instead, consider an IT career that has a lesser math requirement. Identifying a career that you will enjoy begins with finding out what you like to do.

What is your work style? Some individuals prefer to work independently. Others need constant direction to accomplish a task. Mornings are more productive for some workers, whereas others perform better in the afternoons. Casual dress influences one person to perform well. Business dress makes others more effective on the job.

FYI

When taking a self-assessment, strive to identify your aptitudes, abilities, values, and interests. Learning this information can reveal careers for which you are well suited.

Aptitudes

An *aptitude* is a characteristic that an individual has naturally developed. Aptitudes are also called *talents.* When a person naturally excels at a task without practicing or studying, he or she has an aptitude for it. For example, a person with an aptitude for music may be very good at accurately humming a tune or keeping a beat, even if he or she

has never studied music. Knowing your aptitudes can lead to job success. Some examples of aptitudes are:

- mathematics;
- drawing;
- writing; and
- art.

Abilities

Ability is a mastery of a skill or the capacity to do something. Having aptitudes and skills are supported or limited by your abilities. For instance, a student who has musical aptitude and skill might not have the ability to perform under pressure in musical concerts.

While aptitudes are something a person is born with, abilities can be acquired. Often, it is easier to develop abilities that match your natural aptitudes. For example, someone with an aptitude for acquiring languages may have the ability to speak French. A person without an aptitude for acquiring language can also learn to speak French. However, it will be more difficult.

Aptitudes and abilities do not always match. Someone with an aptitude for repairing machines may not enjoy doing this type of work and never develop the ability. Examples of abilities include:

- teaching others;
- multitasking;
- thinking logically; and
- speaking multiple languages.

Values

The principles and beliefs that you consider important are your *values*. They are beliefs about the things that matter most to an individual. Values are developed as you mature and learn. Your values will affect your life in many ways. They influence how you relate to other people and make decisions about your education and career.

Your work values can provide great insight into what kind of career will appeal to you. For some individuals, work values include job security. For others, the number of vacation days is important. Everyone has a set of work values that are taken into consideration when choosing a career path. For example, a person who values the environment may want to pursue a career in green energy or conservation, as shown in Figure 17-16. Examples of values include:

- perfection;
- equality;
- harmony; and
- status.

Closely related to values are family responsibilities and personal priorities. These can have a direct impact on career choice. For example,

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Figure 17-16. If you wish to pursue an IT career related to green technology, you may consider working with the control systems for solar power installations.

if you expect to have a large family, you may decide that time is a family responsibility. You may want to spend as much time as possible with your children as they grow. This may mean choosing a career that does not typically require travel or working long hours. On the other hand, it may be important to you to live in an expensive house and drive an expensive car. This personal priority will require you to enter a career with an income level that will support these choices.

Interests

An *interest* is a feeling of wanting to learn more about a topic or to be involved in an activity. Your interests might include a subject, such as history. You may be interested in local politics or cars. Your interests can also include hobbies, such as biking or cooking. Since all types of companies need IT professionals, there is a good chance you can find a career that would allow you to be around your interests.

Your interests may change over time. You may find new hobbies or topics that interest you. Try to determine if there is a uniting theme to your interests. When considering your interests, look at the "big picture." For example, you may enjoy working on cars right now. In a few years, a career as an IT professional for a car manufacturer or dealer may suit you because you enjoy cars. Examples of interests include:

- art and creativity;
- woodworking;
- sports and adventure; and
- collecting.

Researching Career Information

There are several resources to help in researching a career. A good thing to keep in mind is that a career is rarely one job you have for 30 or 40 years. Especially in the IT field, job requirements rapidly change. There is almost always the opportunity for a better job through advancement or lateral movement. Better jobs often have more responsibility, more opportunity to impact the final result, and, generally, larger salaries.

Internet Research

FYI

The Internet is also a great tool to use when you begin applying for jobs. You can search for available jobs and submit a résumé, job application, and cover letter online.

The Internet is a good place to start when researching your future career. Researching various professions, employment trends, industries, and prospective employers provides insight to careers that may interest you. Many postsecondary schools have websites that provide career information.

The Occupational Information Network (O*NET) is a valuable resource for career information. O*NET Online (www.onetonline.org) is the most comprehensive database of occupational information. It was created by the US Department of Labor and is regularly updated. This website contains data on salary, growth, openings, education requirements, skills and abilities, work tasks, and related occupations for more than 1,000 careers. The database can be searched by career cluster. IT careers are found in the information technology career cluster.

Another way to explore careers online is through employment websites. Examples of these are Monster.com and Dice.com. Other sites that focus on technical careers include ComputerWork.com, CareerBuilder.com, ComputerJobs.com, and TechCareers.com, as shown in Figure 17-17. Governmental jobs are found on USA.gov. It is a good idea to visit these sites to see what the overall requirements are for jobs in the geographic area being sought.

Career Handbooks

Career handbooks offer a great place to begin researching specific careers, their industries, and areas of the country or world in which these industries thrive. The US Bureau of Labor Statistics publishes the *Occupational Outlook Handbook* and the *Career Guide to Industries*. These handbooks describe the training and education needed for various jobs. They provide up-to-date information about careers, industries, employment trends, and even salary outlooks.

The information technology industry is considered a nature of business. Nature of business is a general category of operations. The business can be organized as proprietorships, partnerships, or corporations.

A *proprietorship* is a business that has a sole owner. This person is responsible for every aspect of the business including making money or losing money.

A *partnership* is comprised of two or more people working toward a joint purpose. Individual partners bring many attributes to a business,

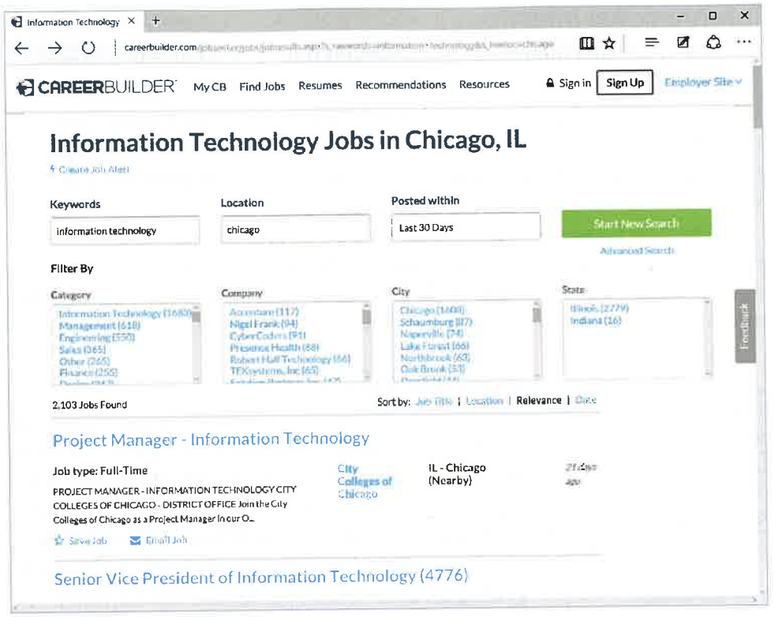

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Figure 17-17. CareerBuilder.com is one of the many employment websites that can be used to research and locate career positions.

such as money, talent, and time. All are responsible for the business, including making money or losing money.

A *corporation* is a type of business that is recognized as a separate legal entity from its owners. A corporation is defined by the US Supreme Court as "an artificial being, invisible, intangible, and existing only in contemplation of the law." It is a form of ownership in which owners are not personally liable for the business.

Networking

Eighty percent of new jobs are found by networking. Some open jobs are never even advertised. **Networking** means talking with people you know and making new contacts. Most employers would much rather hire someone who comes recommended by someone they already know. Asking family and friends for contacts in the field is a good way to start. Then it is possible to contact these professionals and ask if they know of any open jobs or employers who are hiring.

Many professional organizations have student chapters. These can be great places to network with others in your chosen career field. When you begin looking for your first job, let other members know. The more contacts you make, the greater your opportunities for finding career ideas.

Green Tech

Green Job Search

Technology has made finding and applying for jobs more eco-friendly than ever before. Job seekers can now locate and apply for job positions online by electronically uploading their résumé in response to a job posting. Many websites allow job seekers to complete their applications online. Searching and applying for jobs electronically saves time and money.

FYI

Follow up with your contact after the interview. Send a thank-you message to show appreciation for his or her time.

Informational Interviews

Informational interviews can give you unique insight into a career. **Informational interviewing** is a strategy used to interview a professional to ask for advice and direction, rather than for a job opportunity. This type of interview will help you get a sense of what it is like to work in that profession. At the interview, be as professional and polite as you would in any other interview situation.

An informational interview can also be a valuable networking opportunity. By talking with someone in the field, you can learn more about what is expected. You can also learn what types of jobs are available and other information about an industry.

Setting SMART Goals

Another step in the career-planning process is to set goals. A **goal** is something a person wants to achieve in a specified time period. There are two types of goals: short term and long term. A *short-term goal* is one that can be achieved in less than one year. An example of a short-term goal may be getting an after-school job for the fall semester. A *long-term goal* is one that will take a longer period of time to achieve, usually more than one year. An example of a long-term goal is to attend college to earn a four-year degree.

Goal setting is the process of deciding what a person wants to achieve. Your goals must be based on what you want for your life. Well-defined career goals follow the SMART goal model. **SMART goals** are specific, measurable, attainable, realistic, and timely, as illustrated in Figure 17-18.

S	Are my short- and long-term goals **specific**? Exactly what do I want to achieve?
M	Are my goals **measurable**? How will I know when a goal is achieved?
A	Are my goals **attainable**? Am I setting goals that can be achieved?
R	Are my goals **realistic**? Have I set goals that are practical?
T	Are my goals **timely**? Are the dates for achieving my goals appropriate?

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Figure 17-18. Well-defined career goals follow the SMART goal model.

Specific. A career goal should be specific and straightforward. For example, "I want to have a career" is not a specific goal. Instead, you might say, "I want to have a career as a security analyst." When the goal is specific, it is easier to track your progress.

Measurable. It is important to be able to measure progress so you know when you have reached your goal. For example, "I want to earn a bachelor degree in information technology." This goal can be measured. When you earn the degree, you will know your goal has been reached.

Attainable. Goals need to be attainable. For example, "I want to be an IT manager at IBM when I graduate from college." This is not reasonable for that point in a person's career. Gaining work experience is necessary before obtaining a management position. For a large corporation, you may need ten or more years of experience to become a manager. This goal becomes more attainable when coupled with a plan to gain the necessary aptitudes, skills, and experience.

Realistic. Goals must be realistic. Obtaining a position as an IT manager may be practical with proper planning. It is not realistic for a new college graduate. Finding an entry-level IT position in the company and working your way up to IT manager over a number of years make this a realistic goal.

Timely. A goal should have a starting point and an ending point. Setting a time frame to achieve a goal is the step most often overlooked. An end date can help you stay on track. For example, you may want to be an IT manager by the time you are 35 years old. Aiming to get the experience and education to achieve this position by a specific age will help you remain motivated to reach your goal on time.

Education, Certification, Training, and Experience

There are many steps you will take as you plan your career. Your educational needs will depend on your career interests and goals. Some careers require a high school diploma followed by technical training or a bachelor degree. Others require graduate work, such as a master degree. Still other careers require professional certification. Early career planning can help you make decisions about your education.

Education

Formal education is the education received in a school, college, or university. Most IT careers require a college degree. This is called postsecondary education. Jobs higher on the career ladder often require additional formal education. This is called graduate, postgraduate, or continuing education.

Two- and four-year colleges have programs set up to offer a degree in information technology. Sometimes the programs are found in the computer science or management information systems (MIS) departments. There are also licensed technical schools whose coursework concentrates on a particular IT career. Some may focus on system networking, while others may offer web development. These schools grant certificates rather than diplomas.

FYI

Academic certificates are professional endorsements that often require fewer classes than a degree. They are usually considered less rigorous than a two-year degree.

Postsecondary Education

Postsecondary education is any education achieved after high school. This includes all two- and four-year colleges and universities. Common postsecondary degrees are an associate degree and a bachelor degree. An associate degree is a two-year degree. A bachelor degree is a four-year degree.

Students in postsecondary schools choose an area of study that suits an interest or meets a career goal. This is referred to as a *major*. For example, a student who wants a career in the IT field will likely major in computer science, information technology, or management information systems. When considering a major, be sure to look at the earnings

potential and the number of jobs available in the area, both for new graduates and for those with experience.

In addition to major area of studies, postsecondary students are typically required to take a wide variety of classes in other subjects. These courses are referred to as *general education courses*. They cover many of the same subject areas as high school courses. They also cover subjects not often offered at the high school level.

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Figure 17-19. What most people think of as "college" is a not-for-profit school. For-profit schools are alternatives for many students.

A postsecondary school may be either a not-for-profit school or a for-profit school. A *not-for-profit school* is one that returns the money it earns back into the school. These schools receive funding from student tuition and fees, donations, and governmental programs. A not-for-profit school is what most people think of in terms of "college," as shown in Figure 17-19. It may be public, such as a state university. Others may be private, such as a private college or a community college. Not-for-profit schools tend to encourage academic exploration and personal growth beyond the specific requirements of a student's major.

A *for-profit school* is one that is set up to earn money for investors. It provides a product, which is education. In return for providing education, a for-profit school receives money from its customers, which are students. For-profit schools are also known as *proprietary schools*. They tend to focus on specific skills and do not require general education courses. A trade school is an example of a for-profit school. These schools typically offer a two-year degree specialized in a field of trade, such as information technology technician. Some for-profit schools offer bachelor degree programs.

When considering a college or university, be aware of what is needed to apply. Requirements may include:

- official transcripts;
- college exam test scores;
- essays; and
- interviews.

For all requirements, be sure to know the deadlines for completing and submitting the information. Missing a deadline can mean not being accepted to the school.

The costs of a postsecondary education must be considered. In addition to tuition, there are fees for many classes. As an IT major, you may need to take many laboratory classes. These classes can have more fees than other courses. Living expenses must also be considered as part of the cost of a postsecondary education.

Graduate and Postgraduate Education

Education received after an individual has earned a bachelor degree is *graduate education*. Master degrees are graduate degrees. Education beyond a master degree is called *postgraduate education*. Doctorate degrees are postgraduate degrees.

Graduate and postgraduate study often build on the same subject area or a closely related subject in which the bachelor degree was earned. For example, a student who earned a Bachelor of Science degree in computer programming may pursue a Master of Science degree in information technology.

Continuing Education

Some careers that have professional licenses require *continuing education* classes. These classes are completed to maintain the license. Completing these classes earns the student *continuing education units (CEUs)*.

Career and Technical Student Organizations

Career and technical student organizations (CTSOs) are national student organizations with local school chapters that are related to career and technical education (CTE) courses. CTSO programs are tied to various course areas. Internships and other cooperative work experiences may be a part of the CTSO experience. CTSOs can help prepare high school graduates for their next step, whether it is college or a job. The goal of CTSOs is to help students acquire knowledge and skills in different career and technical areas.

Competitive events are a main feature of most CTSOs. Competing in various events enables students to show mastery of specific content. Events also measure the use of decision-making, problem-solving, and leadership skills. Students may receive recognition awards for participation in events. In some cases, scholarships may be awarded if they win at state- and national-level competitions.

Professional Certification

There are many types of certification available. **Certification** is a professional status earned by an individual after passing an exam focused on a specific body of knowledge. When cerfitication is achieved, the person receives a certificate. The individual usually prepares for the exam by taking classes and studying content that will be tested. The exam is often given online.

Certification programs are helpful to employers who are looking for a standardized way to assess a candidate's skill level. Certificates might give the candidate an extra advantage to gaining an interview, such as demonstrating computer literacy with IC3 cerficiation. However, a certificate is not an alternative to a college degree.

FYI

Employees who earn certificates generally make more money than those who do not.

Some certifications must be renewed on a regular basis. For example, many certifications sponsored by Microsoft are only valid for the specific version of software. When the next version is released, another exam must be taken to be certified for the update. Other certifications require regular continuing education classes to ensure individuals are current with up-to-date information in the profession.

HANDS-ON EXAMPLE 17.2.2

INVESTIGATING PROFESSIONAL CERTIFICATION

Software and hardware vendors and professional organizations often offer certification. Becoming certified in an area related to your career can be beneficial.

1. Launch a browser, and navigate to www.microsoft.com.
2. Use the search function and the keywords IT certification MCP to locate articles on certification.
3. Read several of the articles to investigate what types of certifications are available.
4. Navigate to www.cisco.com.
5. Use the search function and the keywords IT certification to locate articles on certification. Cisco offers five levels of network certification.
6. Investigate each of the five levels of certification to see what is needed to do to pass the exam.
7. Navigate to www.comptia.org. The Computing Technology Industry Association (CompTIA) is a professional organization.
8. Click the **Certifications** link. Review the information provided on certification, training, testing, careers, and continuing education.

Training and Experience

Most employers want candidates who have some real-world work experience. Taking advantage of internships or part-time paid positions in the IT field is a good way to start. Many colleges hire students to handle technical support for their call centers. Others allow IT students to assist IT instructors in setting up and maintaining the computer labs. There are many options for career training, including occupational training, internships, apprenticeships, and military service.

Leadership and Mentoring

Leadership is the process of influencing others or making things better. Certain traits such as honesty, competence, self-confidence, communication skills, problem-solving skills, and dependability are examples of leadership characteristics. The ability to set goals, follow through on tasks, and be forward-thinking are also important leadership abilities. A leader has to be able to take responsibility, make decisions, and inspire members to accomplish tasks. Leaders must be able to work with different personalities and motivate the group to accomplish its goals. Each leader has his or her style or may develop a style based on the personalities of the team. Three common leadership styles are democratic, autocratic, and laissez-faire, as shown in Figure 17-20.

Common Leadership Styles

Leadership Style	Characteristics
Democratic	• Open and collegial • Invited participation from team • Shares decision making with team members
Autocratic	• Maintains power within the group • Keeps close control over the members of the team • Makes all decisions for the group
Laissez-faire	• Hands-off approach • Little to no direction is provided • Makes decisions only if requested by the team

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Figure 17-20. Every leader has his or her own leadership style. These are three common leadership styles.

A *mentor* is someone with experience who trains or guides a less-experienced person. When you start your first professional job, you will likely be paired with a mentor who will teach you how to apply the skills you learned in school. As you gain experience and move up to higher positions, you may be called on to be a mentor yourself. Mentorship is an important part of most careers. It is a way to pass along information that may be specific to the company. It is also important as a way to help those who have just completed their education to make the transition into the world of work. Often, mentorships extend outside of the workplace and into the community. This is a way for companies and individuals to improve the communities in which they work and live.

Occupational Training

Training for a specific career can be an option for many technical, trade, and technology fields. *Occupational training* is education that prepares you for a specific type of work. This type of training typically costs less than a traditional college education. It can also be completed in less time. A computer repair technician, for example, may receive occupational training, as shown in Figure 17-21.

Internships

An *internship* is a short-term position with a sponsoring organization that gives the intern an opportunity to gain on-the-job experience in a certain field of study or occupation. Internships can be paid or unpaid. Often, high schools, colleges, and universities offer school credit for completing internships. Internships are an opportunity to gain work experience while completing an education.

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Figure 17-21. Many career positions will involve occupational training from a mentor.

Apprenticeships

An *apprenticeship* is a combination of on-the-job training, work experience, and classroom instruction. Apprenticeships are typically available to those who want to learn a trade or a technical skill. The apprentice works on mastering the skills required to work in the trade or field under the supervision of a skilled tradesperson. The IT field generally does not have apprenticeship programs.

Military Service

Service in the military can provide opportunities to receive skilled training, often in highly specialized technical areas. In addition to receiving this training, often it can be translated into college credit or professional credentials. After completing military service, there are many benefits available to veterans. For example, the *GI Bill* is a law that provides financial assistance for veterans pursuing education or training. Other forms of tuition assistance are also available.

Some people choose to enter the armed forces through the Reserve Officers Training Corp (ROTC). Each branch of the military has an ROTC program at selected colleges and universities. Some high schools have Junior ROTC programs. The purpose of the ROTC program is to train commissioned officers for the armed forces. It can provide tuition assistance in exchange for a commitment to military service. Students enrolled in this program take classes just like other college students. The program is considered an elective. However, students also receive basic military and officer training. Information is available on the Military Career Guide Online at www.todaysmilitary.com. Also, opportunities available in the armed forces are outlined in the Occupational Outlook Handbook.

Funding Your Education

As you are making decisions on your education, you will need to create a financial plan for paying for your education. You will need to figure out which sources are available to you and which ones fit your needs. Once you have an idea of how much it will cost to go to college, you need to figure out how you will pay for it. Figure 17-22 shows potential sources of funding for your education.

Someone in your family may have established a 529 plan to fund your college education. A **529 plan** is a savings plan for education operated by a state or educational institution. These plans are tax-advantaged savings plans and encourage families to set aside college funds for their children. Each state now has at least one 529 plan available. Make sure you

Potential Sources of Funding a College Education

Source	Brief Description	Repayment
529 Plan	Tax-advantage savings plan designed to encourage saving for future college costs. Plans are sponsored by states, state agencies, and educational institutions.	No repayment.
Grants	Money to pay for college provided by government agencies, corporations, states, and other organizations. Most grants are based on need and some have other requirements.	No repayment.
Scholarships	Money to pay for college based on specific qualifications including academics, sports, music, leadership, and service. Criteria for scholarships vary widely.	No repayment.
Work-study	Paid part-time jobs for students with financial need. Work-study programs are typically backed by government agencies.	No repayment.
Need-based awards	Aid for students who demonstrate financial need.	No repayment.
Government education loans	Loans made to students to help pay for college. Interest rates are lower than bank loans.	Repayment is required. Repayment may be postponed until you begin your career.
Private education loans	Loans made to students to help pay for college. Interest rates are higher than government education loans.	Repayment is required.
Internships	Career-based work experience. Some internships are paid and some are not. In addition to experience, you will likely earn college credit.	No repayment.
Military benefits	The US Military offers several ways to help pay for education. It provides education and training opportunities while serving and also provides access to funding for veterans. The US Reserve Officers' Training Corps (ROTC) programs and the military service academies are other options to consider.	No repayment, however a service commitment is required.

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Figure 17-22. There are many ways with which to fund a college education.

understand how the plan works. You will be penalized if you use money invested in a 529 plan for anything other than college expenses.

More than half of the students attending college get some form of financial aid. Financial aid is available from the federal government as well as from nonfederal agencies. There are more than $100 billion in grants, scholarships, work-study, need-based awards, and loans available each year.

A *grant* is a financial award that does not have to be repaid and is typically provided by a nonprofit organization. Grants are generally need-based and are usually tax exempt. A Federal Pell Grant is an example of a governmental grant.

FYI

Many scholarships and grants go unused because no one has applied for them. Do not miss out on financial assistance because you did not apply for it.

A **scholarship** is financial aid that may be based on financial need or some type of merit or accomplishment. There are scholarships based on standardized test scores, grades, extracurricular activities, and athletics. There are also scholarships available for leadership; service; and other interests, abilities, and talents.

Work-study programs are part-time jobs on a college campus. They are often subsidized by the government. Wages earned at a work-study job go toward paying for tuition and other college expenses.

Need-based awards are financial-aid awards available for students and families who meet certain economic requirements. Income and other demographics determine if a student qualifies for this assistance.

The *Free Application for Federal Student Aid (FAFSA)* is the application form used to determine your eligibility for federal financial aid. Many institutions require the FAFSA form if you are applying for any type of financial aid. You can file your application online at the Federal Student Aid website, which is an office of the US Department of Education. In addition to the financial aid application, the FAFSA website has resources to help you plan for college.

Résumé and Portfolio

GS4 Key Applications 1.2.1, 1.2.2

When seeking professional employment, it is almost always necessary to compose a résumé. The first impression most employers will have of you is your résumé. As a result, it must be well written and error free. In many cases, you will also need to have a portfolio to showcase your work.

When creating a résumé, use proper formatting. Create styles as needed to help with formatting. Use an appropriate typeface, font size, and formatting such as bold and italic. Look for examples of résumés in books and online. Use these examples to format your résumé. It should reflect your personal tastes, but should also follow similar formatting that other résumés have.

Creating a Résumé

A **résumé** highlights a person's career goals, education, work history, and professional accomplishments. The purpose of the résumé is to show you have the needed skills and qualifications and to influence the reader into requesting an interview. A sample résumé is shown in Figure 17-23.

Robert Jefferies
123 Eastwood Terrace
Saratoga Springs, NY 60123
123-555-9715
rjefferies@e-mail.edu

OBJECTIVE
A mature and responsible high school student seeks an entry-level job as a computer repair technician.

EXPERIENCE
Saratoga Springs City Online Newspaper, Saratoga Springs, NY
September 2016 to present
Computer Support
- Maintained various computers for the newspaper.
- Assisted with network setup.
- Set up new computer stations.
- Installed new software as needed.

Hunter High School, Saratoga Springs, NY
September 2015 to September 2016
Student Volunteer
- Monitored the computer lab.
- Performed troubleshooting on lab computers.
- Installed software updates as needed.
- Performed routine software maintenance.

EDUCATION
Hunter High School, Saratoga Springs, NY
Expected graduation date: May 2017
Relevant coursework: Principles of Information Technology

HONORS
- Hunter High School Honor Roll, 8 quarters
- Winner: Student Troubleshooting Contest, 2014–2016

PUBLICATIONS
- Saratoga Springs City Online Newspaper
- Saratoga Springs City Calendar 2015

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Figure 17-23. This is a sample of a properly formatted résumé.

A potential employer will only spend 15 seconds reading the résumé before a decision is made whether or not to set up an interview. Therefore, a résumé should be neat and professional in appearance. It should begin with your contact information followed by an objective. The contact information should include your name, address, phone number, and e-mail address. It is okay to omit the street address, but do not omit the city and state. Make sure the e-mail address is appropriate and professional.

GS4 Living Online 3.1.1

Next, include work and volunteer experience. Follow this with educational experience and certifications with dates. The last part of the résumé is a list of professional accomplishments. If you are experienced with many professional accomplishments, you may choose to place this list immediately after the objective.

Once the résumé is written, proofread it several times. Ask others to read it for errors as well. Potential employers may have to review hundreds of résumés for a single position. Be the one they remember for your skills and qualifications, not for the misspellings or grammatical mistakes you made.

Objective

FYI

Some people choose to include a summary before the objective to highlight key points or skills included later in the résumé.

The objective states what kind of position you are seeking. Use some of the specific terms that appear in the employer's job description. This shows the employer you are looking for that specific position, not just randomly sending out résumés. This section may be labeled Objective, Career Objective, or Career Goal.

Figure 17-24 shows an example of an objective section for someone seeking an IT position. Notice that background qualifications are mentioned, including IT subjects and the skills mastered. The candidate also states that he or she wants to contribute to the profitability of the company. It is a good idea to use the company's name.

Work History

The work history lists all places where you have worked. For someone just beginning in the IT field, this will be short. Include volunteer jobs as well as paid positions. Jobs that are not professional in nature, such as lifeguard or restaurant server, are often omitted unless somehow relevant experience was gained. Be prepared to explain any gaps in your work history. This section may be labeled Work History,

OBJECTIVE
Seeking a challenging position in information technology where broad knowledge of software applications, operating systems, hardware, and networks and a degree in applied information technology can be combined with skills in communication, customer relations, troubleshooting, and attention-to-detail to make the XYZ Company profitable.

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Figure 17-24. This is an example of an objective statement for a résumé.

Work Experience, or Experience. Figure 17-25 shows an example of a work history section.

Education and Certification

The education and certification section lists degrees, where they were obtained, and the areas of concentration. Also include any certificates you have and the organizations that granted them. List any awards received in school or from the community, although these may be listed in a separate section. An inventory of various hardware and software expertise should also appear here. Figure 17-26 shows an example of an education and certification section.

Ethics

Applications and Résumés

When applying for a job, to a college, or for a volunteer position, it is important to be truthful in your application and résumé. Fabricating experience or education is unethical and could cost you the opportunity to be a part of that school or company. Always tell the truth about your skills, experience, and education.

Professional Accomplishments

The professional accomplishments section lists specific things you have done. These may be projects you completed, papers you published, or awards you received. Think about your work and educational experience in terms of small successes. These accomplishments should have a beginning and an end. They should be projects or activities where you had a measurable role.

Begin each statement with an active verb. Figure 17-27 shows some examples that might be included on the résumé for a recent college graduate. Notice how this person has chosen to set the action verbs in bold to make them stand out.

WORK HISTORY
University of Baltimore, Baltimore, MD (10/2015 to 8/2017)
Help Desk Analyst: Duties included building positive relations with faculty and students; solving hardware, Microsoft Office, PeopleSoft, and Internet problems.

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Figure 17-25. This is an example of a Work History or Experience section for a résumé.

EDUCATION AND CERTIFICATIONS
B.S., University of Baltimore, Baltimore, MD, Applied Information Technology, 2014

Eagle Scout Award, Boy Scouts of America, Baltimore Area Council, 2010

- PC Software: Visual Basic.NET, Java, C++, Cold Fusion, HTML, Microsoft Access, Excel, PeopleSoft, SQL, Windows Server
- Operating Systems: Windows 7, Windows 8, Linux

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Figure 17-26. This is an example of an Education and Certifications section for a résumé.

PROFESSIONAL ACCOMPLISHMENTS
Built a computer from individual components. Results: Gained hands-on knowledge of hardware and problem solving; began small, profitable business in computer repair.

Mastered coding in Visual Basic.NET, Java, and C++ as well as database software. Results: Became proficient in programming and database usage.

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Figure 17-27. This is an example of a Professional Accomplishments section for a résumé.

HANDS-ON EXAMPLE 17.2.3

SUBMITTING A RÉSUMÉ

Many open positions are posted on online job boards. Other than networking, the Internet is the primary way most people find jobs.

1. Launch a browser, and navigate to www.monster.com.
2. Search for computer support technician jobs in your area.
3. Read a few of the postings, and assess what the job requirements are.
4. Investigate how to upload a résumé and apply for one of the jobs.
5. Write a brief paragraph explaining how to upload a résumé.

FYI

A portfolio provides a quick insight into many facets of your personality and skills.

Creating a Portfolio

A **portfolio** is a collection of examples organized to show what you have accomplished and finished. It shows qualifications, skills, and talents to support a career or personal goal. Artists and other creative professionals have historically presented portfolios of their work when seeking jobs or admission to educational institutions. However, portfolios are now used in many professions and for many educational areas.

If you have created web pages or video games, these should be included in a portfolio. If creating a paper portfolio, include hard copy, color representations of these projects. If creating an electronic portfolio, include the fully functional digital versions. If you have completed any programming projects, these should be included in a portfolio. Include screen captures and documentation. If practical, include functional versions in an electronic portfolio.

Bring your portfolio to the interview. Do not submit it with your résumé and application unless specifically requested to do so.

17.2 SECTION REVIEW

CHECK YOUR UNDERSTANDING

1. What are the three parts of good communication skills?
2. Why is it important to conduct a self-assessment when researching a career?
3. What is graduate education?
4. What is the purpose of a résumé?
5. What contains visual representations of your work that may be presented in a job interview?

IC3 CERTIFICATION PRACTICE

The following question is a sample of the types of questions presented on the IC3 exam.

1. What should be created to help with formatting a résumé?
   A. documents
   B. graphics
   C. styles
   D. portfolios

BUILD YOUR VOCABULARY

As you progress through this course, develop a personal IT glossary. This will help you build your vocabulary and prepare you for a career. Write a definition for each of the following terms and add it to your IT glossary.

529 plan
career and technical student organizations (CTSOs)
career plan
certification
formal education
Gantt chart
goal
informational interviewing
networking
portfolio
postsecondary education
résumé
scholarship
self-assessment
SMART goals
storyboarding