Understanding Essential Computer Concepts

Computers are essential tools in almost all kinds of activity in virtually every type of business. In this unit, you will learn about computers and their components. You will learn about input and output, how a computer processes data and stores information, how information is transmitted, and ways to secure that information. Finally, you will learn about system and application software. Quest Specialty Travel is expanding its North American offices and just purchased Sheehan Tours, an established travel agency in Boston, Massachusetts. Sheehan Tours has been in business for over 40 years and has a large customer base. Unfortunately, its computer system is tremendously outdated. Its office contains a hodgepodge of computer equipment, most of which has been purchased used. The office staff still carries data between computers on floppy disks, and only one computer is connected to the Internet. Kevin O'Brien, the manager of the New York office, has been sent to the new Boston office to help them switch to Quest's business practices. He has already ordered and installed new computer equipment. His next task is to teach the staff how to use the new equipment.

OBJECTIVES
- Investigate types of computers
- Examine computer systems
- Examine input devices
- Examine output devices
- Investigate data processing
- Understand memory
- Understand storage media
- Explore data communications
- Learn about networks
- Learn about security threats
- Understand system software
- Understand application software
A computer is an electronic device that accepts information and instructions from a user, manipulates the information according to the instructions, displays the information in some way, and stores the information for retrieval later. Computers are classified by their size, speed, and capabilities. Most of the staff at Sheehan Tours do not know anything about computers except for the ones that sit on their desks, so Kevin decides to start with a basic explanation of the types of computers available.

The following list describes various types of computers:

- **Personal computers** are computers typically used by a single user, for use in the home or office. Personal computers are used for general computing tasks such as word processing, manipulating numbers, working with photographs or graphics, exchanging e-mail, and accessing the Internet.

- A personal computer is available as a desktop computer, which is designed to sit compactly on a desk; as a notebook computer (also referred to as a laptop computer), which is small, lightweight, and designed for portability; or as a tablet PC, which is also designed for portability, but includes the capability of recognizing ordinary handwriting on the screen. Figure A-1 shows a MacBook, one of Apple's notebook computers. Desktop personal computers can be purchased for as little as $300, but high-end notebooks can cost more than $3500. A notebook computer with similar capability is usually more expensive than a desktop computer, and tablet PCs are generally more expensive than notebook computers. Many computer users spend between $800 and $1500 when purchasing a new personal computer.

- **Hand-held computers** are small computers that fit in the palm of your hand. Hand-held computers have more limited capabilities than personal computers.
  - PDAs (personal digital assistants) are generally used to maintain an electronic appointment book, address book, calculator, and notepad. See Figure A-2. High-end PDAs are all-in-one devices that can send and receive e-mails and make phone calls.
  - MP3 players are hand-held computers that are primarily used to store and play music, although some models can also be used to play digital movies or television shows.
  - Cell phones are another type of hand-held computer. In addition to being used to make telephone calls, cell phones store contact information. Many cell phones can take and store digital photos and video and play and store music. Most cell phones have additional capabilities such as built-in calculator programs. High-end cell phones can also perform many of the same functions as a PDA.

- **Mainframe computers** are used by larger businesses and government agencies to provide centralized storage, processing, and management for large amounts of data. The price of a mainframe computer varies widely, from several hundred thousand dollars to several million dollars.

- The largest and fastest computers, called supercomputers, are used by large corporations and government agencies when the tremendous volume of data would seriously delay processing on a mainframe computer. A supercomputer, like the one shown in Figure A-3, can cost tens of millions of dollars.

**Understanding terminals**

When an organization uses mainframes or supercomputers, each user inputs processing requests and views output through a terminal or a terminal emulator. A terminal has a keyboard for input and a monitor for output, but processes little or no data on its own. A terminal emulator is a personal computer, workstation, or server that uses special software to imitate a terminal so that the PC can communicate with the mainframe or supercomputer for complex data processing.
A **computer system** includes computer hardware and software. **Hardware** refers to the physical components of a computer. **Software** refers to the intangible components of a computer system, particularly the **programs**, or lists of instructions, that the computer needs to perform a specific task. Kevin explains how computers work and points out the main components of a computer system.

The following list provides an overview of computer system components and how they work:

- The design and construction of a computer is referred to as its **architecture** or **configuration**. The technical details about each hardware component are called **specifications**. For example, a computer system might be configured to include a printer; a specification for that printer might be a print speed of eight pages per minute or the capacity to print in color.

- The hardware and the software of a computer system work together to process data. **Data** refers to the words, numbers, figures, sounds, and graphics that describe people, events, things, and ideas. Modifying data is referred to as **processing**.

- In a computer, processing tasks occur on the **motherboard**, which is located inside the computer and is the main electronic component of the computer. The motherboard is a **circuit board**, which is a rigid piece of insulating material with **circuits**, electrical paths, on it that control specific functions. See Figure A-4. The motherboard contains the following processing hardware:
  - The **microprocessor**, also called the **processor** or the **central processing unit (CPU)**, consists of transistors and electronic circuits on a silicon **chip** (an integrated circuit embedded in semiconductor material). See Figure A-5. The processor is mounted on the motherboard and is responsible for executing instructions to process information.
  - Cards are removable **circuit boards** that are inserted into slots in the motherboard to expand the capabilities of the motherboard. For example, a sound card translates the digital audio information from the computer into analog sounds that the human ear can hear.

- The data or instructions you type into the computer are called **input**. The result of the computer processing input is referred to as **output**. The computer itself takes care of the processing functions, but it needs additional components, called **peripheral devices**, to accomplish the input, output, and storage functions.
  - You use an **input device**, such as a keyboard or a mouse, to enter data and issue commands. **Commands** are input instructions that tell the computer how to process data. For example, you might want to center the title and double-space the text of a report. You use the appropriate commands in the word processing program that instruct the computer to modify the data you have input so the report text is double-spaced and the report title is centered.
  - Output can be in many different forms, including reports, documents, graphs, sounds, and pictures. Computers produce output using **output devices**, such as a monitor or printer.
  - The output you create using a computer can be stored either inside the computer itself or on an external storage device, such as a DVD. You will learn more about storage devices later in this unit.
Comparing microprocessor speeds

How fast a computer can process instructions depends partially on the speed of the microprocessor, which is determined by its clock speed, word size, and cache size, and whether it is single or dual core. **Clock speed** is measured in **megahertz (MHz)**, millions of cycles per second, or in **gigahertz (GHz)**, billions of cycles per second. **Word size** refers to the amount of data that is processed at one time. Finally, a **dual-core processor**, one that has two processors on a single chip, can process information up to twice as fast as a **single-core processor**, one with one processor on the chip.
Examining Input Devices

Before a computer can produce useful information, people must get data into the computer. This is accomplished by using input devices. In a typical personal computer system, you input data and commands by using an input device such as a keyboard or a mouse. Computers can also receive input from a storage device. You will learn about storage devices later in this unit. As Kevin explains peripheral devices to the Sheehan Tours staff, they ask several questions about input devices. For example, one person doesn't understand the difference between a mouse and a trackball. Kevin continues his explanation with a discussion of various input devices.

There are many types of input devices, as described below:

- One of the most frequently used input devices is a keyboard. The top keyboard in Figure A-6 is a standard Mac keyboard. The bottom keyboard in Figure A-6 is ergonomic, which means that it has been designed to fit the natural placement of your hands and should reduce the risk of repetitive-motion injuries. It also has several additional keys programmed as shortcut keys to commonly used functions.

- Another common input device is a pointing device, which controls the pointer, a small arrow or other symbol on the screen. Pointing devices are used to select commands and manipulate text or graphics on the screen.

- The most popular pointing device for a desktop computer is a mouse, such as the one shown on the left side in Figure A-7. An ordinary mouse has a rolling ball on its underside, and an optical mouse has a tiny camera on its underside that takes pictures as the mouse is moved. You control the pointer by moving the entire mouse. A mouse usually has two or more buttons for clicking commands. A mouse might also have a scroll wheel that you roll to scroll the page on the screen and that may function as one of the buttons.

- The trackball, such as the one shown on the right side in Figure A-7, is similar to a mouse except that the rolling ball is on the top side and you control the movement of the pointer by moving only the ball.

- Notebook computers are usually equipped with a trackpad or a pointing stick. See Figure A-8. A trackpad is a touch-sensitive device that you drag your finger over to control the pointer. The buttons or button are located in front of the trackpad. Some Mac notebook computers are equipped with a Multi-Touch trackpad, which does not have any buttons in front of it; the trackpad itself is the button. A pointing stick is a small, eraser-like device embedded among the typing keys that you push up, left, right, or down to move the pointer. Two buttons equivalent to mouse buttons are located in front of the spacebar.

- A scanner is a device that transfers the content on a piece of paper into memory. To do this, you place a piece of paper on the glass, a beam of light moves across the glass similar to a photocopier, and stores the image or words on the paper as digital information. You can scan a document or a photo and save it as an image file, or you can scan a document and have the text “read” by the scanner and saved in a document file for editing later.

- Microphones are another type of input device. You can use them to record sound for certain types of files, or, if you have the voice-recognition software, you can use them to input data and commands.

- Input devices can be connected to the computer with cables or wirelessly. Wireless input devices connect to the computer using infrared or radio frequency technology, similar to a remote control for a television.

Using assistive devices

People with physical impairments or disabilities can use computers because of advances in making computers accessible to everyone. For example, people who cannot use their arms or hands instead can use foot, head, or eye movements to control the pointer. People with poor vision can use keyboards with large keys for input, screen enlargers to enlarge the type and images on the monitor, or screen readers to read the content of the screen aloud. Computers are being developed that can be controlled by a person’s thoughts, that is, the brain’s electromagnetic waves.
**FIGURE A-6: Keyboards**

- Function keys
- Main keyboard
- Editing keypad
- Numeric keypad
- Ergonomic keyboard

**FIGURE A-7: Personal computer pointing devices**

- Mouse
- Trackball

**FIGURE A-8: Notebook pointing devices**

- Trackpad
- Multi-Touch trackpad
- Pointing Stick
Examining Output Devices

As stated earlier, output is the result of processing data; output devices show you those results. The most commonly used output devices are monitors and printers. Kevin continues his discussion of peripheral devices with an explanation of output devices.

Output devices are described below:

- The **monitor** displays the output from a computer.
  - The monitor shown on the left in Figure A-9 is a **flat panel monitor**, a lightweight monitor that takes up very little room on the desktop. Most flat panel monitors use **LCD (liquid crystal display)** technology, which creates the image you see on the screen by manipulating light within a layer of liquid crystal. A **CRT (cathode ray tube) monitor**, shown on the right in Figure A-9, uses gun-like devices that direct beams of electrons toward the screen to activate dots of color to form the image you see on the screen. CRT monitors require much more desk space than flat-panel display monitors. Apple's iMac combines the LCD monitor and the internal components of the computer into one unit, as shown in Figure A-10.
  - Monitor **screen size** is the diagonal measurement from one corner of the screen to the other. In general, monitors on desktop computers range in size from 15" to 30", whereas monitors on notebook computers range in size from 12" to 20".
  - Most monitors have a **graphics display**, which divides the screen into a matrix of small dots called **pixels**. Resolution is the number of pixels the monitor displays. Standard resolutions range from 640 x 480 to 1600 x 1200, although some Macs have a higher resolution. If your screen is small, a 1600 x 1200 resolution will make the objects on the screen too small to see clearly.
  - Dot pitch (dp) measures the distance between pixels, so a smaller dot pitch means a sharper image. A .28 or .26 dot pitch is typical for today's monitors.

- A **printer** produces a paper copy, often called **hard copy**, of the text or graphics processed by the computer. There are three popular categories of printers: laser printers, inkjet printers, and dot matrix printers.
  - **Laser printers**, like the one shown on the left in Figure A-11, are popular for business use because they produce high-quality output quickly and efficiently. In a laser printer, a temporary laser image is transferred onto paper with a powdery substance called **toner**.
  - **Inkjet printers**, such as the one shown on the right in Figure A-11, are popular printers for home use. These printers spray ink onto paper and produce output whose quality is comparable to that of a laser printer.
  - **Dot matrix printers** transfer ink to the paper by striking a ribbon with pins. A 24-pin dot matrix printer produces better quality print than a 9-pin. Dot matrix printers are most often used when a large number of pages need to be printed fairly quickly or when a business needs to print multi-page continuous forms.

- **Speakers**, like speakers on a sound system, allow you to hear sounds from the computer. Speakers can be separate peripheral devices attached to the computer, or they can be built in to the monitor.
- Like input devices, output devices can be connected to a computer using cables or a wireless connection.
FIGURE A-9: Monitors

Flat panel monitor

CRT monitor

FIGURE A-10: Apple’s iMac

FIGURE A-11: Printers

Laser printer

Inkjet printer
In order to understand how data is processed in a computer, you first need to learn how the computer represents and stores data. All data and programs are stored as files. A computer file is a named collection of stored data. An executable file contains the instructions that tell a computer how to perform a specific task; for instance, the files that are used while the computer starts are executable. A data file is created by a user, usually with software. For instance, a report that you write with a word processing program is data, and must be saved as a data file if you want to access it later. Kevin gives a basic description of how information is represented inside a computer.

The following information will help you understand data processing:

- The characters used in human language are meaningless to a computer. Like a light bulb, the computer must interpret every signal as either “on” or “off.” A computer represents data as distinct or separate numbers. Specifically, it represents “on” with a 1 and “off” with a 0. These numbers are referred to as binary digits, or bits.
- A series of eight bits is called a byte. As Figure A-12 shows, the byte that represents the integer value 0 is 00000000, with all eight bits “off” or set to 0. The byte that represents the integer value 1 is 00000001, and the byte that represents 255 is 11111111.
- A kilobyte (KB or simply K) is 1024 bytes, or approximately one thousand bytes. A megabyte (MB) is 1,048,576 bytes, or about one million bytes. A gigabyte (GB) is 1,073,741,824 bytes, or about one billion bytes. A terabyte (TB) is 1,024 GB, or approximately one trillion bytes.
- Personal computers commonly use the ASCII system to represent character data. ASCII (pronounced “ASK-ee”) stands for American Standard Code for Information Interchange. Each ASCII number represents an English character. Computers translate ASCII into binary data so that they can process it.
  - The original ASCII system used 7 bits to represent the numbers 0 (0000000) through 127 (1111111) to stand for 128 common characters and nonprinting control characters. Because bits are usually arranged in bytes, the eighth bit is reserved for error checking.
  - Extended ASCII uses eight bits and includes the numbers 128 (10000000) through 255 (11111111) to represent additional characters and symbols. Extended ASCII was developed to add codes for punctuation marks, symbols, such as $ and ©, and additional characters, such as é and ü, that were not included in the original 128 codes.
  - Most computers use the original ASCII definitions, but not all computers use the same definitions for Extended ASCII. Computers that run the Leopard operating system use the set of Extended ASCII definitions defined by the American National Standards Institute (ANSI). Figure A-13 shows sample ASCII code with ANSI standard Extended ASCII characters.
### Figure A-12: Binary representation of numbers

<table>
<thead>
<tr>
<th>Number</th>
<th>Binary representation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>00000000</td>
</tr>
<tr>
<td>1</td>
<td>00000001</td>
</tr>
<tr>
<td>2</td>
<td>00000010</td>
</tr>
<tr>
<td>3</td>
<td>00000011</td>
</tr>
<tr>
<td>4</td>
<td>00000100</td>
</tr>
<tr>
<td>5</td>
<td>00000101</td>
</tr>
<tr>
<td>6</td>
<td>00000110</td>
</tr>
<tr>
<td>7</td>
<td>00000111</td>
</tr>
<tr>
<td>8</td>
<td>00001000</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>253</td>
<td>11111101</td>
</tr>
<tr>
<td>254</td>
<td>11111110</td>
</tr>
<tr>
<td>255</td>
<td>11111111</td>
</tr>
</tbody>
</table>

### Figure A-13: Sample ASCII code representing letters and symbols

<table>
<thead>
<tr>
<th>Character</th>
<th>ASCII Code</th>
<th>Binary Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>(space)</td>
<td>32</td>
<td>00100000</td>
</tr>
<tr>
<td>$</td>
<td>36</td>
<td>00100100</td>
</tr>
<tr>
<td>A</td>
<td>65</td>
<td>01000001</td>
</tr>
<tr>
<td>B</td>
<td>66</td>
<td>01000010</td>
</tr>
<tr>
<td>a</td>
<td>97</td>
<td>01100001</td>
</tr>
<tr>
<td>b</td>
<td>98</td>
<td>01100010</td>
</tr>
<tr>
<td>?</td>
<td>129</td>
<td>10000001</td>
</tr>
<tr>
<td>£</td>
<td>163</td>
<td>10100011</td>
</tr>
<tr>
<td>®</td>
<td>217</td>
<td>11011001</td>
</tr>
<tr>
<td>é</td>
<td>233</td>
<td>11101001</td>
</tr>
</tbody>
</table>
Understanding Memory

In addition to the microprocessor, another important component of personal computer hardware is the memory, which stores instructions and data. Memory is different from permanent storage in a computer. Your computer has five types of memory: random access memory, cache memory, virtual memory, read-only memory, and complementary metal oxide semiconductor memory. Kevin realizes that most of the Sheehan Tours staff don’t understand the difference between memory types, so he explains the different types of memory.

Types of memory include the following:

- **Random access memory (RAM)** temporarily holds programs and data while the computer is on and allows the computer to access that information randomly; in other words, RAM doesn’t need to access data in the same sequence in which it was stored. For example, if you are writing a report, the microprocessor temporarily copies the word processing program you are using into RAM so the microprocessor can quickly access the instructions that you will need as you type and format your report. The characters you type are also stored in RAM, along with the fonts, graphics, and other objects that you might use. RAM consists of chips on cards that plug into the motherboard.
  - Most personal computers use some type of **synchronous dynamic random access memory (SDRAM)**, which is synchronized with the processor to allow faster access to its contents.
  - RAM is sometimes referred to as **volatile memory** or **temporary memory** because it is constantly changing as long as the computer is on and is cleared when the computer is turned off.
  - **Memory capacity**, sometimes referred to as **storage capacity**, is the amount of data that the computer can handle at any given time and is measured in megabytes or gigabytes. For example, a computer that has 512 MB of RAM has the capacity to temporarily store more than 512 million bits of data at one time.

- **Cache memory**, sometimes called **RAM cache** or **CPU cache**, is a special, high-speed memory chip on the motherboard or CPU itself that stores frequently accessed and recently accessed data and commands.

- **Virtual memory** is space on the computer's storage devices that simulates additional RAM. It enables programs to run as if your computer had more RAM by moving data and commands from RAM to the hard drive and swapping in the new data and commands. See Figure A-14. Virtual memory, however, is much slower than RAM.

- **Read-only memory (ROM)** is a chip on the motherboard that has been prerecorded with data. ROM permanently stores the set of instructions that the computer uses to check the computer system's components to make sure they are working and to activate the essential software that controls the processing function when you turn the computer on.
  - ROM contains a set of instructions called the **BIOS (basic input/output system)**, which tells the computer to initialize the motherboard, how to recognize the peripherals, and to start the boot process. The **boot process** is the set of events that occurs between the moment you turn on the computer and the moment you can begin to use the computer. The set of instructions for executing the boot process is stored in ROM.
  - ROM never changes and it remains intact when the computer is turned off; therefore, it is called **nonvolatile memory** or **permanent memory**.

- **Complementary metal oxide semiconductor (CMOS, pronounced “SEE-moss”) memory** is a chip installed on the motherboard that is activated during the boot process and identifies where essential software is stored.
  - A small rechargeable battery powers CMOS so its contents are saved when the computer is turned off. CMOS changes every time you add or remove hardware on your computer system.
  - CMOS, often referred to as **semipermanent memory**, changes when hardware is added or removed, but doesn’t empty when the computer is shut off.
  - Because CMOS retains its contents when the computer is turned off, the date and time are stored there.
1. Your computer is running a word processing program that takes up most of the program area in RAM, but you want to run a spreadsheet program at the same time.

2. The operating system moves the least-used segment of the word processing program into virtual memory on disk.

3. The spreadsheet program can now be loaded into the RAM vacated by the least-used segment of the word processing program.

4. If the least-used segment of the word processing program is later needed, it is copied from virtual memory back into RAM. To make room, some other infrequently used segment of a program will need to be transferred into virtual memory.

**Upgrading RAM**

One of the easiest ways to make a computer run faster is to add more RAM. This enables the computer to access instructions and data stored in RAM very quickly. The more RAM a computer has, the more instructions and data can be stored there. Currently, you can buy from 64 MB to 1 GB RAM cards, and usually, you can add more than one card. You need to check your computer's specifications to see what size RAM cards the slots on your motherboard will accept.
Because RAM retains data only while the power is on, your computer must have a more permanent storage option. As Figure A-15 shows, a storage device receives data from RAM and writes it on a storage medium, such as a CD. Later the data can be read and sent back to RAM to use again. Kevin explains the types of storage media available. He starts with magnetic storage because almost all computers have a hard disk.

The types of storage media are discussed below:

- **Magnetic storage devices** store data as magnetized particles on mylar, a plastic, which is then coated on both sides with a magnetic oxide coating. Common magnetic storage devices are hard disks, tape, and floppy disks.
  - A **hard disk** is the most common type of magnetic storage media. It contains several magnetic oxide-covered metal platters that are usually sealed in a case inside the computer.
  - **Tape** is another type of magnetic storage media. Tape storage is much too slow to be used for day-to-day computer tasks; therefore, tapes are used to make backup copies of data stored on hard disks. Tape provides inexpensive, though slow, archival storage for large companies who need to back up large quantities of data.
  - A **floppy disk** is a flat circle of magnetic oxide-coated mylar enclosed in a hard plastic case; a floppy disk can store 1.44 MB of data. Floppy disks are sometimes called 3½ disks because of the size of the hard plastic case. The floppy disk has almost become obsolete, and most personal computers are now manufactured without a floppy disk drive.

- **Optical storage devices** are polycarbonate discs coated with a reflective metal on which data is recorded using laser technology as a trail of tiny pits or dark spots in the surface of the disc. The data that these pits or spots represent can then be “read” with a beam of laser light.
  - The first standard optical storage device available for personal computers was the **CD (compact disc)**. One CD can store 700 MB of data.
  - A **DVD**, though the same size as a CD, currently stores between 4.7 and 15.9 GB of data, depending on whether data is stored on one or two sides of the disc, and how many layers of data each side contains. The term **DVD** is no longer an acronym, although it was originally an acronym for **digital video disc** and later was sometimes updated to **digital versatile disc**.
  - New formats of optical storage include Blu-ray Discs and HD-DVD, which are capable of storing between 15 and 50 GB of data. They are used for storing high-definition video. Different companies support each format and it remains to be seen if one dominates the market.

- **Flash memory** is similar to ROM except that it can be written to more than once. **Flash memory cards** are small, portable cards encased in hard plastic to which data can be written and rewritten. They are used in digital cameras, handheld computers, video game controllers, and other devices.

- A popular type of flash memory is a **USB flash storage device**, also called a **USB drive** or a **flash drive**. See Figure A-16.
  - **USB drives** for personal computers are available in a wide range of sizes; they currently range from drives capable of holding 32 MB of data to drives capable of holding 16 GB of data. They are becoming more popular for use as a secondary or backup storage device for data typically stored on a hard disk drive.
  - **USB drives** plug directly into the USB port of a personal computer; the computer recognizes the device as another disk drive. The location and letter designation of USB ports varies with the brand and model of computer you are using, but the physical port may be on the front, back, or side of a computer.
  - **USB flash storage devices** are about the size of a pack of gum and often have a ring that you can attach to your key chain.
Storage devices and RAM

A storage device receives information from RAM, writes it on the storage medium, and reads and sends it back to RAM.

Erasing and rewriting on CDs and DVDs

CD-ROM stands for compact disc read-only memory. CDs that you buy with software or music already on them are CD-ROMs—you can read from them, but you cannot record additional data onto them. In order to record data on a CD, you need a CD-R (compact disc recordable) or CD-RW (compact disc rewritable) drive and a CD-R or CD-RW disk. On CD-ROMs, data is stored in pits made on the surface of the disk; when you record data on a CD-R or -RW, a laser changes the reflectivity of a dye layer on a blank disk, creating dark spots on the disk’s surface that represent the data. On a CD-R, once the data is recorded, you cannot erase or modify it, but you can add new data to the disk as long as the disk has not been finalized. In contrast, you can re-record a CD-RW. CD-R disks can be read by a standard CD-ROM drive or a DVD drive; CD-RW disks can be read only by CD-RW drives or CD-ROM drives labeled “multi-read.” Recordable DVD drives are also available. As with CDs, you can buy a DVD to which you can record only once, or a rewritable DVD to which you can record and then re-record data. Recordable and rewritable DVDs come in several formats; for example, recordable DVDs are available as DVD-R and DVD+R. Make sure you know which type of DVD your DVD drive uses. Newer DVD drives are capable of reading from and writing to both -RW and +RW DVDs and CDs, as well as DVDs with two layers.
**Exploring Data Communications**

**Data communications** is the transmission of data from one computer to another or to a peripheral device. The computer that originates the message is the **sender**. The message is sent over some type of **channel**, such as a telephone or coaxial cable. The computer or peripheral at the message's destination is the **receiver**. The rules that establish an orderly transfer of data between the sender and the receiver are called **protocols**. The transmission protocol between a computer and its peripheral devices is handled by a **device driver**, or simply **driver**, which is a computer program that can establish communication because it contains information about the characteristics of your computer and of the device. 

The Sheehan Tours staff will use their computers to connect to the computers at the Quest headquarters in California as well as to surf the Internet, so Kevin next explains how computers communicate.

- **QUICK TIP**
  - Typically, a printer that is near the computer is connected to a parallel port, and the mouse, keyboard, and modem are connected to serial ports.
  - FireWire is another standard for transferring information between digital devices similar to USB.

The following describes some of the ways that computers communicate:

- The data path between the microprocessor, RAM, and the peripherals along which communication travels is called the **data bus**. Figure A-17 illustrates the data bus that connects a printer to a computer.
- An external peripheral device must have a corresponding **port** and **cable** that connect it to the computer. Inside the computer, each port connects to a **controller card**, sometimes called an **expansion card** or **interface card**. These cards plug into electrical connectors on the motherboard called **expansion slots** or **slots**. Personal computers can have several types of ports, including parallel, serial, SCSI, USB, MIDI, and Ethernet. Figure A-18 shows the ports on a Windows desktop personal computer and on the back of an iMac (your port configuration may differ).
  - A **parallel port** transmits data eight bits at a time. Parallel transmissions are relatively fast, but they have an increased risk for interference. A **serial port** transmits data one bit at a time.
  - One **SCSI** (small computer system interface, pronounced “scuzzy”) **port** provides an interface for one or more peripheral devices at the same port. The first is connected directly to the computer through the port, and the second device is plugged into a similar port on the first device.
  - A **USB** (Universal Serial Bus) **port** is a high-speed serial port which allows multiple connections at the same port. The device you install must have a **USB connector**, a small rectangular plug, as shown in Figure A-19. When you plug the USB connector into the USB port, the computer recognizes the device and allows you to use it immediately. You can connect multiple devices to a single USB port by “daisy chaining” them or by using a hub. USB flash storage devices plug into USB ports. For most USB devices, power is supplied via the port, so there is no need for extra power cables.
  - The port for a sound card usually includes jacks for speakers and a microphone, which are designed to work with a **MIDI** (Musical Instrument Digital Interface, pronounced “middy”) **card**.
  - You can connect to another computer, a LAN, a modem, or sometimes directly to the Internet using an **Ethernet port**. Ethernet ports allow data to be transmitted at high speeds.
- An internal peripheral device such as a hard disk drive may plug directly into the motherboard, or it may have an attached controller card.
- Notebook computers may also include a **portable computer card** (PC Card). PC Cards are credit card-sized cards that plug directly into the PC Card slot and can contain additional RAM, a fax modem, or a hard disk drive (similar to a USB flash storage device).
FIGURE A-17: Components needed to connect a printer to a computer

![Diagram of connecting a printer to a computer](image)

Printer port
Cable
Port
Expansion slots
Rear view of printer
Rear view of system unit

FIGURE A-18: Computer ports and connections

![Diagram of computer ports and connections](image)

Power connection
Mouse port
Keyboard port
Audio connection
Monitor port
USB ports
Speaker and microphone connections
Network port
Phone line connection
FireWire port
Audio ports
Firewire ports
Mini-DVI video output port
Apple's iMac
Windows PC

FIGURE A-19: USB connector

![USB connector](image)
A network connects one computer to other computers and peripheral devices, enabling you to share data and resources with others. There are a variety of network configurations; however, any type of network has some basic characteristics and requirements that you should know. Kevin continues his discussion of how computers communicate with an explanation of networking.

Types of networks are described below:

- Each computer that is part of the network must have a network interface card (NIC) installed. This card creates a communications channel between the computer and the network. A cable is used to connect the NIC port to the network.

- Network software is also essential, establishing the communications protocols that will be observed on the network and controlling the "traffic flow" as data travels throughout the network.

- Some networks have one or more computers, called servers, that act as the central storage location for programs and provide mass storage for most of the data used on the network. A network with a server and computers dependent on the server is called a client/server network. The dependent computers are the clients.

- When a network does not have a server, all the computers essentially are equal, and programs and data are distributed among them. This is called a peer-to-peer network.

- A personal computer that is not connected to a network is called a standalone computer. When it is connected to the network, it becomes a workstation. You have already learned that a terminal has a keyboard and monitor used for input and output, but it is not capable of processing on its own. A terminal is connected to a network that uses mainframes as servers. Any device connected to the network is called a node. Figure A-20 illustrates a typical network configuration.

- In a local area network (LAN), computers and peripheral devices are located relatively close to each other, generally in the same building.

- A wide area network (WAN) is more than one LAN connected together. The Internet is the largest example of a WAN.

- In a wireless local area network (WLAN), computers and peripherals use high-frequency radio waves instead of wires to communicate and connect in a network. Wi-Fi (short for wireless fidelity) is the term created by the nonprofit Wi-Fi Alliance to describe networks connected using a standard radio frequency established by the Institute of Electrical and Electronics Engineers (IEEE). Wi-Fi is used over short distances to connect computers to a LAN.

- A personal area network (PAN) is a network that allows two or more devices located close to each other to communicate or to connect a device to the Internet. In a PAN, devices are connected with cables or wireless.

- Infrared technology uses infrared light waves to beam data from one device to another. The devices must be compatible, and they must be positioned close to each other with their infrared ports pointed at each other for this to work. This is the technology used in TV remote controls.

- Bluetooth uses short range radio waves to connect a device wirelessly to another device or to the Internet. The devices must each have a Bluetooth transmitter, but unlike infrared connections, they can communicate around corners or through walls.

- WiMAX (short for Worldwide Interoperability for Microwave Access), another standard defined by the IEEE, allows computer users to connect over many miles to a LAN. A WiMAX tower sends signals to a WiMAX receiver built or plugged into a computer. WiMAX towers can communicate with each other or with an Internet service provider.
Understanding telecommunications

**Telecommunications** means communicating over a comparatively long distance using a phone line or some other data conduit. When it is not possible to connect users on one network, telecommunications allows you to send and receive data over the telephone lines. To make this connection, you must use a communications device called a modem. A **modem**, which stands for modulator-demodulator, is a device that connects your computer to a standard telephone jack. The modem converts the **digital**, or stop-start, **signals** your computer outputs into **analog**, or continuous wave, **signals** (sound waves) that can traverse ordinary phone lines. Figure A-21 shows the telecommunications process, in which a modem converts digital signals to analog signals at the sending site (modulates) and a second modem converts the analog signals back into digital signals at the receiving site (demodulates). Most computers today come with a built-in 56 K modem and/or NIC (network interface card). 56 K represents the modem's capability to send and receive about 56,000 **bits per second** (bps). Actual speed may be reduced by factors such as distance, technical interference, and other issues. People who want to use a high-speed connection either over phone lines, such as a **DSL (digital subscriber line)**, or over a cable connection, usually need to purchase an external DSL or cable modem separately.
Learning about Security Threats

**Security** refers to the steps a computer owner takes to prevent unauthorized use of or damage to the computer. Once a computer is connected to a network, it is essential that the computer be protected against possible threats from people intent on stealing information or causing malicious damage.

Kevin explains how important it is to be vigilant about keeping the office computers secure and reviews ways to do this.

Several types of security threats are discussed below:

- **Malware** is a broad term that describes any program that is intended to cause harm or convey information to others without the owner's permission.
  
  Unscrupulous programmers deliberately construct harmful programs, called viruses, which instruct your computer to perform destructive activities, such as erasing a disk drive. Some viruses are more annoying than destructive, but some can be harmful, erasing data or causing your hard disk to require reformating. **Antivirus software**, sometimes referred to as **virus protection software**, searches executable files for sequences of characters that may cause harm and disinfects the files by erasing or disabling those commands. Figure A-22 shows the screen that appears after AVG Anti-Virus Free Edition finished scanning a computer.
  
  Some software programs contain other programs called spyware that track a computer user's Internet usage and send this data back to the company or person that created it. Most often, this is done without the computer user's permission or knowledge. **Anti-spyware software** can detect these programs and delete them.

- A firewall is like a locked door on a computer. It prevents other computers on the Internet from accessing a computer and prevents programs on a computer from accessing the Internet without the computer user's permission. A firewall can be hardware, software, or a combination of both.
  
  A hardware firewall provides strong protection against incoming threats. A router, a device that controls traffic between network components, usually has a built-in firewall.
  
  Software firewalls track all incoming and outgoing traffic. If a program that never accessed the Internet before attempts to do so, the user is notified and can choose to forbid access. There are several free software firewall packages available. Figure A-23 shows an alert from Zone Alarm, a software firewall.

- Criminals are getting more aggressive as they try to figure out new ways to access computer users' personal information and passwords.
  
  A Web site set up to look exactly like another Web site, such as a bank's Web site, but which does not actually belong to the organization portrayed in the site, is a spoofed site. The site developer creates a URL (address on the Web) that looks similar to a URL from the legitimate site. Usually, spoofed sites are set up to try to convince customers of the real site to enter personal information, such as credit card numbers, Social Security numbers, and passwords, so that the thief collecting the information can use it to steal the customer's money or identity.
  
  Phishing refers to the practice of sending e-mails to customers or potential customers of a legitimate Web site asking them to click a link in the e-mail. The link leads to a spoofed site where the user is asked to verify or enter personal information.
  
  Sometimes a criminal can break into a DNS server (a computer responsible for directing Internet traffic) and redirect any attempts to access a particular Web site to the criminal's spoofed site. This is called pharming.
Protecting information with passwords

You can protect data on your computer by using passwords. You can set up accounts on your computer for multiple users and require that all users sign in with a user name and password before they can use the computer. This is known as logging in. You can also protect individual files on your computer so that people who try to open or alter a file need to type the password before they are allowed access to the file. Many Web sites require a user name and password in order to access the information stored on it. To prevent anyone from guessing your password, you should always create and use strong passwords. A strong password is at least eight characters of uppercase and lowercase letters and numbers. Avoid using common personal information, such as birthdays and addresses.
Understanding System Software

Sometimes the term software refers to a single program, but often the term refers to a collection of programs and data that are packaged together. **System software** helps the computer carry out its basic operating tasks. Before Kevin describes the various types of software that people use to accomplish things like writing memos, he needs to describe system software.

The components of system software are described below:

- System software manages the fundamental operations of your computer, such as loading programs and data into memory, executing programs, saving data to disks, displaying information on the monitor, and transmitting data through a port to a peripheral device. There are four types of system software: operating systems, utilities, device drivers, and programming languages.

- An **operating system** allocates system resources, manages storage space, maintains security, detects equipment failure, and controls basic input and output. **Input and output**, or I/O, is the flow of data from the microprocessor to memory to peripherals and back again.
  - The operating system allocates system resources so programs run properly. A **system resource** is any part of the computer system, including memory, storage devices, and the microprocessor, that can be used by a computer program.
  - The operating system is also responsible for managing the files on your storage devices. Not only does it open and save files, but it also keeps track of every part of every file for you and lets you know if any part is missing.
  - While you are working on the computer, the operating system is constantly guarding against equipment failure. Each electronic circuit is checked periodically, and the moment a problem is detected, the user is notified with a warning message on the screen.
  - Microsoft Windows, used on many personal computers, and the Mac OS, used exclusively on Macintosh computers, are referred to as **operating environments** because they provide a graphical user interface (GUI, pronounced “goo-ey”) that acts as a liaison between the user and all of the computer’s hardware and software. Figure A-24 shows the starting screen on a Mac using Leopard (Mac OS X v10.5.6).

- **Utilities** are another category of system software that augment the operating system by taking over some of its responsibility for allocating hardware resources.

- **As you learned earlier in the discussion of ports, device drivers handle the transmission protocol between a computer and its peripherals. When you add a device to an existing computer, part of its installation includes adding its device driver to the computer’s configuration.**

- **Computer programming languages**, which a programmer uses to write computer instructions, are also part of the system software. The instructions are translated into electrical signals that the computer can manipulate and process.
Figure H-24: Mac OS X Leopard starting screen

Menu bar

Icon (you might see additional icons on your screen)

Dock
Understanding Application Software

Application software enables you to perform specific computer tasks. Some examples of tasks that are accomplished with application software are document production, spreadsheet calculations, database management, and giving presentations. Now that the Sheehan Tours staff understands operating systems, Kevin describes some common application software.

Typical application software includes the following:

- **Document production software** includes word processing software, desktop publishing software, e-mail editors, and Web authoring software. All of these production tools have a variety of features that assist you in writing and formatting documents, including changing the font (the style of type). Most offer spell checking to help you avoid typographical and spelling errors, as shown in Figure A-25.

- **Spreadsheet software** is a numerical analysis tool. Spreadsheet software creates a worksheet, composed of a grid of columns and rows. You can type data into the cells, and then enter mathematical formulas into other cells that reference the data. Figure A-26 shows a typical worksheet that includes a simple calculation and the data in the spreadsheet represented as a simple graph.

- **Database management software** lets you collect and manage data. A database is a collection of information stored on one or more computers organized in a uniform format of records and fields. A record is a collection of data items in a database. A field is one piece of information in the record. An example of a database is the online catalog of books at a library; the catalog contains one record for each book in the library, and each record contains fields that identify the title, the author, and the subjects under which the book can be classified.

- **Graphics and presentation software** allow you to create illustrations, diagrams, graphs, and charts that can be projected before a group, printed out for quick reference, or transmitted to remote computers. You can also use clip art, simple drawings that are included as collections with many software packages.

- **Photo editing software** allows you to manipulate digital photos. You can make the images brighter, add special effects to the photo, add additional images to a photo, or crop the photo to include only relevant parts of the image.

- **Multimedia authoring software** allows you to record digital sound files, video files, and animations that can be included in presentations and other documents.

- **Information management software** keeps track of schedules, appointments, contacts, and “to-do” lists. Most e-mail software allows users to add all the information about contacts to the list of e-mail addresses. In addition, some software, such as Microsoft Entourage, combines a contact list with information management components, such as a calendar and to-do list. The main screen of Microsoft Entourage is shown in Figure A-27.

- **Web site creation and management software** allows you to create and manage Web sites. They allow you to see what the Web pages will look like as you create them.

Understanding object linking and embedding (OLE)

Many programs allow users to use data created in one application in a document created by another application. **Object linking and embedding (OLE)** refers to the ability to use data from another file, called the source. Embedding occurs when you copy and paste the source data in the new file. **Linking** allows you to create a connection between the source data and the copy in the new file. The link updates the copy every time a change is made to the source data. The seamless nature of OLE among some applications is referred to as integration.
Natural Pest Control

Your garden produces bushels of tender green beans, tons of succulent tomatoes, acorns of juicy strawberries, and plenty of peas. What do you do when the cut worms begin munching on those beans?

Figure 8-25: Spell checking a document

A wiggly red line indicates a possible spelling error.

Figure 8-26: Typical worksheet with numerical data and a chart

Cell B5 contains the result of a calculation performed by spreadsheet software.

Figure 8-27: Information management software

Understanding Essential Computer Concepts
Label each component of the desktop personal computer shown in Figure A-28.

1. Which component do you use to point to items on the screen?
2. Which component displays output?
3. Which component is used to enter text?
4. Which component processes data?
5. Which component transmits audio output?
Match each term with the statement that best describes it.

6. configuration  
   a. Software that allocates resources, manages storage space, maintains security, and controls I/O

7. byte  
   b. The style of type

8. RAM  
   c. The design and construction of a computer

9. hard disk  
   d. Magnetic storage media that is usually sealed in a case inside the computer

10. expansion slot  
    e. A computer on a network that acts as the central storage location for programs and data used on the network

11. server  
    f. A program that tracks a user's Internet usage without the user's permission

12. spyware  
    g. A slot on the motherboard into which a controller card for a peripheral device is inserted

13. operating system  
    h. Temporarily holds data and programs while the computer is on

14. font

\[ \text{SKILLS REVIEW} \]

Select the best answer from the list of choices.

15. Which one of the following would not be considered a personal computer?
   a. Desktop  
   b. Notebook  
   c. Mainframe  
   d. Tablet PC

16. The intangible components of a computer system, including the programs, are called _________.
   a. software  
   b. hardware  
   c. price  
   d. peripherals

17. What part of the computer is responsible for executing instructions to process information?
   a. Card  
   b. Processor  
   c. Motherboard  
   d. Peripheral device

18. What are the technical details about each hardware component called?
   a. Configuration  
   b. Circuits  
   c. Specifications  
   d. Cards

19. Keyboards, monitors, and printers are all examples of which of the following?
   a. Input devices  
   b. Output devices  
   c. Software  
   d. Peripheral devices

20. Which of the following is a pointing device that allows you to control the pointer by moving the entire device around on a desk?
   a. Mouse  
   b. Trackball  
   c. Trackpad  
   d. Pointing stick
21. In order to display graphics, a computer needs a monitor and a _________.
   a. parallel port
   b. network card
   c. graphics card
   d. sound card

22. What do you call each 1 or 0 used in the representation of computer data?
   a. A bit
   b. A byte
   c. An ASCII
   d. A pixel

23. Another way to refer to 1024 bytes is a _________.
   a. byte
   b. kilobyte
   c. megabyte
   d. binary

24. Which of the following is a chip installed on the motherboard that is activated during the boot process and identifies where essential software is stored?
   a. RAM
   b. CMOS
   c. CPU cache
   d. ROM

25. Which of the following is space on the computer's storage devices that simulates additional RAM?
   a. Cache memory
   b. Virtual memory
   c. Read-only memory
   d. Volatile memory

26. Which of the following permanently stores the set of instructions that the computer uses to activate the software that controls the processing function when you turn the computer on?
   a. RAM
   b. CMOS
   c. CPU cache
   d. ROM

27. Which of the following storage media is not a magnetic storage device?
   a. Hard disk
   b. Floppy disk
   c. DVD
   d. Tape

28. The transmission protocol between a computer and its peripheral devices is handled by a _________.
   a. channel
   b. data bus
   c. driver
   d. controller card

29. Which of the following is the data path between the microprocessor, RAM, and the peripherals?
   a. Data bus
   b. Data channel
   c. Data port
   d. Cable
SKILLS REVIEW (CONTINUED)

30. The computer that originates a message to send to another computer is called the ________.
   a. channel
   b. sender
   c. receiver
   d. driver

31. A personal computer that is connected to a network is called a ________.
   a. desktop
   b. workstation
   c. terminal
   d. PDA

32. Which of the following acts as a locked door on a computer?
   a. Antivirus software
   b. Firewall
   c. DNS server
   d. Spyware

33. A ________ consists of connected computers and peripheral devices that are located relatively close to each other.
   a. LAN
   b. WAN
   c. WLAN
   d. PAN

34. The term that describes networks connected using a standard radio frequency established by the IEEE is ________.
   a. WiMAX
   b. WAN
   c. WLAN
   d. Wi-Fi

35. A Web site set up to look exactly like another Web site, such as a bank's Web site, but which does not actually belong to the organization portrayed in the site, is a ________ site.
   a. malware
   b. phished
   c. spoofed
   d. served

INDEPENDENT CHALLENGE 1

This Independent Challenge requires an Internet connection. In order to run the newest software, many people need to upgrade their existing computer system or buy a brand new one. What do you do with your old computer when you purchase a new one? Most municipalities have enacted laws regulating the disposal of electronics. Research these laws in your city and state and write a brief report describing them.

a. Start your browser, go to your favorite search engine, then search for information about laws regarding the disposal of electronics in your city and state. Try finding your city's Web site and searching it for the information, or use electronics disposal laws followed by your city name as a search term and then repeat that search with your state's name in place of your city's name.

b. Open each Web site that you find in a separate tab or browser window.

c. Read the information on each Web site. Can some components be thrown away? Are there laws that apply only to monitors?
INDEPENDENT CHALLENGE 1 (CONTINUED)

Advanced Challenge Exercise

- Search for organizations to which you can donate your computer.
- How do these organizations promise to protect your privacy?
- Can you take a deduction on your federal income tax for your donation?

- Write a short report describing your findings. Include the URLs for all relevant Web sites. (Hint: If you are using a word processor to write your report, you can copy the URLs from your browser and paste them into the document. Drag to select the entire URL in the Address or Location bar in your browser. Right-click the selected text, then click Copy on the shortcut menu. Position the insertion point in the document where you want the URL to appear, then press [Ctrl][V].)

INDEPENDENT CHALLENGE 2

This Independent Challenge requires an Internet connection. New viruses are discovered on an almost daily basis. If you surf the Internet or exchange e-mail, it is important to use updated anti-virus software. Research the most current virus threats and create a table listing the threats and details about them.

- Start your browser, go to Symantec's Web site at www.symantec.com, click the Viruses & Risks link, then click the link to Threat Explorer. (If you don’t see that link, type threat explorer in the Search box on the page, then click appropriate links to get to the Threat Explorer page.) On the Threat Explorer page, click the Latest tab if necessary.
- Click links to the first five latest threats.
- Open a new word processing document and create a table listing each virus threat, a description of what each virus does, how widely it is distributed (the Wild value), and how damaging it is (the Damage Level value).
- In your browser, go to the Security Advisor on CA’s Web site at www3.ca.com/securityadvisor, and then click the Virus Information Center link. If any of the first five latest virus threats are different from the ones on the Symantec site, add them to your table. (Hint: After you click a virus name, check the “Also known as” list.)
- For any viruses that are already in your table because they were on the Symantec site, read the CA description to see if there is any additional information describing how the virus could damage your system. Add this information to your table.
- Save the word processing document as Latest Threats to the drive and folder where you store your Data Files.

INDEPENDENT CHALLENGE 3

This Independent Challenge requires an Internet connection. One of the keyboards shown in this unit is an ergonomic keyboard. Ergonomics is the study of the design of a workspace so that the worker can work efficiently and avoid injury. The U.S. Occupational Safety and Health Administration (OSHA) has developed guidelines that describe a healthy computer work environment. Research these guidelines and evaluate your workspace.

- Start your browser, and then go to www.osha.gov/SLTC/etools/computerworkstations/index.html.
- Read the information on the main page. Follow links to descriptions of the best arrangement for equipment you use when working on a computer. (Hint: Look for the Workstation Components link, and point to it to open a submenu of links.)
- Locate and print the checklist for evaluating your workspace. (Hint: Click the Checklist link, then click the View/Print the Evaluation Checklist PDF link. A new tab or window opens and the checklist opens in Adobe Acrobat Reader, a program that displays PDF files. If a dialog box opens telling you that you need to install Acrobat Reader to continue, ask your instructor or technical support person for help.)
- Using the checklist, evaluate each of the conditions listed. If a condition does not apply to you, write N/A (not applicable) in the Yes column.
Advanced Challenge Exercise

- Use the OSHA Web site or a search engine to research repetitive motion injuries to which computer users are susceptible.
- Evaluate your risk for at least three common injuries.
- On the OSHA checklist, note what injury or injuries each applicable item or behavior will help prevent.

REAL LIFE INDEPENDENT CHALLENGE

You are buying a new Mac for home use, but you're having trouble deciding between a desktop or a notebook. You know that the computer you buy will need to run Leopard and Office 2008 for Mac and have enough hard disk space for all your files, and you want to make sure you are protected against security threats. You'll also need a printer.

- To help you make a decision and organize the information to make it easy to compare, create the table shown in Figure A-29.

**FIGURE A-29**

<table>
<thead>
<tr>
<th>Name: Your Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your Requirements</td>
</tr>
<tr>
<td>Hardware:</td>
</tr>
<tr>
<td>Processor (brand and speed)</td>
</tr>
<tr>
<td>RAM (amount)</td>
</tr>
<tr>
<td>Video RAM (amount)</td>
</tr>
<tr>
<td>Hard disk (size)</td>
</tr>
<tr>
<td>Printer (type and speed)</td>
</tr>
<tr>
<td>External speakers</td>
</tr>
<tr>
<td>Maintenance Plan:</td>
</tr>
<tr>
<td>Software:</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Total Price:</td>
</tr>
</tbody>
</table>

Information Source(s):

- [Information Source(s)](https://www.apple.com)

b. You'll need to determine which edition of Office 2008 you should get (Standard Edition, Home and Student Edition, or Special Media Edition). Use the Internet to research the different editions to determine which one will best suit your needs. Enter the cost for the edition in the appropriate cells in the table.

c. Research the hardware requirements for running the edition of Office 2008 that you selected. Enter the technical specifications required in the appropriate cells in the table.

d. Research the cost of a new iMac that has Mac OS X Leopard as its operating system and that meets the system requirements needed to run Office 2008. Next, research the cost of a new MacBook or MacBook Pro with the same or similar configuration. To begin, visit [www.apple.com](https://www.apple.com) to review the technical information to ensure that you are comparing models with similar hardware characteristics. Enter the starting costs for each model in the appropriate cells in the table. (Hint: The Apple store at [www.apple.com](https://www.apple.com) can help you configure your computer and provide you with the cost of the Apple Care maintenance plan.)
REAL LIFE INDEPENDENT CHALLENGE (CONTINUED)

e. Search the Web to find an inexpensive inkjet printer that will work with your Mac. Enter the cost in the appropriate cells in the table.

f. Search the Web to find external speakers that will work with your Mac. Enter the cost in the appropriate cells in the table.

g. Search the Web to find antivirus software for your Mac. Enter the cost in the appropriate cells in the table.

h. Review the items to make sure you have entered information in all the rows. Total the costs you entered in the table for the various items.

i. Based on the information you found, determine whether the better purchase would be the notebook (MacBook or MacBook Pro) or the iMac. Write a brief summary justifying your decision.

j. Submit the completed table and your summary to your instructor.