Module A
Computing Fundamentals
Computing Fundamentals

The Computing Fundamentals examination covers subjects needed for a foundational understanding of computing, including knowledge and use of computer hardware, software, and operating systems.

To pass this examination, the examinee must demonstrate knowledge in the following areas:

- Computer hardware, peripherals and troubleshooting
- Computer software
- Use of a computer operating system to perform everyday tasks (installing software, managing files, changing system settings, etc.)

For purposes of this examination, questions on computer hardware and software will cover a range of computer types and software systems. Performance-based questions on operating systems will be based on a specific operating system such as Microsoft Windows or the Macintosh OS.

The Computing Fundamentals module covers three domains of knowledge and skill:

**Domain 1.0 - Computer Hardware, Peripherals and Troubleshooting**

Objective 1.1 Identify types of computers, how they process information, and the purpose and function of different hardware components

Objective 1.2 Identify how to maintain computer equipment and solve common problems relating to computer hardware

**Domain 2.0 - Computer Software**

Objective 2.1 Identify how software and hardware work together to perform computing tasks and how software is developed and upgraded

Objective 2.2 Identify different types of application software and general concept relating to application software categories

**Domain 3.0 - Using an Operating System**

Objective 3.1 Identify what an operating system is and how it works, and solve common problems related to operating systems

Objective 3.2 Use an operating system to manipulate a computer’s desktop, files and disks

Objective 3.3 Identify how to change system settings, install and remove software
Unit 1

Recognizing Computers

Unit Objectives

This unit covers the knowledge and skills required to identify different types of computers, the components of a personal computer (including internal components such as microprocessors) and how these components work together. The domain also includes the knowledge and skills relating to computer storage as it applies to hardware components like hard or portable disks and performance as it applies to processor speed and memory. It also includes the knowledge and skills required to identify how software works, software categories such as operating systems, applications and utilities, and which application is best suited for a specific purpose.

Lesson  Topic
1  Computers All Around Us
2  Elements of a Personal Computer
3  Working with Storage Systems
4  Using Input/Output Devices
5  Basic Troubleshooting Techniques
6  Buying a Computer
7  Looking at Software
Lesson 1

Computers
All Around Us

Objectives
In this lesson, you will look at different types of computers and how they are used. On completion, you will be able to identify the following:

- personal computer
- notebook or laptop
- tablet
- server
- personal digital assistant
- cellular phone
- calculator
- other types of computing devices

Skills
1-1.1.1 Identify different types of computer devices

Identifying Computers
1-1.1

Computers are integrated into our work, home, and social environments and perform a multitude of tasks. Many organizations have a combination of large and small systems to manage the flow of information. This can be crucial if companies such as banks, insurance agencies, or schools need to keep histories of customer transactions.

Many computers are designed specifically as computing devices, while others are embedded in products such as automobile engines, medical or industrial equipment, household appliances, or calculators.

Desktop Computers
Desktop computers are also called personal computers and sit on, beside, or under a desk. These process data quickly and are typically used in small businesses, schools, and homes.

There are generally two types of personal computers: the PC or personal computer, based on the original IBM machine, and the Mac, designed by Apple.
Notebooks or Laptop Computers

Notebook or laptop computers can be similar to desktop models in terms of speed, performance, and usage. There are instances where an individual or organization will choose a desktop model over a notebook if there is a requirement for high performance such as with manipulating graphics, video, or animation. An advantage of having a notebook is its portability and in some cases, a laptop’s power consumption is considered a “greener” alternative to desktops. You can purchase a number of accessories to enhance your enjoyment and experience of using a notebook such as a bigger hard drive for storage, a larger screen, a wireless external mouse or keyboard, or more memory.

As with desktop models, you can purchase a notebook for either the PC or the Apple environments.

A netbook is similar to a notebook, but is smaller and less expensive. Netbooks are designed for people who want wireless communications or access to the Internet, but are not interested in using the computer for storing data files.

Tablet PCs

These computers look similar to a notebook but the screen can be swiveled or folded over so the user can write or select items using a specially designed pen.

All tablets have “touch screen” capability, which means you can touch a pen or pointing device at an item on the screen to select it. You can also type information using the built-in keyboard.

Servers

A server is a computer dedicated to sharing resources among two or more personal computers and managing large amounts of data. This computer will typically have specialized software installed depending on its purpose. For example, one server may be designated as a database server that stores a huge amount of data such as a list of all customers for an organization; another server may be dedicated to handle electronic mail only; or a Web server may be dedicated to store data for an organization’s Web site as well as manage commercial transactions electronically.

Hand-held or Mobile Computers

A hand-held computer is any computing device that fits within the palm of your hand and is portable. Depending on your needs, you may use a hand-held device as a telephone only, to send or receive voice or electronic messages, or as a portable personal computer. Many of these devices also offer the option to copy or download music or electronic books from the Internet.

Cellular Telephones

Cellular phones are now very sophisticated. They are rarely used for telephone services only, and may include additional functionality such as:

- playing and listening to music
- taking pictures or video
- text messaging
- e-mail
- accessing the Internet
- global navigation system (GPS)
- paging

Your account type determines the number of services you can select or the type of cellular phone you will use. For example, a realtor may choose a cellular phone that is also a personal digital assistant in order not only to handle numerous incoming and outgoing calls, but be able to update his/her Web site with new homes listed or homes he/she has now sold. All cellular telephones include a computer chip enabling the phone to provide appropriate services for that telephone model, although all services may not be activated on the account. On most cellular telephones, you can activate services through that model’s keypad or keyboard.
Personal Digital Assistants

Personal Digital Assistants (PDAs) have specific software to help you make appointments, keep contact lists, or write notes. PDAs are very popular for their portability and include software to create documents, organize calendars, take pictures or video, or access the Internet. PDAs can be used as the main computing device by individuals who do not need the full capabilities of a notebook or desktop computer.

All PDAs incorporate touch screen technology, where you can touch the screen with your finger or a pointing device to activate an option.

These types of computing devices may also be referred to as smart phones.

Music or Media Players

A music player may also be called an MP3 player or a digital audio player; MP3 refers to the file type for the music to be recognized as valid for this player. This is an audio player only.

A media player allows you to view other types of media files such as movies, videos, or books. These players provide both audio and visual capabilities and, occasionally, the option to search the Internet.

Some hand-held devices combine two or more capabilities. For example, the iTouch is a media player, a PDA and can work as a Web browser. The iPhone adds on the cell phone capability and Web browsing anywhere through your cell phone connection. By downloading and installing specialized applications, it is possible to use a hand-held device to synchronize items such as a contacts list from your email program on your computer to your media player.

Game Systems

Game systems include an embedded computing chip that enables an individual to play interactive games with video technology. Many of these game systems come with the option of linking to the Internet to play against others from around the world, get updates from the vendor, or contact technical support.

Electronic Book Readers

An electronic book reader is a special computing device designed with a software program that enables you to download and view an electronic copy of a published work. Many publishers offer the option of joining their online clubs to purchase books in electronic form.

In some cases, you can find software that provides electronic-book-reading capabilities but allows you to use this feature on your PDA or media player.

Calculators

Calculators are the original computing devices dedicated to a specific function. Many calculators use the same type of chips found in computers to perform the same calculations. The computer is really a very large and advanced calculator that performs tasks based on the binary computations of 1 or 0 (zero).
Other Types of Computers

Computer technology is found in a variety of equipment used in daily activities, such as:

- Equipment to diagnose problems with automobile engines
- Automated Teller Machines (ATMs) to handle deposits, withdrawals, or bill payments
- Point-of-sale machines that process credit card and debit transactions in restaurants or stores
- Global Positioning Satellite (GPS) navigation tools in motor vehicles
- Robotics used by manufacturing firms to perform many tasks
- Medical equipment such as heart monitors and diagnostic scanners
- Small home appliances such as microwaves, coffee machines, and entertainment systems
- Large home appliances such as stoves/ovens, refrigerators, and washing machines

Each type of equipment has a computer chip embedded within it to enable it to perform a specific task. In a piece of equipment such as an ATM or point-of-sale (debit) machine, before you can conduct a transaction, your identity must be validated with a card that opens a connection to your financial institution to retrieve personal information. When any of the abovementioned equipment fails, it is usually a result of a computer chip needing to be replaced or reset.

Summary

In this lesson, you looked at different types of computers and how these computers are used. You should now be able to identify the following:

- personal computer
- notebook or laptop
- tablet
- server
- personal digital assistant
- cellular phone
- calculator
- other types of computing devices

Review Questions

1. What is the biggest advantage of using a notebook?
   a. Cost  
   b. Portability  
   c. Speed  
   d. Size

2. A server is a computer that has been designated to share resources and data.
   a. True  
   b. False

3. Which of the following are true?
   a. A cellular telephone may be chosen to provide telephone services only.
   b. All cellular telephones include organizing software that can be activated.
   c. All cellular telephones include Internet service.
   d. All personal digital assistants include touch screen technology.
   e. a and d

4. Game systems include a computing chip that enables you to:
   a. Obtain updates for the game system
   b. Play games with other people on the same game system network
   c. Get technical support
   d. Any of the above
   e. a and b

5. An example of a household appliance that has a computer chip embedded as part of its equipment is:
   a. Refrigerator  
   b. Microwave  
   c. Entertainment system  
   d. Doorbell  
   e. Coffee machine  
   f. Cereal turn-wheel dispenser  
   g. Any of the above  
   h. a, b, c, or e
Lesson 2

Elements of a Personal Computer

Objectives

In this lesson, you will look at some of the elements that make up a personal computer. On completion, you will be familiar with:

- a system unit
- a microprocessor chip
- how memory is measured
- what ROM is
- what RAM is
- how memory works

Skills

1-1.1.2 Identify the role of the central processing unit (CPU) including how the speed of a microprocessor is measured
1-1.1.3 Identify concepts related to computer memory

Looking at the System Unit

The System Unit or Box is often the most important and expensive part of the computer system. Desktop and “tower” boxes provide the same functionality.

There are many separate devices inside the box that perform specialized functions for the computer. If one of these devices fails, it can usually be replaced. The power supply is also located inside the box. Descriptions of these components follow.

A notebook has the same components as a desktop, and can run on batteries.

The Microprocessor Chip

The microprocessor chip is often called the “brain” of the computer as instructions from the software programs and input from the user are received and executed here. This chip is often referred to as the Central Processing Unit (CPU). Each model or type of CPU processes information and instructions at different speeds, measured in Megahertz (MHz) or Gigahertz (GHz).

Hertz (Hz) measures the speed of the internal computer clock in terms of frequency or number of cycles per second. Megahertz refers to millions of cycles per second and Gigahertz refers to billions of cycles per second.

Dual and quad core processors contain two or four processor chips, which together perform faster than a single processor chip with higher speed capabilities. These microprocessors are readily available in new computers.

Looking at Memory

Computers were developed using a numbering system of 1s and 0s, known as the binary system. These two unique numbers represent the charged or uncharged nature of electricity.
For a computer to store information, it needs to have memory chips installed. Memory is measured in bits and bytes. A bit is the smallest unit of data used by computers—it can be a value of 0 or 1. A group of eight bits make one byte. The smallest unit of data used by humans is one alphanumeric character (‘a’ to ‘z’, or 0 to 9) which needs a full byte of computer memory to represent it.

The following shows how computer technology and the requirement for storage capacity have grown:

<table>
<thead>
<tr>
<th>Size in bytes</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Kilobyte (KB)</td>
<td>1,024</td>
</tr>
<tr>
<td>1 Megabyte (MB)</td>
<td>1,048,576</td>
</tr>
<tr>
<td>1 Gigabyte (GB)</td>
<td>1,073,741,824</td>
</tr>
<tr>
<td>1 Terabyte (TB)</td>
<td>1,099,511,627,776</td>
</tr>
<tr>
<td>1 Petabyte (PB)</td>
<td>1,125,899,906,842,624</td>
</tr>
</tbody>
</table>

All data processing within a computer requires the use of various combinations of bytes, as calculated by the computer. Every file used by the computer has a specific size which may increase depending both on the amount of content and the way the content is being used. For instance, the size of a data file will increase or decrease based on what actions are stored in that file, such as centering a title, formatting words in bold type, calculating a formula, or inserting a photograph. The larger the file is, the more memory you will need to process and store information in the file. Even if a file is not being stored on the computer, your computer still needs memory in order to process it.

**Read Only Memory (ROM) BIOS**

*Read Only Memory Basic Input/Output System (ROM BIOS)* refers to a group of integrated circuits responsible for starting your computer, checking RAM, and loading the operating system. This occurs only when you turn the computer on or each time you have to restart or “reboot” it. ROM is also used to control input and output devices such as disk drives, keyboard, and monitor while the computer is running.

This type of memory is found in calculators and printers, as it reads the information that is entered and processes it during the time it resides there. When the required action is complete, this type of memory clears itself and waits for the next entry. It does not perform any other tasks.

**Random Access Memory (RAM)**

*Random Access Memory (RAM)* is located in the system unit and is a kind of electronic memory pool where your computer holds copies of programs and data. The computer uses RAM to temporarily store the software program you are currently using and the data created in that program; this may also be referred to as system RAM.

RAM is volatile; it only works when the computer is on and the information “vanishes” when the computer is turned off. Therefore, software programs must permanently reside on a hard disk or optical disk. From there, the computer can load the program and files into memory while they are in use, and remove them from memory when programs or files are closed.

The speed of RAM is measured in nano seconds (ns); each nano second is one billionth of a second which is the speed it takes from the time a request is made until it is completed (also known as access time). A nanosecond is extremely fast; a computer can perform a large number of tasks in 10 nanoseconds.

RAM chips are used in video display cards, which can increase how quickly a picture appears on your monitor. RAM is also used to buffer information sent to the printer. This increases printing speed and allows the computer to perform other operations while the document is being printed (multi-tasking).

**Understanding How Memory Works**

When you first turn on your computer, the ROM BIOS takes control; this small program is permanently stored in a special area of the computer’s ROM. Its main job is to load the Operating System (OS). The first places the computer looks for the operating system are Drive A (the “floppy” disk drive, because the disks used in early computers were flexible or floppy) or the CD disk drive. If the computer does not find a disk in either drive, it then searches for the hard disk. If there is no hard disk, the computer displays an error message on the screen stating that the computer could not find the necessary operating system files. If the computer finds the OS files, it loads them into the RAM and passes control of the computer over to the operating system. If the computer does not find the OS files, you will not be able to do anything with the computer until it finds an acceptable OS.
When the computer loads the Windows operating system and passes control over to it, the first screen you will see is the Windows “splash screen,” identified by the Windows logo and confirmation of the version of Windows you are using. During this time, the operating system checks the Windows “registry,” which identifies what hardware and software has been installed on the computer that should be recognized by Windows. When this is complete, you will see the Windows “desktop” on your screen.

Windows uses up a certain amount of RAM to run the basic files it needs at this point. As you begin to ask the computer to perform specific tasks, it will use as much RAM as it needs to complete that task.

When you start a software “application” or program, you are asking the computer to make a copy of that program and place it in RAM. This is why the software vendor will tell you that you need a specific amount of RAM to take advantage of the features of that application program while also running the operating system in the “background” or behind the application. When you close the application program, the amount of RAM being used by the application becomes available again.

Close the application program when it is no longer needed; this frees RAM for other application programs to run.

**Summary**

In this lesson you looked at how to measure memory and how it is used within a computer. You should now be familiar with:

- a system unit
- a microprocessor chip
- how memory is measured
- what ROM is
- what RAM is
- how memory works

**Review Questions**

1. The speed of a microprocessor chip is measured in frequency or number of cycles per second.
   a. True
   b. False

2. What are binary numbers?
   a. 1s and Is
   b. 0s and Os
   c. 1 to 9
   d. 1s and 0s

3. Read Only Memory is used only when you turn the computer on.
   a. True
   b. False

4. Why is RAM considered volatile?
   a. It disappears when the computer is shut down or reset.
   b. It uses up only as much memory as it needs for processing.
   c. It always uses a certain amount of memory for Windows.
   d. a or b
   e. a or c

5. The best way to gain more RAM for processing a newsletter is:
   a. Close any files you are not currently using.
   b. Close any application programs you are not currently using.
   c. Restart the computer.
   d. Any of the above
   e. a or b
Lesson 3

Working with Storage Systems

Objectives

In this lesson, you will look at what storage systems are and how they are used. On completion, you will be familiar with:

- storage systems
- hard disk drives
- optical drives
- portable or removable storage devices
- network drives
- remote storage

Skills

1-1.1.4 Identify the features and benefits (storage capacity, shelf-life, size, etc.) of different storage media

What Are Storage Systems?

1-1.1.4

When working on the computer, the RAM holds your current work and a copy of the active software program. As RAM is only temporary, you must save the work to a storage device before exiting the software program or turning off the power.

The storage device you use will depend on the amount of storage you require as well as the speed of data retrieval or data transfer rate (the speed at which data is sent from computer to storage device and vice versa). Hard disk drives are used most often to store and retrieve software programs and data due to their speed and storage capacities. You can use other media such as a flash drive or optical disc to store copies of the data for backup or portability purposes.

Working with Disk Drives

A disk drive rotates the disk at a constant speed, allowing access to each sector on the entire disk surface.

The computer writes data from RAM using the read/write head, a small recording/playback head, to a disk arranged in tracks divided into equal sections, called sectors, to manage the data.

A disk drive has two or more read/write heads to read the top and bottom of the disk. The disk drive steps the read/write head across the surface of a disk in precise increments, moving the head to a specific location on the disk for retrieving or writing data instead of starting at the beginning of the disk each time.

The process of preparing a disk for use so that the tracks and sectors are present is called formatting. The computer places special information on each track that marks the location of each sector. A disk must be properly formatted before you can store any data on it.
Working with Hard Disk Drives

Hard disk drives, or simply hard drives, are the primary storage area for both data and programs. Software programs must be installed on a hard drive before you can use them. The hard drive stores and retrieves information at high speeds. Hard drives work the same regardless of whether they are “internal” (inside the computer) or “external” (sitting on the desk beside the computer).

The data transfer rate (or throughput) of a hard drive is a function of the hard drive rotation speed (measured in rpm) and the number of heads per surface; the higher the rotation speed and/or the number of heads, the less time it takes to find a particular piece of data. Hard drives range in capacity from 100 million bytes (100MB) to several thousand million bytes (1000MB is 1GB).

Working with Optical Drives

Optical disc drives are designed to read a flat, circular disc commonly referred to as a Compact Disc (CD) or Digital Versatile/video Disc (DVD). The disc is read by a laser device or optical drive that spins the disc at speeds from 200 revolutions per minute (rpm) or higher. The higher the speed, the faster the information is read and is transferred to the computer.

A CD-ROM (Compact Disc Read Only Memory) or DVD-ROM drive is similar to a player in an audio/video entertainment system. The information is written or burned onto the surface and retrieved with a laser beam. You can only read the data. This is the typical format used in DVD players where you can place the DVD into the device to play the disc.

New computers come with at least one optical drive, usually a DVD optical drive and a CD/DVD optical writer drive.

Optical Writers

An optical writer drive, also known as a burner drive, looks and acts like a regular optical disc drive, but has the ability to record information onto a blank disc. Software comes with the optical writer drive, which allows you to “burn” or write data onto a disc. There are two types of technology for writing to discs. Formats for these drives include:

- **CD-R/ DVD-R** You can write once only to a blank disc, but the disc can be read multiple times. This format can be read in a DVD player or a DVD drive.
- **CD-RW/ DVD-RW** You can read and write multiple times onto the same disc. This format can be read in a DVD drive and some DVD players that support this format.
- **DVD-RAM** This is similar to a DVD-RW but can only be used on devices that support this format. These types of DVDs are usually in the form of cartridges.

Blank discs are relatively inexpensive, with -R disks being cheaper than -RW discs. The size of a CD can be 650 or 700 MB, while DVDs can store information from 4.7GB to 17+GB with rapid access speeds.

Special software comes with the DVD burner and often contains tools to manipulate or edit the video before it is burned to a DVD.
Using Other Types of Storage Devices

Other types of storage devices you can use to store data include the following; they can be portable, although a device such as a tape drive connected to a network server may not move from its location.

Tape Drives

A *tape drive* or *tape streamer* uses a cartridge with magnetic tape to store information, and is generally used to backup a large amount of data.

These drives use different formats, with tape sizes ranging from 250MB to over 80GB. Other tape drives use the *Digital Audio Tape (DAT)* format, which can transfer data from large tapes at speeds that exceed 7.2GB per hour.

Zip Drives

A *zip drive* is similar to a DVD-RAM drive except that the disk used can hold between 100MB and 750MB of data. This technology was developed by Iomega Corporation and offers a relatively inexpensive storage option. A disadvantage of this type of drive is that newer systems are not compatible with the original 100MB devices, which are now difficult to find or purchase.

Removable Media Systems

Removable media systems can include devices such as flash memory cards, sticks or USB flash key/thumb drives. They may also include external hard drives that work similar to other removable media systems. Benefits of all these devices include portability, large storage sizes, and data-sharing capability. For example, most people use a memory card in a digital camera to store pictures or videos. The memory card is small and therefore very portable but it can store large amounts of data; the exact amount depends upon factors such as the resolution quality of the digital camera. In this example, the memory card is used to store the data (photos) temporarily until you can transfer it to a computer. You might then copy some of the pictures from your computer onto a USB flash drive to take to a photo lab, where they are used on posters advertising your company’s new product line. These pictures may be too large to send via electronic mail without reducing quality. Transporting them on a flash drive is faster and preserves the original quality.

Network Drives

The hard drives in a network server are similar to hard disk drives in a computer. The main difference is the size and type of drive chosen for the network server which is traditionally much larger than available with a desktop computer to accommodate the requirements of a whole organization and its data storage requirements. The data transfer rate is quite fast although this can be restricted by the type of network interface cards set up on the computers and number of users and tasks to be processed by the server.

This may be set as a *disk array*, as the drives are usually organized to work together in this computer. The network contains many storage drives, although you may actually be storing data to only one drive that has been set up to show as different drives. For instance, in the diagram shown here, drives F to P appear to be six separate drives; in reality, the network administrator has “mapped” these six areas to share space on one hard drive in the server.

Remote Storage Systems

*Remote or virtual* storage systems do not exist on your computer or at your location, as indicated by the term “virtual.” These drives are a common service provided by *Internet Service Providers (ISP)*, because they offer the ability to save information on a virtual/web/Internet storage system.

The drives in a remote storage system are on a network or dedicated server at a particular site, which you must log on to with a secure ID and password in order to access the system. Virtual storage systems are very useful for off-site backup storage of data, or as a “central system” for people around the world to share information. For example, a health organization may choose to have a remote storage system that authorized users can log on to the wide area network from anywhere in the world to receive updates on the latest research findings or surgery dates for specific procedures.
A disadvantage of a virtual storage system can be the speed of the Internet connection, which can enhance or hinder the flow of information. As with networks, virtual storage systems can be impacted by the number of requests being made of that storage device at any point in time. The cost of these systems can vary, depending on requirements.

**Summary**

In this lesson, you looked at storage systems and how they can be used. You should now be familiar with:

- storage systems
- hard disk drives
- optical drives
- portable or removable storage devices
- network drives
- remote storage

**Review Questions**

1. You can use hard disk drives to store and retrieve software programs and data because of their speed and storage capacities.
   a. True  
   b. False

2. Why should you save your files to a storage device?
   a. To prevent data loss if the computer is turned off
   b. To store information from RAM onto the storage device
   c. To have a copy of the data
   d. Any of the above
   e. a and b

3. Which removable storage device would you use to copy pictures from one computer to another?
   a. External hard drive
   b. Memory card from digital camera
   c. USB memory key
   d. Any of the above
   e. b or c

4. A virtual storage system can exist at a location such as your ISP, where you can store data from anywhere in the world.
   a. True  
   b. False

5. How can you access a remote storage system?
   a. Start a Web browser and navigate to that site
   b. Through your e-mail program
   c. Using a USB memory key
   d. Log on with a valid ID and password
Lesson 4

Using Input/Output Devices

Objectives
In this lesson, you will look at what input or output devices are, be able to identify some of these devices, and understand how they work on the computer. On completion, you will be familiar with:

- input/output devices
- common input devices
- common output devices
- specialized devices
- how a device connects
- what a port is
- what a device driver is

Skills
1-1.1.5 Identify the types and purposes of standard input and output devices on desktop or laptop computers
1-1.1.6 Identify the types and purposes of specialized input devices
1-1.1.7 Identify the types and purposes of specialized output devices
1-1.1.8 Identify how hardware devices are connected to and installed on a computer system

What are Input/Output Devices?

1-1.1.5

Input or output (I/O) devices enable communication between the user and the computer. There are three classifications of I/O devices you can use to:

- send information to the computer (for example, the keyboard, mouse, trackball, or scanner).
- display or transmit information from the computer (examples include the monitor, printer, and speakers).
- communicate between computers (for example, modems and networks).

In simple terms, anything used to enter information into a computer is an input device. Anything that can display information from a computer is an output device. This is true for devices that are both internal (installed inside the computer) and external (connected outside the computer).

Standard input devices include a keyboard, mouse, and microphone. Common output devices are a monitor, printer, and speakers.

Using the Keyboard

The keyboard is an input device that allows you to send information to the computer. It is the primary tool for inputting data. You can also use the keyboard to input commands for a task in an application program.
The previous graphic shows a traditional keyboard. Some keyboards are ergonomically designed to reduce or prevent stress on the wrists (i.e., carpal tunnel syndrome) or eyestrain. Many newer keyboards also contain buttons to enhance the multimedia experience while using your computer.

Regardless of keyboard type, the same keys are available for document processing. Special keyboards can be purchased for game enthusiasts or for people with disabilities.

**Typewriter Keys**

These keys enter text or commands into the computer.

You can combine some keys with others to perform a function by pressing the first key and holding it down while you press the second key once. After you release the second key, you may release the first key. The following provides a basic description of the more commonly used keys:

**Enter**

Executes a typed command or a selected option from a menu, marks the end of a line, or creates a blank line.

**Backspace**

Deletes one character to the left of the cursor each time you press it. When held down, the computer continuously deletes characters to the left of the cursor until you release the key. This key may also be shown with a left pointing (←) arrow.

**Delete**

Deletes the character above or to the right of the cursor each time it is pressed. When held down, it continuously deletes characters to the right of the cursor until released.

**Spacebar**

Inserts a blank space between words, and is the safest key to press when a software program prompts you to press any key.

**Esc**

 Cancels a current selection or generates a special code for the computer; also referred to as the Escape key.

**Tab**

Advances the cursor to the right by a set amount or to the next cell in a spreadsheet program. When held down with the **Shift** key, you can move the cursor a similar distance to the left.

**Shift**

Displays uppercase letters for the alphabetic keys or the punctuation symbols that share the number keys. Use this key with other keys to perform a function in a program; for example, **Shift+F7** activates the thesaurus in Word.

**Caps Lock**

Locks the letter keys to produce only uppercase versions of each letter.

**Ctrl**

Provides a secondary meaning or function for almost every other key on the keyboard. You can press and hold down the **Ctrl** or **Control** key and press another key at the same time to perform a specific task in an application program, such as adding boldface to the text by pressing **Ctrl+B**.

**Start**

Displays the Start menu.

**Menu**

Displays a shortcut menu—similar to right-clicking an item. Options available in the menu depend on where the mouse pointer is at the time the key is pressed.

**Alt**

Provides an alternate meaning or function for almost every other key on the keyboard. Press and hold down the **Alt** or **Alternate** key and press another key to send a command to the computer or to perform a specific task in an application program; for example, **Alt+F** activates the File menu.
Moves the cursor up, down, left, or right, and is usually located between the typewriter keys and the numeric keypad.

Captures the information on the screen and sends it to the Windows Clipboard.

Toggles (starts and stops) the scrolling display of data on the screen.

Stops or freezes the computer. The computer will continue when any key is pressed. This key combination sends a Break code to unfreeze a computer.

**Function Keys**

These are located across the top of the keyboard and are labeled F1 through F12. Each application program assigns a special meaning or function to each key, which is generally a shortcut for commonly used commands.

**Cursor and Numeric Keypad**

This is located at the far right of the keyboard, and can be toggled on and off by pressing the Num Lock key in the pad. When the toggle light is on, the pad becomes a calculator or numeric pad; when off, the pad becomes an arrow or cursor movement pad.

**Using Pointing Devices**

A pointing device enables you to select or activate items on the screen by placing the pointer arrow on the item and performing the required action; for example, you can click to select a file or click and drag to select text. Pointing devices come in many forms but the traditional pointer device is a mouse.

**Mouse**

This device moves the pointer around on the monitor. Moving the mouse on a flat surface such as a desk causes the mouse to initiate movement reflected by the pointer on the monitor. The traditional mouse used a ball that rotated to initiate this movement as you moved the mouse device on the desk. Newer mouse models use an optical light or diode technology to move the pointer on the screen. A trackball has the ball on the side where your thumb rests; you rotate the ball to move the pointer.

A mouse usually has two buttons that are used to select and activate features on the screen:

**Click** Point the mouse pointer at an item, then press and release the left mouse button to select an item on the screen.

**Double-Click** Point the mouse pointer at an item, then press the left mouse button twice in rapid succession to initiate programs and open files.

**Right-Click** Point the mouse pointer at an item, then press the right mouse button to display the shortcut menu for that item.

**Left Drag** Press and hold the left mouse button as you move the mouse to move or select multiple items on the screen.

**Right Drag** Press and hold the right mouse button as you move the mouse to move or copy items. On release of the mouse button, a shortcut menu appears with further options.

**Wheel** Roll the wheel between the buttons to scroll through the contents on the screen. Most software applications will zoom in or out when you press the Ctrl key while rolling the scroll wheel.

**Thumb Button** An additional button on the side of the device where your thumb would rest. This can be set to perform specific tasks, such as starting a program or working as an alternate Ctrl key.
To use the mouse pointer to select items, grasp the mouse with your palm down and your index finger gently resting on the first button. As you slide the mouse flat along the desk, the mouse pointer will move in the same direction on the screen. If you run out of space on the desk, lift the mouse and place it in a new position on the desk, and continue moving.

To cancel any option, click the left button anywhere on the screen away from the option being selected.

Mouse devices are available in the traditional style or as wireless devices. The traditional mouse has a cord that extends from the base of the mouse to a plug or port on the computer. A wireless mouse has a separate connector that plugs into the computer and recognizes the commands from the mouse; it may look like a memory key that plugs directly into your computer or may have a connector box with a cord that plugs into the computer. A wireless mouse requires a battery, whereas a traditional mouse just needs to be plugged into a computer.

A mouse can work with a PC or a Mac computer.

**Touchpad**

A touchpad device enables you to use your finger to move the mouse pointer around on the screen. This is common on a notebook, although these devices can be purchased separately for a desktop. A touchpad has two buttons that work in the same manner as the left and right buttons on a mouse.

- To move the mouse pointer around on the screen, place your finger anywhere on the touchpad and then glide your finger around the touchpad in the direction you want to move the mouse pointer.
- To select an item, position the mouse pointer over the item and then tap the touchpad once or click the left button below the touchpad.
- To activate an item, position the mouse pointer over the item and then tap the touchpad twice in quick succession or double-click the left button below the touchpad.
- To drag an item, position the mouse pointer over the item, press [Ctrl], and then glide your finger on the touchpad to the required location.
- To display a shortcut menu, position the mouse pointer over the item and then click the right button below the touchpad.

A touchpad can work with a PC or a Mac.

**Using Microphones**

Microphones allow you to record sounds and convert them into a digital format for use on the computer. Specialized software recognizes your voice and converts what you say into text characters on the screen. This is very beneficial for users with special needs.

Microphones are not usually included with a desktop computer although many newer notebooks include one. There are many microphones of varied quality available that you can purchase separately.

**Looking at the Monitor**

The monitor is an output device that enables you to view information the computer displays. All monitors have a power switch as well as brightness and contrast controls to adjust the screen image.

Monitors come in a variety of sizes, resolutions, and types; the larger the screen, the larger the image will be on the screen and the more expensive the monitor will be. **Resolution**, or the monitor’s ability to display images, is a measurement based on particular mathematical levels of sharpness and clarity, and is a factor in the price.

Flat screen monitors are popular due to their size as well as for touch screen technology. A touch screen allows you to select an option on the screen using your finger instead of a mouse or keyboard.
Using Printers
Printers convert what was on the screen into print when you activate the print command. All applications allow you to choose different print options, such as landscape or portrait orientation, paper size, and manual or automatic feed.

A number of different types of printers are available, such as inkjet printers, laser printers, photo printers, and all-in-one printers; what you choose will depend on your needs.

- Many home users have inkjet-type printers for printing simple documents. Inkjet printers, ink cartridges, and paper are lower in cost as compared to laser printer cartridges, the print quality is quite good and they can print several pages per minute. This is an appropriate choice for home users who have very low printing volumes.
- If a large amount of printing is required, for schools or businesses, a laser printer is set up on a network so multiple users can share this device. You can choose from black-and-white or color laser printers. A laser printer may contain several trays of varying paper sizes, including one that holds large pieces of paper for printing booklets, posters, or flow charts.
- Other types of printers available for specific uses include a plotter to print large posters or architectural plans, a photo printer to print high quality photographs, or an all-in-one printer that enables you to print, copy, and scan items from one machine.

Using Speakers
Speakers play the sounds saved as digital files on the computer. Different forms of sound files, such as .mp3, .wav, or .wma, can be specific to music programs or generic for any player device on the computer. The file format used to save the sound file determines the quality of the audio file.

A set of speakers may be included with the computer as a separate device to plug in, or may be incorporated into the computer (as with notebooks). A variety of speakers of different qualities can be purchased separately.

Looking at Specialized Devices

A number of input and output devices can be used for specialized tasks. Following are some of the most common.

Input Devices

- Scanners
Scanners "take a picture" of the original item and convert it to a digital format. The software for the scanner determines the degree of detail you can get for the scanned file, including a feature called Optical Character Recognition (OCR) that tries to interpret the typed or written characters on the original documents and then convert them to text characters.

- Bar Code Reader
This is another type of scanner, which is designed to reduce the amount of data entry for routine transactions or verification of product. Each code reader scans or reads the thin and thick lines as well as the spaces of bar codes. The common Universal Product Code (UPC) is just one example of bar codes.

- Game Controllers or Joysticks
These devices are designed for use with game programs or with a dedicated game system such as an Xbox or Wii. They can be purchased in a variety of forms based on what is needed for the game. The type of controller is determined by the game system. For example, joysticks can be used for flight simulator games whereas a game controller may be more appropriate for an action game.
Touch Screens
Many systems include a touch screen that uses a pen or stylus to select or activate items. These include game systems such as Nintendo DS and PDAs such as the Blackberry. Computing devices that offer touch screen technology using a finger to select or activate items include tablets and cellular phones or PDAs such as the iPhone, iTouch, or Blackberry Storm.

Digital Cameras
This type of camera captures pictures as digital files that you can transfer directly to the computer. You can view the pictures using a special cable that connects the camera to a computer or television, or you can print them using a photo printer. You can also use flash cards that come in a variety of sizes and styles to enable you to store more files.

Webcam
A Webcam is a type of digital camera connected to your computer that enables you to take pictures and video and share live with others. This type of camera requires an Internet connection and a specialized software program to connect the computers. Webcams are very popular with instant messaging programs as well as communication programs such as Skype or Web conferencing. Some notebooks come with a built-in Webcam; and they are also available for purchase separately.

Remote Control
A remote control may be used to activate the commands on a projector or for the computer itself while running a slideshow, so the presenter can move around and control the presentation. Remote controls are also available to improve accessibility for people with impairments that make keyboard or mouse use difficult.

Specialized Input Devices
Certain industries use specialized input devices. For example, some scientific studies use sensors that measure specific types of data, such as air quality, soil temperature, or weather conditions. These items work in a manner similar to other input devices connected to a computer allowing the data to be analyzed using specialized software programs.

Security Devices
Biometrics is popular as a way to handle security issues for the logon process and to maintain the integrity of data on a computer. These devices require a unique identifier such as a fingerprint or optical (eye) recognition before they allow you to access a computer. Another type of security device uses the same identifiers and encodes these onto a security card, which must be scanned and read at specific locators before access to restricted areas is permitted.

Accessibility Devices
Numerous devices are available for people with physical challenges to improve their ability to use computers. Examples include voice recognition software to interpret speech and then convert it to text characters onscreen, specialized keyboards with overlays for tasks such as typing or navigating onscreen, labels with Braille characters that can be applied to corresponding alphanumeric keys, and wireless devices that can be activated using the head or mouth.
Output Devices

1-1.7

As with input devices, there is also a variety of output devices designed to handle special tasks.

**Projector**
When delivering a presentation on your computer, you can connect this to a projector to display your presentation on your screen only, on a surface such as wall-mounted screen, or both if needed for a live presentation or with Web conferencing. Projectors can be purchased to suit a number of requirements such as size, resolution, and portability, and a variety of accessories can also be purchased.

**Photo Printer**
A digital camera can be plugged into a photo printer to print photographs on special photographic paper. These printers provide exceptional quality, as they are designed to handle photographic images, similar to having the pictures produced by a photo finishing service.

**Plotters**
Plotters are specialized printers designed to print images onto very large pieces of paper for items such as posters or architectural plans. A plotter may print the final output vertically or horizontally.

**Specialized Output Devices**
These are control devices that allow you to use a type of remote control to manage or control tasks. An example would be an automobile manufacturer which uses robotic technology to assemble different items and the user controls different aspects of the manufacturing process using this control device.

**Voice Synthesizer**
Devices designed to assist people with physical challenges include voice synthesizers to convert onscreen text to audio, monitors with screen magnification software, or Braille translators to convert onscreen text to Braille and Braille printers to output information on paper in Braille.

Connecting Devices

1-1.8

To connect a device to the computer, you need two items; the appropriate connector or port for the device and software that identifies the device and then installs it correctly.

**Identifying Ports**
Any device that can be used with a computer includes a connector for that device. The end of the connector identifies the type of connection you need to match the device to a corresponding type of port on the computer. In some cases, you may need an extra cable to adapt a device with one type of connector to match the appropriate port on your computer. Following are the most common ports on a computer:

**Parallel Ports**
These are generally used for connecting printers. This connection type is now rare, and has been replaced by USB or Ethernet.

**Serial Ports**
These are generally used for connecting mouse devices or modems. This connection type has also been replaced by USB and Firewire connections in all consumer and most commercial areas. However, they are still commonly used in specialized industrial equipment.

**Small Computer System Interface Ports**
SCSI ports are used to connect devices with high performance data transfer requirements, such as hard disks. Most CD drives now use SATA (Serial Advanced Technology Attachment) as this technology provides high performance without requiring high data transfer requirements.
Universal Serial Bus (USB) Ports
USB ports support plug-and-play systems where the operating system recognizes a new device just plugged in and displays the information when it detects the device. The term, hot plugging, refers to the computer’s ability to recognize a USB device has been unplugged from the USB port without having to disable the device first, or shutting down the computer. Always wait until the USB device has completed any actions before unplugging it from the port.

Network Ports
These look like telephone jacks and can connect to another computer on a network, a modem, or the Internet directly. (The last two depend on the type of Internet connection.)

Musical Instrument Digitized Interface Ports
Midi ports look much like a parallel or serial port but are specialized to handle musical devices such as keyboards and synthesizers.

Wireless Devices
Wireless devices use a variety of technologies such as infrared or radio, which use a type of frequency called wave technology to send and receive data over short distances. These devices do not use a cable, as with traditional devices, but there is still a connector that plugs into the appropriate port on your computer. These connectors could be an antennae or infrared reader. Bluetooth is a standard or protocol that uses radio as its technology for sending or receiving data.

Adapters
If you have a device with a connector that is not available on the computer, you can use a special cable to connect that input or output device to your computer. For example, if the only mouse available has a serial connector that your notebook does not provide, you can use a cable designed to convert it to fit a USB port.

Hubs
If the number of devices you wish to connect to your computer exceeds the number of ports your computer has available, you will need to use a hub. A hub is a device with several ports that other devices can be plugged into, but just one cable that needs to be plugged into your computer. For example, you may have a notebook with only two USB ports to which you want to connect four items including a wireless mouse, printer, external hard drive and USB drive. You would then plug your four devices into the hub, and plug the hub into one of your notebook’s ports, which would leave the other USB port available for another device.
Using Software

Before you can use a new device, your computer must be able to recognize it. It does this using a device driver. The device driver is a mini-program that tells the operating system what kind of device it is, what make or brand it is, and what its purpose is. Its main purpose is to enable communication between the operating system and the device, hence the ability for a device to be used with multiple operating systems.

The Windows operating system has a built-in feature called plug-and-play that automatically identifies that a new device has been connected so that it will look for and install that device automatically. If it cannot find the right driver, you will need to do so manually either by using the software that came with the device or searching for an appropriate driver on the Internet.

It is important to have the correct driver installed for the device to work properly. If there are special features included with the device, having the correct driver ensures that these features will be available to you.

Summary

In this lesson, you looked at what input and output devices are, as well as how to identify some of them and understand how they work on the computer. You should now be familiar with:

- input/output devices
- common input devices
- common output devices
- specialized devices
- how a device connects
- what a port is
- what a device driver is

Review Questions

1. What are three common input devices?
   a. Keyboard, mouse, monitor
   b. Keyboard, mouse, speakers
   c. Keyboard, mouse, printer
   d. Keyboard, mouse, microphone

2. Which mouse button would you press to select an option?
   a. Left
   b. Right

3. How can you use a biometric device on your computer?
   a. To identify someone who wants access to that computer
   b. To identify the person as valid using their fingerprint
   c. As another security method to logon to the computer
   d. Any of the above
   e. a or c

4. Identify the type of port shown in the following image:
   a. Network
   b. Serial
   c. USB
   d. Parallel

5. Why is it important to have the correct device driver installed?
   a. The computer can recognize the purpose of the new device driver.
   b. It enables the Windows operating system to install it automatically.
   c. The device driver is the configuration file that identifies what the device is and how it should work.
   d. Any of the above
   e. a or c
Lesson 5

Basic Troubleshooting Techniques

Objectives

In this lesson, you will look at different options to help maintain your computer’s performance, as well as how to perform basic troubleshooting functions. On completion, you will be familiar with:

- computer performance
- care of the computer
- working with hardware
- basic maintenance
- basic troubleshooting

Skills

1-1.1.9 Identify factors that affect computer performance
1-1.2.1 Identify the importance of protecting computer hardware from theft or damage
1-1.2.2 Identify factors that can cause damage to computer hardware or media
1-1.2.3 Identify how to protect computer hardware from fluctuations in the power supply, power outages and other electrical issues (such as use of computers on different electrical systems)
1-1.2.4 Identify common problems associated with computer hardware
1-1.2.5 Identify problems that can occur if hardware is not maintained properly
1-1.2.6 Identify maintenance that can be performed routinely by users
1-1.2.7 Identify maintenance that should ONLY be performed by experienced professionals, including replacing or upgrading internal hardware (especially electrical) components (such as processors or drives) that are not designed to be user accessible
1-1.2.8 Identify the steps required to solve computer-related problems

Increasing the Computer’s Performance

1-1.1.9

Regardless of the microprocessor type or speed, you may occasionally find the performance of the computer appears to decrease or that it is not responding to commands. This could be a result of any of the following:

- System resources are too low to process work, especially in RAM. This occurs if you have too many programs or files open, or one program taking up a lot of memory.
- The hard drive is reaching capacity and there is not enough room to install new programs or save files. You are prompted with a message about this when space becomes limited. Even if you delete files to the Recycle Bin you will not free space on the computer until you empty the Recycle Bin which permanently removes those files.
- There is not enough space on your hard drive for the operating system to handle processing multiple programs. This could be caused by too many temporary files or errors on the system.
- The file is quite large and will not open or close as quickly due to the speed of your microprocessor.
- The contents of a document take a long time to display on screen. This usually happens when you do not have enough video RAM to display the contents or to refresh the screen.
- A component of the operating system, a software program, or a data file is generating system errors but is continuing to try to work in the background.
- A hardware component or software program was recently added (sometimes unintentionally such as a computer virus or spyware program) and is causing slowdowns or conflicts with other system components.
Taking Care of the Computer

In general, computers are efficient and run well on their own. As you add or remove devices and software to the computer, you may experience different errors, problems, or have general queries on how to manage the computer. You should also consider what steps you should take to protect your computer from theft or damage. The more portable or sensitive the data, the more important it is to ensure loss or damage prevention. For instance, when not using your cellular phone or PDA, consider locking the device with a personal identification number (PIN) to prevent unauthorized access. Never leave your notebook unattended in a public area.

Use the following as a guide when setting up or maintaining your computer:

- Use a surge suppressor or an Uninterruptible Power Supply (UPS) unit to protect your system from power surges (sudden increases in voltage coming through the electrical wiring in your home or office), brownouts (a drop in voltage in the electrical wiring), or general fluctuations that may occur due to the electrical requirements of other equipment connected to the same electrical circuit. A UPS is a dedicated device that sits between the wall outlet and the computer. This can help protect the computer in the case of a power surge or failure.

- Ensure there are not too many electrical devices connected to a single wall outlet or power bar. Similarly avoid connecting other electrical equipment—such as laser printers, space heaters, vacuum cleaners, and coffee makers—that draw large quantities of power on the same electrical circuit (generally all the wall outlets in the same room of a house).

- When traveling to another country that uses a different voltage system than your own country, use a converter that adapts to the different electrical system and voltage.

- Always turn off the computer during stormy weather to protect it against any sudden power surges.

- If you can see your computer from a window or door, consider positioning it in a better location to prevent it from being an easy target of theft. You can also purchase special types of security cables that will lock your computer to a desk or other fixed apparatus.

- The file server should be located in a room that can be locked and requires special access for entry.

- Do not store any computing device near a heat source, or in a cold environment. The computer needs to have a temperature-controlled, well ventilated area in order to prevent damage due to heat, humidity or extreme cold.

- Avoid liquids near the computing device. A keyboard is made up of switches and circuits that translate the keystroke to a signal understood by the computer. It can be easily damaged by spilling water or other liquid on it. Also be careful around bodies of water; if you jump into a pool or even if it rains heavily, take the USB drive out of your pocket and put it somewhere safe and dry, and if it does get wet wipe it dry immediately. Try not to keep your cellular phone near a tub; if the phone falls into the water, it will likely be damaged beyond repair.

- Refrain from eating or drinking around the keyboard. Try to keep the area round the keyboard and mouse as clean as possible. This includes dusting or wiping the desk and chair clean.

- Ensure there are no magnetic items near the computer. This includes anything that produces an electrical field such as your television or a microwave.

- Turn the computer off before you move it. Use the proper shutdown method to turn it off, then unplug all the devices, and move them carefully to the new location. If a device no longer works, always check first to ensure it is connected properly to the computer, and then try restarting the computer to see if the device is recognized.

- Use care when traveling with a notebook and the type of case you use to carry it. It should be a durable and padded case designed for notebooks in order to protect it from damage during travel.
Unit 1: Recognizing Computers

Lesson 5 Basic Troubleshooting Techniques

- Be careful when carrying the notebook. You can easily dislodge, damage, or break a device within the notebook if it's accidentally dropped. Take care when opening the notebook as you may damage the hinge that holds the screen to the notebook.

- For any portable device, be careful where you place these and ensure they are within reach at all times. For example, never leave your cell phone lying on a table while you go to get a cup of coffee, as the phone may not be there on your return. This is also true of a notebook.

- Try to keep cables clear of walkways. Cables can be tied together to reduce tripping hazards or being pulled loose. They can be damaged as a result of poor maintenance, or just age and this can result in the device using the cable not responding. Replace a worn or damaged cable immediately.

- Occasionally, you may need to clean the computer or printer of dust or paper particles. You can buy items to clean the keyboard, mouse, monitor, and other peripheral devices. Be very careful when removing devices for cleaning or replacement, and take your time putting them back into place. For instance, if you are removing an ink cartridge, take note of how you removed it and how you need to insert the new cartridge so the printer will recognize and use this new cartridge.

- If you need to change a major component of your computer and you are not comfortable making the change, use a technical support specialist to help or perform the change for you. Unless you are experienced working with computers, it is best to leave the installation or repair of major components to a computer technician.

- Before taking the computer to a specialist to replace or upgrade a component, or before you do it yourself, always make a backup of the data. Backups should be performed on a regular basis even if you have no plans to upgrade or replace anything. How many backup copies you have depends on the value of the data and how long it would take you to recreate all the files. For example, copying the data from a home computer may not be as crucial as having a backup of all data stored on a server in an organization. Purchasing equipment to add or replace components in a computer is a much lower cost in time and effort than to reproduce some or all of the historical data on a computer.

- Always ensure your antivirus program is up to date and that you scan your computer regularly to detect viruses or spyware.

Working with Hardware

- If you cannot open any files from the hard drive, this usually means there is a problem with the hard drive. It could be that the hard drive has failed or crashed, and is no longer available. Check to determine whether the hard drive is connected properly inside the computer—if the computer was dropped or moved recently, the connection may have come loose. If not, you may need to replace the complete drive. At the same time, never move a computer if it is processing data; for instance, refrain from moving a notebook while it is copying files.

- If you cannot read files from media such as CDs or DVDs, check the disk for scratches or dirt. Clean the disk using an appropriate cloth and try again.

- If you cannot print, check that the printer is connected and turned on. If this is not the problem, check the cable connections from the printer to your computer to ensure they are securely connected. If you are on a network or using a wireless connection for the printer, check these connections are operational and then try printing again. If that still does not work, check that the printer you are using actually exists and is active on your computer. You may need to install a new device driver for this printer, or add the printer for your system (e.g. if you have recently purchased a new computer).

- If the connections are active but the printer does not print, check the printer for any possible error messages such as a paper jam or empty ink cartridge. These problems can easily be resolved by reading the screen for the printer. Turn the printer off before removing any paper jams or changing the ink cartridge. Check to ensure the correct cables are used.
• If you cannot log on the network, check that you are using the correct logon ID and password. Also check to ensure the network connection is active on this computer. If you are using a wireless connection, ensure you are connected to the correct network. Some organizations restrict access to their network unless you connect only to that network; an example would be an organization that has a SharePoint server with restrictions to certain external Web sites.

• Also, check that the cables are connected and that all other network hardware is working correctly if you are not able to log on the network. You may need to check with your network administrator for the network hardware if you still cannot log on after checking the cables.

• The age of a computer can also be a source of problems. For instance, the image displayed on the monitor may begin to deteriorate, indicating a problem with the display or video card. Depending on the computer, this may be solved with a new video card, a new monitor, or notebook screen.

• A newly installed hardware device may not work for a number of reasons, such as not being connected properly or the wrong device driver has been installed.

Performing Hardware Maintenance

Occasionally you may be required to perform some general maintenance on specific devices for your computer.

• If a key on the keyboard or the mouse is not working properly, try cleaning the input devices. You can purchase cleaning kits for the keyboard, mouse, and CD drives to help keep them clean. You can also purchase vacuums or compressed air cans to help disperse any dust. In the case of liquid spilled on the keyboard, cleaning may not help. You may need to replace the keyboard.

• Every computer component has a life cycle, which varies with type, make, model, and use of the item. Replacing an item may be as simple as changing the battery in a wireless mouse, or a little more involved, such as if you need a new mouse because the USB connector is damaged. You may also want to replace components for other reasons, such as upgrading from a traditional keyboard to an ergonomic one.

• If printing appears smeared or does not show all the content, the printer may need cleaning. For instance, paper jams can leave residual ink on the rollers in the printer. Depending on the printer, you may be able to use an appropriate cloth and cleaning solution to clean these areas, or you may need to replace a leaky ink cartridge. Some recycled printer cartridges do not work well after several refills and, as a result, the quality of print deteriorates. Generally speaking, cleaning the printer or doing maintenance on it should be done by someone who has the appropriate equipment to handle this task.

• Use care when removing paper jams and check all areas that need clearing as noted on the printer prior to removing the paper. Remnants of paper may remain in the printer after you remove a jammed sheet.

• File management is crucial on the computer and should be given serious consideration when installing new applications, as well as for data files. Every file stored on the computer takes space on the hard drive. The less space available on the hard drive, the slower the computer will become as it tries to find space to create copies of the files you are using. Windows prompts you when the amount of free space is too low for it to continue. You must take steps to free space by deleting files from the hard drive and the Recycle Bin, uninstalling programs, or moving data files to another drive.

• Another type of file you can delete from the system without causing problems is temporary files. These are generated when you install a program, use attachments in electronic mail, visit Web sites, or register/subscribe to information from a Web site—these are known as cookies. You can delete these files from the system using specific commands available in Windows.

• The hard drive spins when it is processing information; when asked to save a file, it tries to store as much of the file as possible in the first unused area it finds on the hard drive. As much of the file will be stored in the space available, and it will then try to store as much of the rest of the file in the next unused area. If the available space is consumed, then it will continue allocating more unused areas until all of the file is stored. This means parts of various files are saved in different areas, causing the computer to take time to retrieve these files. Windows provides a defragmentation feature that instructs your computer to reorganize files so that each one is stored in one place in its entirety. This speeds up retrieval of the file.
Any time you are uncomfortable upgrading or replacing items in your computer, ask for help from a specialist. For instance, adding more RAM chips to your system is relatively easy and you may not require anyone’s help. However, adding a hard drive may require a specialist to help you connect it and change the system settings so the operating system can identify this new drive. A specialist has the appropriate tools, knowledge and experience to handle changes to any internal component of a computer.

You may be able to learn how to make a change to the hardware by watching the specialist do things, like changing the RAM chips, keyboard, mouse, monitor, etc. In general, if the item requires a special configuration or new settings to be applied to the computer, you will want a specialist to assist you with this change.

Performing Basic Troubleshooting
As noted previously, there are some steps you can follow to isolate a problem and resolve it. Consider the steps used in the following example to help identify a problem and resolve it.

1 Collecting Information
As you begin to notice potential problems with the computer, write the information down for reference, especially the exact wording of any error messages. The issue may occur only once or several times, but in case it continues, it is important that you collect information about all the incidents or messages you see on the screen. Keep notes also about the frequency of each type of message and what you were doing at the time the message appeared. This may include trying to duplicate the problem to see if the same message occurs each time you perform a task or if the message occurs randomly.

2 Analyzing the Information
Once you have gathered enough information about the errors or issues, be sure to analyze the information for any patterns or common themes. For instance, if the messages you see refer to a problem with saving files due to lack of space, this could mean there is limited free space left on the hard drive. If the messages refer to problems with accessing the Internet, requiring you to restart the modem or router each time, this may be a problem with the settings on the modem/router to access the Internet, or the modem/router needs to be replaced. If the errors occur whenever you use the mouse, this could mean the mouse needs a new battery or you may need a new mouse.

3 Attempting Basic Solutions
Now that you have the information and a general analysis of what the problem could be, you can try some basic troubleshooting. For hardware issues such as a keyboard or mouse not working, try simple steps such as replacing the battery, or replacing the keyboard or mouse. If the error messages refer to lack of space on the hard drive, consider deleting files no longer needed or uninstall application programs no longer used. An error message indicating a lack of memory means you are running low on RAM; in this scenario, close any files or programs not actively in use. Refrain from installing or opening any new application programs, or saving any files until the problem is fixed. Make a backup of all data files. Be careful with changes for hardware, such as a modem, or the operating system, that require any configuration.

4 Finding Help
If the messages continue or the problem persists, seek help and advice from a technical support specialist. A business or school organization will have an Information Technology (IT) department you may be able to contact. If you have friends who are knowledgeable with computers, they may be able to offer advice and work with you to fix the problem. If these two options are not available to you, try searching for this type of issue on the Internet. Many people post information to help others with common types of computer problems and include solutions you can then try. Alternatively, you can use offline resources such as libraries, reference books, magazines, periodicals, or retail vendors.

5 Communicating the Problem Accurately
Be accurate and concise when communicating the problem to the technical support specialist. Wherever possible, provide information including the exact text of the messages, what you were doing at the time the problem occurred, and how often the problem occurred. Provide as much detail as possible so the specialist can begin to isolate the problem and find a solution.
6 Analyzing and Selecting the Proper Action
The number of actions to resolve an issue will depend on the problem. By providing as much detail as you can, the specialist will be able to provide you with a list of options to correct the situation. For example, problems with accessing the Internet or a network could result from entering the wrong logon ID or password; having the wrong connection type selected; or needing a different modem/router, or having your modem or router incorrectly configured. Generally a specialist will work through a list of options with you, from the easiest to hardest, with the harder ones usually requiring someone with more experience or knowledge to fix the problem.

7 Implementing the Solution
When you know all the options for fixing a problem, you may be able to try these on your own or you may require a specialist to try each option. Regardless of who implements the list, it should be followed in the order provided so that the problem will be solved in the quickest manner available.

8 Confirming the Problem is Fixed
After implementing each option, try to duplicate the problem to see if it occurs again. If so, proceed to the next option and then test the implementation. Repeat with each option until the problem is fixed.

9 Documenting and Communicating the Incident
When the problem is resolved, be sure to document the incident to use for future reference. You can then share this document with others. For instance, this may be an issue that all users on the same network need to know and learn to correct on their own, or you could post your information in a Weblog to alert others to this potential issue.

10 Avoiding Similar Problems in the Future
Documenting an issue can help prevent similar problems in future. For example, if the problem was a virus that came from installing a program you downloaded from the Internet, make sure to scan any files you download before installing them. At the same time, you will want to ensure your antivirus program is active and up to date before using anything obtained from the Internet or others. Alternatively, if you want to store all your digital pictures, you may purchase an external hard drive and save the pictures to this drive instead of your internal hard drive. This keeps space on your internal hard drive free for application programs and other types of data.

Summary
In this lesson, you looked at different options available to help maintain your computer’s performance as well as how to perform basic troubleshooting functions. You should now be familiar with:

✓ increasing the computer’s performance                       ✓ performing basic maintenance
✓ taking care of the computer                                 ✓ performing basic troubleshooting
✓ working with hardware
Review Questions

1. What should you watch for when setting up a computer in a specific location?
   a. The type of power source in that country
   b. Whether it is visible to the public from this location
   c. That it is not near any heat or cold sources
   d. That there are no magnetic or electrical fields near the computer
   e. Any of the above
   f. a, b and c

2. You should refrain from eating or drinking around the computer and try to keep the area around the computer as clean as possible.
   a. True  b. False

3. John is beginning to see numerous messages about the lack of space on his hard drive. What should he do next?
   a. Gather information regarding the messages
   b. Call technical support to fix the problem
   c. Shut down the computer until technical support arrives.
   d. Buy a new computer

4. It is important to communicate the problem as accurately as you can so the specialist can isolate the problem and resolve it.
   a. True  b. False

5. Where can you find help or advice for fixing a problem on your computer?
   a. IT department
   b. Online sources, such as the Internet
   c. Offline sources, such as the library
   d. Any of the above
   e. a or b
Lesson 6  Buying a Computer

Objectives

In this lesson, you will look at what decisions you need to make in order to choose the most appropriate computer for your needs. On completion, you will be familiar with:

- hardware considerations
- software considerations
- price considerations
- support or service considerations

Skills

1-1.2.9 Identify consumer issues related to buying, maintaining and repairing a computer

Deciding What to Purchase

Many factors are involved when buying a computer. These vary depending on the purpose of the computer, as well as how and where it will be used (for example, school, home, or business). These same factors will determine the type of computer you purchase or the operating system you choose. Some additional factors are listed below.

Determining the Purpose

The first factor is purpose: how will this computer be used and by whom? For example, if the purpose is to store a large amount of data that must be available to multiple users around the world, then this computer will likely need to be a server with one or more large hard drives.

Hard drive size and type are crucial when purchasing a computer that will become a server. The computer type and model are also important, especially if it will store a large amount of data. You will also need to ask what other equipment you will need to protect the data on the server, such as a backup device or a UPS.

On the other hand, if the computer is for a new sales representative who will be travelling around a lot, he/she may need a notebook that can be set to connect to the server at head office and should include a number of features that will enable him or her to present information to customers (for example, ensure there is an appropriate port to allow a LCD projector to be connected, or wireless networking).

If the computer is for someone in marketing who works with videos, graphics, or other media, the microprocessor speed, amount of RAM, quality of video card, size of monitor, and size of hard drive are important. How many monitors and what size of monitor will this person need?

Someone who will be using the computer at home may only need a base-model notebook or a Netbook. The latter can be an inexpensive option for the home user who wants Internet access only and does not plan to store many files on the computer. Alternatively, if the home user is a student who requires the portability of a notebook consider the amount of hard disk space needed to accommodate application programs and personal data such as homework or shared photographs and videos.

Identifying Other Requirements

When purchasing a computer for a particular organization, you may need to consider company standards. Specific departments may require standard configurations or types of computers; for example, perhaps all field sales people need a minimum hardware requirement on their notebooks, which are passed along to administration staff every two years when the sales people are upgraded with the latest notebooks.
Similarly, a school may purchase computers from a designated vendor who can accommodate one set of standards for classroom computers and another set of standards for faculty. A library may need computers without hard drives (called thin clients) in order to offer free courses to the public while ensuring that participants do not save anything to the library network. An Internet café may only need a server that handles wireless Internet access for customers.

An organization such as a travel agency may not need computers with large hard drives as they will be connected via the Internet to a number of other organizations, like airlines and hotels, which provide enquiry services. The major requirement here could be for adequate bandwidth to search these databases in order to make reservations.

### Selecting the Operating Platform

In addition to hardware requirements, you will also need to consider which operating platform should be installed. In some cases, an organization may use multiple operating platforms. An example would be a university that uses a Unix or Linux platform for its school database system, while students might be using any computer with any operating system when they sign on to the university Web site to find information. Alternatively, all employees at a particular business may use PCs, except for the marketing department staff, who use Mac-based computers for the specific types of documents they create and use.

Another factor in selecting an operating platform is what application programs will need to run on it. While many applications designed for different platforms share similar features, there often is enough of a difference to create problems in sharing files or features. For example, Microsoft Office 2007 on the PC shares many features with Microsoft Office 2008 for the Macintosh. Consider compatibility issues that may arise from using different operating platforms for a variety of tasks in the organization, such as whether the contact management program works the same on a PDA as it does on a desktop, or what is required to set up access to the contact management program on a PDA.

Popular application programs, such as those made by Microsoft and Adobe, are available in different versions for multiple platforms, while customized or specialized programs may be available for only one platform and may require you to choose a different operating platform than you first thought. While most network administrators can find a “work around” for these situations, there are no guarantees that these solutions will work all the time. As such, be sure to ask the network administrator about any requirements for the new computer and build this into your decision-making process.

### Looking at Support Options

New computers are covered by warranty; the length and scope of coverage depend on the vendor. The warranty is usually one year and covers any replacement costs associated with manufacturing defects, such as abnormal hard drive failure, malfunctioning network card, or faulty monitor. Warranties do not cover damage caused by careless actions such as dropping a notebook or spilling liquid on it. Once the warranty expires, you may be required to bring or ship the computer to an authorized repair depot and wait for it to be returned—which may be a considerable length of time.

Retailers often offer support agreements which can help extend the life of your computer for a cost that may be less than paying for each repair as need arises. Prices are adjusted based on call volume and cost of parts. The term of the agreement and the services included will also vary. Some agreements include an option for the retailer to lend you another computer while yours is in for repair. When purchasing one of these agreements, ensure you read the agreement carefully and fully understand what you are buying. These types of agreements may be expensive but are necessary for many whose business relies on its computers.

Extended warranties differ from support agreements as these do not extend the life of the computer. These warranties typically cover two years beyond the manufacturer’s one year warranty. They do not, as a rule, cover damage through accidents or misuse and, as with a support agreement, be sure to read the warranty carefully before agreeing to purchase it.
In general, the useful life of a new computer is considered to be a minimum of two to three years, depending on how you use it and what you use it for. A desktop computer will typically last longer than a notebook as it is not moved from location to location. As the owner of the computer, it makes sense for you to protect it from damage as a result of poor care and maintenance, such as lack of space for air flow to the power supply, protection against power surges, damage during travel, loss due to theft, antivirus protection, and so on.

A computer’s useful life can also end when it is no longer capable of meeting its owner’s requirements, such as insufficient RAM or processor speed to run new software applications. It is still functional—there are no errors or component failures—but it no longer meets the user’s needs. Its life can be extended by upgrading those components, or ended by replacing it with totally new equipment.

Another consideration when buying a computer is whether you plan to purchase a basic model now and upgrade the hardware or software later. With some types and models, there will be limitations on what and how much you can upgrade, such as size and style of RAM chips. You can generally get information about hardware limitations at the time of purchase.

Software upgrades are a bit more difficult as the requirements shown for software are usually minimum setup requirements; once the software is installed, you may need to purchase more RAM for the monitor or to process documents, so it’s important to know how much RAM you can buy and how much it will cost. You must also consider whether the original warranty or an extended warranty will continue to cover the computer if you alter it, such as installing more RAM or a bigger hard drive.

The best guideline when buying an extended warranty is how much knowledge you possess to handle basic problems on the computer and who you can turn to for help.

Any time you are looking to purchase a computer, do research so that you know what you want and how it will be used, and compare specifications and price at different locations whenever possible. Also, try to work with an IT specialist who can provide you with the proper advice and information. This may be someone in the business environment or at a retail store. One way or another, a computer is a significant investment so it makes sense to take care in your decision-making process.

### Disposing of Computer Equipment

One last factor to include in your decision-making process should be what you plan to do with any computer equipment that becomes obsolete or unnecessary. For example, some organizations re-use older computers by incorporating them into the network to handle dedicated processes, such as a mail server or remote log on verification server. Other organizations make old computers available to staff for home use.

You can also incur costs to dispose of this equipment. The cost may be “internal” as it may consist only of the time required by IT staff to remove all files (especially those containing confidential information) from old hard drives; or there may be “external” costs such as contracting out to a company that can dispose of or recycle computer equipment safely. (Some equipment may contain hazardous material that needs to be handled correctly rather than simply disposing of it in a landfill.)

### Summary

In this lesson you looked at the process involved in purchasing a computer and what you need to consider when purchasing a computer appropriate for your needs. You should now be familiar with:

- hardware considerations
- software considerations
- price considerations
- support or service considerations
Review Questions

1. What factors should you consider when purchasing a computer for someone who works with video files?
   a. Large Hard Drive
   b. Digital Camera
   c. Microprocessor Speed
   d. Amount of RAM
   e. Any of the above
   f. a, c, or d

2. An organization that may not need computers with large hard drives would be:
   a. Library
   b. Internet Café
   c. School
   d. Travel Agency
   e. Any of the above
   f. a or b

3. The useful life of a computer is exactly two years.
   a. True
   b. False

4. What factors should you consider when choosing an application program?
   a. The ability to share files between operating platforms
   b. The ability to use the same features in similar application programs on the different operating platforms
   c. How to use the same application program on different computer devices
   d. Any of the above
   e. a or b

5. A support agreement is:
   a. A replacement for a warranty
   b. An agreement that can extend for the life of the computer
   c. An extra cost that you do not need
   d. Any of the above
   e. a or b
Lesson 7

Looking at Software

Objectives

In this lesson, you will look at some of the common types of software applications or programs being used. On completion, you will be familiar with:

- what software programs are
- how software programs are developed
- what the operating system is
- which software programs are designed for specific tasks

Skills

1-2.1.1 Identify how hardware and software interact
1-2.1.2 Identify the difference between an operating system and application software
1-2.1.3 Identify issues relating to software distribution
1-2.2.1 Identify fundamental concepts relating to word processing
1-2.2.2 Identify fundamental concepts relating to spreadsheets
1-2.2.3 Identify fundamental concepts relating to presentation software
1-2.2.4 Identify fundamental concepts relating to databases
1-2.2.5 Identify fundamental concepts relating to graphic and multimedia programs
1-2.2.6 Identify fundamental concepts relating to education and entertainment programs
1-2.2.7 Identify the types and purposes of different utility programs
1-2.2.8 Identify other types of software
1-2.2.9 Identify how to select the appropriate application(s) for a particular purpose, and problems that can arise if the wrong software product is used for a particular purpose
1-2.2.10 Identify how applications interact and share data

What is a Software Program?

The term computer software refers to everything that makes a computer run, including operating systems, programming software, and application programs. Computer software only functions when loaded into the computer’s RAM. Software applications are created using programming languages that allow professional computer programmers to write sometimes complex code into the software, so that users can activate functions and complete tasks. The software code can usually be executed quite simply by selecting a menu option, toolbar button, shortcut keystroke or menu, or a combination of these options.

The computer software code is based on a set of rules, called algorithms, and designed to complete specific tasks in specific sequences. For example, when you enter a formula to perform a sum calculation in Excel, the program will run the algorithm for this formula, find the data you want added up, do the calculation, and then display the results.

These algorithms specify how the software program identifies the type of data being input, and then the proper format for the output. For example, to enter text or numbers, you need only to press the appropriate keys on the keyboard. Data is also recognized when you use other input devices such as the mouse, scanner, tablet pen, or a digital camera. The computer interprets your keystrokes and displays them onscreen, requiring a relatively simple algorithm. To record narration for a video presentation, on the other hand, the computer must convert your voice from analog to digital. Having a microphone connected to the computer does not do this conversion automatically; you need to have a software program that identifies your vocal input and converts that information or data into a sound file.
The software program determines whether that information will be output as text, numbers, sound, video, and so on. To receive output, you must have hardware:

- Your monitor displays documents, pictures, video, Web sites, and file locations.
- Your printer makes hard copies (paper copies) of files.
- Your speakers or headphones allow you to hear audio files.

A number of software programs perform similar tasks. Your choice of software should be based on what you need to accomplish, the degree of detail and features you need, and what is most cost-effective.

## Obtaining Software

All retail software programs go through a thorough process before they are released to the public. Software vendors perform quality controls on their software based on the most commonly used tasks, in order to minimize problems that can occur once you install the program. The cost of a software program often includes future updates to the program.

When you purchase a software program, you are purchasing a license to install and use that program on one computer only. The traditional method of purchasing software is with the program on CDs in a package that includes a booklet with instructions on how to install and use the program. You can also purchase and download software online where you pay for the program, usually with a credit card, and then receive separate e-mails from the vendor confirming the purchase and providing a license number, often called the **product code** or **key code**.

An organization or company with a large number of users for a software program will usually purchase a network **license** instead of individual copies. The network administrator will receive one media set (for example, a set of CDs) that contains the software, as well as options such as drivers. The network administrator then copies the program into a folder on the network, from which he/she can install it onto individual computers and enter the key code to activate the program. This option is cost-effective in reducing the amount of time needed to install a program on many computers. The network administrator can also do this from a remote site without needing to carry the software media around, thereby reducing the possibility of damage or loss.

**Software as a Service (SaaS)** or **Application Service Provider (ASP)** licensing enables you to access and use a software program from your system via a network, the organization intranet, or the Internet. You are required to log on to the appropriate network using a valid ID and password before you can access the software. Once a SaaS contract expires, you can no longer access that software until you renew the license. Managing the licenses can be done by a network administrator in an organization or by an ASP.

Although these are the most common ways to obtain software, there are other legitimate means as well. Other methods of distributing or obtaining software include **shareware**, **freeware**, **bundling**, and **Open Source**. Shareware are trial version software that you can download for free, but usually these programs have limited functionality or provide a limited amount of time that you can access the program. If you like the program though, you pay a nominal fee which removes these restrictions. Freeware programs do not charge a fee and may be shared with others at no charge.

Software can also be “bundled” with a computer purchase. For example, when you purchase a new PC, the purchase price includes the license for the operating system, and may include a trial version of Microsoft Office, and a number of other programs such as Microsoft Money. Some of these programs may require you to purchase a full version of the program or to register online before you have access to the program, while others may be the full version and require no further action on your part.

Another type of software is **Open Source**, which is where the programming code is available to anyone who wants to use it. Some Open Source programs are set up like freeware in that they are available at no cost. You can modify the program to your needs and also share your version with others; however, you are not permitted to charge anyone for it. The feature that distinguishes Open Source programs is that, by sharing the programming code as well as the program itself, users who like certain programs can build in new functions and also make them available to others.

Whichever way you obtain software, it is your responsibility to ensure you are observing whatever licensing rules apply. When you purchase licensed software, you will be notified by the vendor of any updates and you will be able to obtain them at no additional cost. If you do not have a valid license, you will be violating the vendor’s copyright and could be subject to legal action. A network administrator is aware of this responsibility and should take the necessary steps to ensure there are enough licenses for each computer in the organization.
Upgrading Your Software

It is very unusual for software programs to be error free in their first release. Many of the bugs (errors) that occur are problems that the software company cannot predict because they are based on how customers use the program. Software companies develop programs for the most commonly used or requested features and later provide “patches” to address bugs and announce updates.

Updates or upgrades are not always created to address problems with the software; they may be required due to changes in government regulations (such as a new tax table for accounting programs) or other external factors beyond their control (such as new viruses).

These known issues should not prevent users from purchasing software. Whether you purchase software as soon as it is released or a few months later should be dictated by your own requirements; for example, perhaps your company is upgrading to Office 2007, or the latest version includes new features that could be very useful to you.

When you register your copy (license) of the software, you can become entitled to receive notification about updates or upgrades, usually via a link in an e-mail that you can use to download the upgrade. Some software vendors build a feature within the program to schedule or automatically check for online updates, and display messages to indicate when a new update is ready for installation. Microsoft does this whenever upgrades are available for Windows, as does Adobe for their products.

Users can generally perform software upgrades, regardless of whether the computer is a stand-alone model or connected to a network. Most network administrators provide access to users to perform software updates; but restrict changes to configuration or to critical software such as antivirus programs.

Web applications such as Web browsers may be upgraded more often than other applications to address security issues. You will usually be informed that an upgrade has become available when you next visit the site or start the program from your system.

Always register your software to ensure you receive notices when updates are available. A number of organizations, groups, and newsgroups share information about updates, why they’re being provided, and whether you should install them; if you find you’ve missed something, you can check the software vendor’s Web site to find specific updates. Once you receive a notice of the update, you have the option of saving a copy of the update file onto your system instead of automatically installing it from the vendor’s web site.

Choosing an Application Program

One software program you must have installed on your computer is an operating system (OS) as it controls the computer’s interaction and communication with the user. An OS performs two important functions:
- It manages all hardware resources including the input, output, and storage devices, and
- It manages the files stored on the computer and recognizes the file types to complete tasks.

The OS acts as the host for application programs that want to run on that computer. As the host, it controls the hardware, thereby relieving the application from having to deal with those details. The computer must load the OS into memory before it can load any application program. This applies regardless of which operating system or type of computer you use. On a PC-based computer, an OS such as Microsoft Windows must be installed, and a Mac-based computer must have the Mac OS installed prior to installing any other programs.

An application program performs a specific function such as accounting, word processing, or drafting. Some standard categories of application programs include:

- **Word Processing**
- **Utility**
- **Multimedia**
- **Presentations**
- **Accounting**
- **Web Browsers**
- **Graphics**
- **Spreadsheets**
- **Suite**
- **Electronic Mail**
- **Database Management**
- **Customized**

Within each category, there are several software programs with industry-wide acceptance.
It is important to use the appropriate software program to complete tasks to help organize and generate information as needed. Many programs share a number of features; to choose the one that best suits your needs, look closely at what you want to accomplish. Make a list of all the tasks you want to accomplish on the computer, and check off items as you compare different software programs. Look for a program that can handle at least eighty percent of these tasks, and include the amount of training time you’ll need to become familiar with that program.

Keep in mind that many programs of one type provide some features from another type of program that may make you think you need not invest in both types of program. However, while these programs are perfect in some situations, they lack the flexibility provided by a dedicated version of that type of program, which you may need to perform certain functions efficiently.

For instance, there are desktop publishing features in Word but they are not as advanced or stable as the features in a dedicated desktop publishing program such as Adobe InDesign. If you have a large amount of financial data, it may be easier to choose a spreadsheet or database program that enables you to manipulate the data in any way you want; a word processing program is unlikely to offer the flexibility you’ll need for tasks such as sorting, calculating figures for what-if scenarios, and so on. On the other hand, if what you really need is the ability to create a blank table, it will probably be easier to do this in a word processing program than a spreadsheet program.

Consider also that your needs may change as time passes. For example, a spreadsheet program might be adequate to handle accounting tasks for a small business just starting up. But as the company grows, it may become crucial to move all those daily transactions over to a dedicated accounting program.

With a dedicated program, however, you should have some fundamental knowledge in order to use the program to its full advantage. For example, you should know some graphic design basics before manipulating parts of a picture, or accounting basics before using a dedicated accounting program to enter transactions.

You may also need software programs that can share data with other types of programs. For instance, if you are creating a quarterly sales report and want to include a summary of the revenue for the quarter, you could create a link from the quarterly report to the spreadsheet file so that the figures in the spreadsheet can be updated regardless of which program the numbers are changed in. Alternatively, you could copy the revenue figures from a spreadsheet report and paste them into your word processing document rather than type them all over again.

Another example could be a Web site that posts an animation or movie that you can view in your browser once you install the Adobe Flash Player on your local machine; or viewing and sharing PDF (Portable Document Format) documents, from Web sites or via e-mail, using the free, and readily available, Acrobat Reader program.

**Word Processing**

Word processing applications are the most commonly used programs; they allow you to create, edit, and save documents, change the appearance or position of text or pictures, review changes made by others, or remove items no longer needed.

Word processing programs are standard for documents such as letters, memos, invoices, and faxes, and can also be used to create basic Web pages, newsletters, forms, brochures, or flyers. The following examples of documents you can produce with word processing programs include a newsletter, a reviewed document, and a letter.
Spreadsheets

Spreadsheet programs perform mathematical calculations, produce “what-if” analyses, and display graphs, charts, and diagrams. If you need to track numbers or analyze information for trends or patterns, a spreadsheet can generally help. A spreadsheet file is called a workbook and you can have any number of worksheets or reports within that file. For example, an entire workbook file may be called Sales Projections and within this file there might be one worksheet with estimated revenue figures for each product the company sells.

One advantage of using a spreadsheet program to manage large amounts of data is the ability to sort, find or filter information. If you need to analyze data this can help; you can also use an analysis tool within the program. In addition, you can use worksheets to track information such as bank reconciliations, travel expenses, assignment or report marks, and so on. You can also sort information by different criteria such as grades, average grade, highest expense, number of deposits, or numerous other parameters.

The following examples of reports you can create with a spreadsheet program include a simple budget report, a contact list sorted by last name, and the same contact list with filters applied.

Notice how the text and numbers entered into each worksheet set up the purpose of the worksheet and describes what information is being viewed or calculated. The Budget worksheet contains formulas to add or determine specific information for that report, whereas the other two files comprise of data for a contact list. Entering data in this format can then enable the data to be sorted or filtered to show specific results.
Presentations

There are several presentation programs that allow you to create slides or handouts for presentations (speaker delivered or self-running) quickly and easily. Special effects generally include things like animation, slide transitions, and theme designs, and your slides can contain any type of content such as text, graphics, diagrams, charts, or tables.

You can also create speaker notes and handouts for the audience, or set up the presentation to be broadcast over the Internet, to a live audience, or as a self-running slide show on a computer for training or education purposes. You can add, edit, and format text, as well as insert pictures, charts, or tables onto the slides.

The following examples of files created with presentation programs include a certificate award, a photo album, and a presentation in a view that shows all the slides for that presentation.

Database Management

A database is an organized collection of related information. Some common examples are a phone book, inventory list, or personnel files. A Database Management Software (DBMS) program organizes, stores, tracks, and retrieves the information in a database.

A database application takes any task ordinarily handled by a filing cabinet, multiple file folders, or other information storage system and applies some type of order to it that will make the data more easily accessible.

Database programs can also be used to generate reports, such as monthly sales reports, that can assist a company’s management in making sound business decisions. Databases are identified by their structure:

- Fields contain individual pieces of data, such as names, addresses, and customer types
- A collection of related fields make up a record (for example, all information for one contact is considered a record)
- A collection of records make up a table
- Multiple tables of related records make up a database

With this structure, you can use queries to extract data, generate reports on the data, use forms to access fields within a table, set up key fields, and relate (link) tables to each other. This is called "working with relational databases," as data records in one table include one or more fields that can be "linked" to other tables based on a common key value.

Not all databases are created for companies to collect information. Many Web sites use databases “behind the scenes” to help you find and purchase items on the site. They may also have databases to collect information about you when you subscribe or register as a user for that site. The information in this type of database can then be sorted or filtered to meet specific criteria, such as sending e-mails to those people who want information on a particular product, or to those customers who have not purchased in the past year.
Examples of items you could use with a database management program include a list of customers, an inventory list or a query.

Graphics

You can obtain graphics (pictures) from different sources, but you can also create your own or customize picture files to use in flyers, newsletters, letterhead, or Web pages. It is best to have some knowledge of graphic design before working with a dedicated graphics program in order to minimize your learning curve and understand which tools to use for which purposes.

Graphic design programs can be grouped with multimedia software programs so that, in addition to manipulating pictures, you can create or edit sounds or video. A dedicated graphic design program is different from a software program with built-in drawing features, which may offer similar tools, but is generally not as flexible as a dedicated graphic design program.

All graphic design programs include a basic set of tools for drawing shapes, or text, and painting fill colors or patterns, changing line styles, width, and color, or filling in arrowhead styles. Larger graphic design programs also provide options to create and edit shapes or curves, as well as photographs and have a wide variety of enhancement or effect tools such as 3-D and artistic blends.

The program you use to create or edit the graphic will also allow you to save your graphic in different file formats suitable for a variety of uses. The most common file types for graphics include:

- .tiff (Tagged Image File Format)
- .wmf (Windows Metafile Format)
- .bmp (Bitmap)
- .jpeg/jpg (Joint Photographic Experts Group)
- .gif (Graphics Interface Format)
- .png (Portable Network Graphics)

Each file format affects the quality of the picture in different ways, depending on the program and the effects used in the picture. Anyone can view pictures saved in any of these file formats in Windows, without needing another program.

Many advertising, media, or publishing companies use graphics programs to create unique and interesting images for use in marketing and promotional materials, to create logos or product IDs, or Web pages.

In addition, a number of “studio” type products allow you to be creative without needing the same experience as a graphic designer for drawing or manipulating images or photographs. These programs enable people to create greeting cards, manipulate digital images for reports or promotional material, record music files, create Web pages with animated elements, or edit videos with additional elements such as text and still photographs. Many of these programs are simple enough for young children to use easily.
Following is an example of how you can change a photograph or image:

**Multimedia**

Multimedia programs enable you to extend the capabilities of graphic design by adding elements such as video, music, or animation. These programs are becoming so much easier to use that multimedia elements are now commonly included in Web pages on the Internet or an intranet.

As with graphics programs, you need to save multimedia files in the correct file format in order for the computer to recognize and play it. The file formats used mostly for video are .mpg/mpeg (Moving Picture Experts Group), or .mov, or .avi (includes animation), which is also used for still graphics. Music files are also most commonly saved in this format, although music files are at a different level (3) than video (level 1, 2 or 4); that is why music files are often referred to as .mp3 files. Music files can also be saved in the .wav (Waveform Audio Format or Audio for Windows) format. Files in this format can be played on any computer that has Windows Media Player or QuickTime software programs installed.

The term “multimedia” encompasses any software programs that incorporate graphics, music, or video. An example of a multimedia program is Adobe Flash, which allows you to set up animated objects using drawings, pictures, or video, and then combine this animation with sound or music files.

The following examples show multimedia files in Adobe Flash, Windows Media, and QuickTime.
Education or Entertainment

Programs used for teaching have changed dramatically as technology has advanced. Many programs are now designed to entertain in addition to educate people of all ages. These programs integrate simulation and interaction as a way for one user or multiple users to acquire information.

For example, some educational programs are games in which students are required to use strategy and creative thinking, or share available resources with others, to achieve particular goals. Some of the best teaching games are designed so well that players are being entertained and do not realize they are learning while playing.

Another example of educational programs that entertain and educate at the same time are those played on game systems such as Xbox or Wii. There are a variety of games that can be purchased for each game system and targeted to all ages. Many of these games enable individuals to play by themselves or with others in the same location or online via the Internet.

Other educational programs are referred to as Computer-Based Training (CBT), often offered though a vendor’s Web site. The user needs to log on to the system and can then work through the learning material at their own pace. There may also be measures built into the program to track the individual’s progress or assess their skills. These are referred to as eLearning programs.

Utility Tools

Utility programs can be indispensable if your computer breaks down unexpectedly. One of the best investments you can make is to purchase an antivirus program that you update frequently. Virus programs can disrupt, erase, or corrupt information on your computer. The most dangerous feature of a virus is that you rarely know when you have one, or when it will strike your computer.
Some popular types of utilities you should consider having available on your system include:

**Antivirus Protection**
Having an antivirus program and keeping it up to date protects your system from viruses that may corrupt files.

**Adware/Spyware Protection**
Many vendors include a utility with antivirus software to find and block unwanted items from the Internet such as spam, spyware, and adware. Spam refers to unwanted messages, usually selling something; spyware refers to programs that gather information about your Internet use; and adware are programs that display advertisements automatically.

**Disk Compression**
Compressing files on your hard disk is like taking rarely-used files out of the top drawer of the filing cabinet and squeezing them tightly into the bottom drawer. This frees up space to store more files in the most accessible drawer, while keeping less-used files in a less accessible spot in case they need to be retrieved.

**Disk Cleanup**
Software programs create many temporary files, such as automatic saves in your word processing program or copies of attachments in your e-mail program. Disk cleanup is a way of reducing the number of these temporary files, which can take up space and cause conflicts between programs.

**Backup Protection**
These programs enable you to schedule backups or copies of specific data to have on hand should the computer fail. The frequency of backups will depend on the importance of the data and how easy it is to replicate.

**File Compression**
This utility can be very helpful when you need to reduce the size of a file or several files, usually for storage purposes or to transfer a file from one location to another. Compressing a file is also referred to as zipping, much like when you stuff a tote bag as full as possible and then press everything down to make it fit prior to zipping (closing) the bag.

**Widgets/Gadgets**
These are mini-programs that display on your desktop and provide quick access to information, services and tools from the Internet. Windows provides a sidebar, to help organize the gadgets, that includes a variety of popular tools such as a calendar, or links to sites that provide up to date weather or news from your location or another location anywhere in the world.

The following illustration shows what an antivirus program with other types of protection tools can look like.
Following are examples of what disk management and utility programs can include.

Accounting or Financial

Accounting or financial programs automate tasks performed by bookkeepers and accountants. Users need to understand accounting fundamentals to understand all the features available in an accounting software program.

The following illustration shows some of the features an accounting program can include.

Some financial programs target tasks with personal or small business finances. Financial programs are a little different than accounting programs, as they focus on specialized areas such as small business management, investments, or personal finances. Examples of personal finance programs are Quicken or Microsoft Money. You can purchase these programs to “stand alone” on your computer, or set up a secure account to keep track of your information on the vendor’s Web site.
You can often obtain financial investment programs from the financial institution where you do your banking. These can be downloaded from their Web site so that you can manage your financial portfolio on your own or with the help of an investment advisor.

**Electronic Mail**

Electronic mail or e-mail programs are similar to a desktop or paper organizer. The process of sending an e-mail is similar to the manual process for addressing, writing, and mailing a hard copy letter. The main difference is that the manual process requires you to use paper, envelope, and a stamp, and have your post office deliver the letter, whereas e-mail requires only that you have an e-mail program, the correct e-mail address, and an Internet connection.

E-mail programs are generally quite user friendly and users receive responses to their e-mails much more quickly than they would through traditional mail. All e-mail programs include the option to send and receive mail, as well as a contact list or address book. Some e-mail programs also include a calendar and task list area, to help you keep notes or track activities.
Web Browsers

A Web browser is a program that enables you to view Web sites placed online by different companies, organizations, or individuals. Browsing on the Internet requires you to have an Internet connection, as well as a Web browser where you can enter the address of the site you want to visit. You can then click links on the Web site to navigate to different areas of the same Web site, or enter a new Web address to go to another Web site.

Messaging

A very popular way to communicate quickly with someone else is through an Instant Messaging (IM) program. Instant messaging is also used in chat rooms, and when you send text messages over a cellular telephone. This type of communication is limited in that only one “line” of communication can occur at a single time; also, unlike in-person conversations where two or more people can speak at once, instant messaging can only display text submitted by one person at a time.

Instant messaging programs such as Microsoft Windows Live and Yahoo Messenger are very useful when a quick response is required. Instant messaging is like text messaging except that it allows you to include emoticons (small graphics that represent emotions), whereas text messaging is only text and mainly sent or received through handheld devices such as cellular phones or PDAs.

To join a chat room, you need to subscribe to the particular group that has the chat room. Chat rooms can be included in instant messaging programs or you can search for Web sites of interest and join their chat rooms. It takes time to understand how a chat room works; at any time, there will be numerous conversations going on and you need to orient yourself to decide which conversation you wish to join.

Web Page Authoring

A Web page authoring program enables you to create and design pages for your Web site with a focus on the options that are important to consider on the Web. Many programs offer the option to save a file as a Web page, but do not offer the flexibility or ability to view the code behind the Web page, which determines the formatting or layout of that page.

Web page authoring programs are becoming easier to use. However, you do need to know some fundamentals about Web site design and maintenance to address issues such as readability, checking links and storing data.
Many Web page authoring programs work in combination with multimedia programs to include entertainment items such as video or pictures. For example, you can use Adobe Flash to create a video to be inserted onto a Web page.

Following is an example of what a web page authoring program can include.

**Web Conferencing**

One method of communicating with people in different locations is to set up a Web conference. Traditional conferencing requires that all participants attend one physical location or be connected via a telephone service. In-person meetings can be expensive; “teleconferencing” (telephone conferencing) can be less expensive, and does not allow visually interactive communication.

Web conferencing software allows you to communicate with people in their own locations. Depending on hardware setups at each site, everyone who signs into the program can view a presentation and both see and hear each other, or perhaps only view the presentation and hear each other. Web conferencing can be advantageous for delivering training sessions, holding meetings, or sharing information with customers.
Computer Aided Design

Computer Aided Design (CAD) programs are used for designing objects. Architects and engineers can use CAD programs to create plans or drafts; CAD can also be used to animate special effects. Designs can be set up in two or three dimensions, as required.

Project Management

Project management programs enable you to plan and track tasks for small and large projects that will use many people or resources. By entering tasks into a program such as Microsoft Project, you can organize tasks, people, and other resources to accurately estimate and track start and end dates and important milestones in between. As things change in the project, the program enables you to make changes to see how the timeline or resources will be affected.

Group Collaboration

Group collaboration software enables people to share information or coordinate activities, usually within an organization although it can also include external people. Most group collaboration software, such as Microsoft SharePoint or Lotus Notes, enable members in the group to go to a central spot, such as an intranet home page, to view or find information about activities in the organization. Members can add or modify items for their own department or for themselves. For example, a sales person can enter a news item in the main area to show when he/she will be out for client visits for all staff to view, and also enter information about an upcoming meeting that will only be viewed by the other members of the department.

Group collaboration software includes tools that the network administrator can set up to have the same feel as the company Web site. These tools might include a company blog for general comments (announcements regarding a project milestone or the company’s summer picnic, for example), as well as a shared calendar, an area for shared photographs, or online document collaboration.

Integrated Suites

An integrated suite is a group of programs packaged together for purchase. For example, an office suite might consist of word processing, spreadsheet, presentation, and e-mail programs, and perhaps database or graphics program. The programs are all integrated or compatible with each other, so that data from one program can be used in any other program without difficulty. Grouping programs this way is generally more cost-effective than purchasing these programs individually.

Adobe Design CS4 Premium:
Adobe InDesign®
Photoshop® Extended
Illustrator®
Flash® Professional
Dreamweaver®
Fireworks®
Acrobat® 9 Pro

Microsoft Office 2007 Professional:
Word
Excel
PowerPoint
Access
Outlook Business Contact Manager
Accounting Express
Publisher
Specialized or Custom

A specialized or custom program is any program that targets a specific market by performing tasks such as managing contacts, generating reports, or filing income taxes. Custom programs may also be developed for specific companies, with that company’s particular needs as the program’s main purpose.

Custom programs can be used for many tasks in many industries. For example:

<table>
<thead>
<tr>
<th>Types of Requirements</th>
<th>Examples of Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools</td>
<td>taking registration and attendance, completing report cards</td>
</tr>
<tr>
<td>Sales people/contact management</td>
<td>recording sales calls, contacts, purchases, notes, leads</td>
</tr>
<tr>
<td>Restaurants</td>
<td>processing food orders, bills, inventory or stock control</td>
</tr>
<tr>
<td>Retail stores</td>
<td>purchasing at point of sale, reading bar codes, inventory control</td>
</tr>
<tr>
<td>Banking/credit card institutions</td>
<td>processing debit card and credit card transactions</td>
</tr>
<tr>
<td>Internet shopping sites</td>
<td>shopping through eBay, browsing through Yahoo!</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>producing automobiles, specifying lumber sizes</td>
</tr>
<tr>
<td>Transportation</td>
<td>accessing airline reservations from a travel agency, online, or at the airline counter</td>
</tr>
<tr>
<td>Scientific, medical, or engineering</td>
<td>doing inspections, tracking patient progress</td>
</tr>
</tbody>
</table>

Summary

In this lesson you looked at some common types of software applications or programs and how they are used. You should now be familiar with:

- what software programs are
- how software programs are developed
- what the operating system is
- which software programs are designed for specific tasks

Review Questions

1. What are algorithms?
   a. A set of rules used for computer software code
   b. Designed to complete specific tasks in specific sequences
   c. Specifications for how data is inputted into a software program
   d. Any of the above
   e. b and c

2. When you purchase a software program, you are actually purchasing a license to use that software program.
   a. True
   b. False

3. Which is the most cost-effective method for a network administrator to purchase licenses for 25 computers in an organization?
   a. Purchase 25 licenses from a retail store
   b. Purchase a network license for 25 computers
   c. Purchase a SaaS for 25 computers
   d. Any of the above
   e. b or c

4. Which software program would you use to manage a quarterly sales report for expenses?
   a. Word Processing
   b. Spreadsheet
   c. Accounting
   d. Utility
   e. Any of the above

5. If you wanted to have a meeting with someone in Tokyo, London, and Miami, which type of program would be best to use to simulate everyone being in the same room?
   a. Teleconferencing
   b. Webconferencing