LESSON 4

Computer Maintenance

■ OBJECTIVES

Upon completion of this lesson, you should be able to:

- Identify maintenance issues.
- Maintain hardware.
- Upgrade and replace hardware components.
- Perform preventive maintenance.
- Request specialized maintenance.

■ DATA FILES

You do not need data files to complete this lesson.

■ WORDS TO KNOW

cable management

cookie

corona wires

defragmentation

ergonomic keyboard

fragmentation

maintenance

Recycle Bin

sector

seek time

touchpad

wireless keyboard

This lesson explores the importance of computer maintenance, the risks of using a computer if the equipment is not properly maintained, and the measures that can be taken to minimize those risks. The type of maintenance needed determines whether the work should be performed by a computer user or someone with expert knowledge.

Identifying Maintenance Issues

Consider the following: To properly maintain a car and have it run smoothly, you change the oil and filter, check the tire pressure, and complete other required maintenance on a regular schedule. A computer is no different; it also requires regular *maintenance*. Sooner or later, you will begin to experience problems with the hardware. For instance, after an extended period of use, the performance of a hard disk can slow or printer problems can occur. The keyboard and the mouse can become sluggish, and the monitor may not work properly. This could be the result of loose or incorrect cables, poor power connections, or other more severe problems.

Managing computer cables is an overlooked problem when maintaining a computer system. Damaged and poorly maintained cables can prevent peripheral devices from communicating with the computer. Unorganized and unprotected cables also can create safety hazards (see **Figure 4–1**).
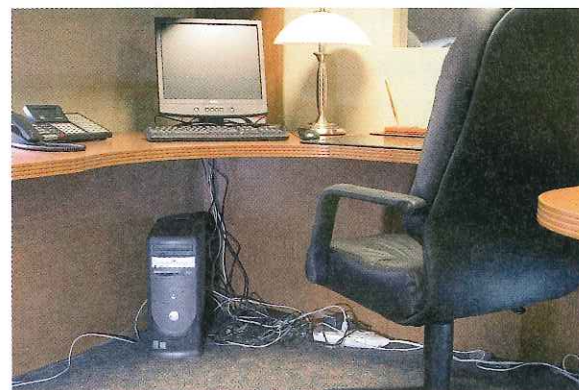
> **VOCABULARY**
>
> **maintenance**
>
> **cable management**

Courtesy of Cable-Safe LLC

FIGURE 4–1   Unprotected cables are a safety hazard

Cable management kits and individual cable management products are available online and through most stores that sell computer equipment (see **Figure 4–2**). You use these kits to organize cables and bundle them together.

Courtesy of Cable-Safe LLC

FIGURE 4–2   Managing cables

Maintaining Hardware

One of the best ways to cut down on computer repair is through preventive maintenance performed on a regular schedule. As a general rule, you should clean a computer every three to six months. If it is in a dusty environment, however, you should clean it more often. This section provides guidelines that you easily can put into practice.

Keyboard and Mouse

You should check and clean the keyboard periodically. Dirt, dust, hair, and food particles can accumulate, causing the keys to jam or otherwise malfunction. Many people clean the keyboard by turning it upside down and shaking it. A more effective method, however, is to use compressed air. Every six months, use a can of compressed air to remove the dust from the keyboard (see **Figure 4–3**).

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FIGURE 4–3   Cleaning a keyboard

If you spill a liquid on the keyboard, turn off the computer immediately. Disconnect the keyboard, spray it with water to clean it, turn it upside down and shake to remove the liquid, and then use a cloth to dry it as much as possible. After it is cleaned, leave it upside down and don't reconnect it until after at least 12 hours.

A mouse with a ball (which is a mechanical mouse) can be difficult to move if the rollers are clogged. Cleaning mechanical mice often eliminates jerky or erratic movement of the mouse pointer. To clean the rollers, you need to remove the cover of the mouse (see **Figure 4–4a**). Next, remove the ball (see **Figure 4–4b**) to access the rollers. Generally, you will find dirt or hair in the middle of the roller. Remove as much of this debris as possible (see **Figure 4–4c**), clean the ball, and then remove any other debris from the mouse. Finally, reassemble the mouse.

(a)   (b)   (c)

(a) © TimArbaev / iStockphoto; (b) and (c) Source: "Got Fear?," by G.D. Warner, at http://www.cheapandsleazy.net/gotfear.html, copyright G.D. Warner, 2005 - 2011; used with permission

FIGURE 4–4   (a) Removing the cover of a mouse (b) Removing the mouse ball (c) Cleaning debris

Cleaning a printer helps prolong the printer's life. The first step is to check the printer documentation. If this is unavailable, most likely you can find information online. Clean only the parts recommended. Recall that the two more popular types of printers are inkjet and laser. The following general instructions apply to both types of printers:

- Use a cleaner recommended by the manufacturer or a lint-free cloth, and then moisten it with a 50-50 percent solution of water and vinegar. Wring out all excess moisture and thoroughly clean the outside of the printer, making sure that no fluid gets inside the printer.

- Never spray an aerosol directly onto the printer.

- Although not necessary, consider wearing latex gloves to protect your hands from dirt and other debris.

Inkjet Printers

After much usage, small deposits of dry ink accumulate on the print head of an inkjet printer. Eventually, these deposits begin to clog the printer's ink jets and affect the print quality of the document. This also causes streaks and blotchy printing.

Many inkjet printers have a self-cleaning mode that you access through the printer's control panel. If this is not available, use an inkjet cleaning cartridge. This flushes dirt and debris out of clogged printer nozzles. Verify that the cleaning cartridge is approved for your printer.

Dust and ink from inexpensive paper can affect the printer's rollers. Before cleaning inside an inkjet printer, turn it off and unplug it. Let it cool down if necessary. Use a small vacuum to remove the debris.

You can use special cleaning supplies to clean an inkjet printer. Check the printer documentation to verify the correct cleaning supplies your printer needs (see **Figure 4–5**).

> **⚠ WARNING**
>
> Most printer manufacturers recommend against using compressed air because the propellant may add moisture to the inside of the printer.

Courtesy of HK Wentworth Limited

FIGURE 4–5   Cleaning supplies for an inkjet printer

Laser Printers

Laser printers should be cleaned when print quality deteriorates or when you change the toner cartridge, which you need to do when the print becomes faint. When you open a laser printer, do not touch anything shiny because it might be hot or contain a charge. To clean the printer, perform the following maintenance tasks:

- Use a printer brush or a good paint brush and a lint-free cloth to clean inside the toner opening.
- Remove paper fragments.
- Use a clean cloth to wipe up any spilled toner and dust.
- Clean the rollers, but don't touch the transfer (sponge) roller.
- Replace the toner cartridge (see **Figure 4–6**).

FIGURE 4–6   Maintaining a laser printer

Some laser printers contain exposed *corona wires*. These wires are used to generate a field of positive charges on the surface of the drum and the paper. You should not brush or vacuum these wires.

WARNING

Exposure to light can damage toner cartridges. After removing a cartridge, always cover it with an extra lint-free cloth or piece of paper.

▶ **VOCABULARY**
corona wire

Upgrading and Replacing Hardware Components

At some point, hardware components may be damaged and need to be changed, or output and production needs to be increased. You can make your computer more productive by upgrading various hardware elements. For instance, adding computer memory is often the best value for increasing overall computer performance. Replacing the keyboard and the mouse also can enhance computer performance. The following section describes upgrade options that you can implement.

Computer Memory

One way to measure a computer's power is by its memory capacity. RAM is made up of small memory chips that form a memory module. These modules are installed in the RAM slots on the motherboard of your computer (see **Figure 4–7**).
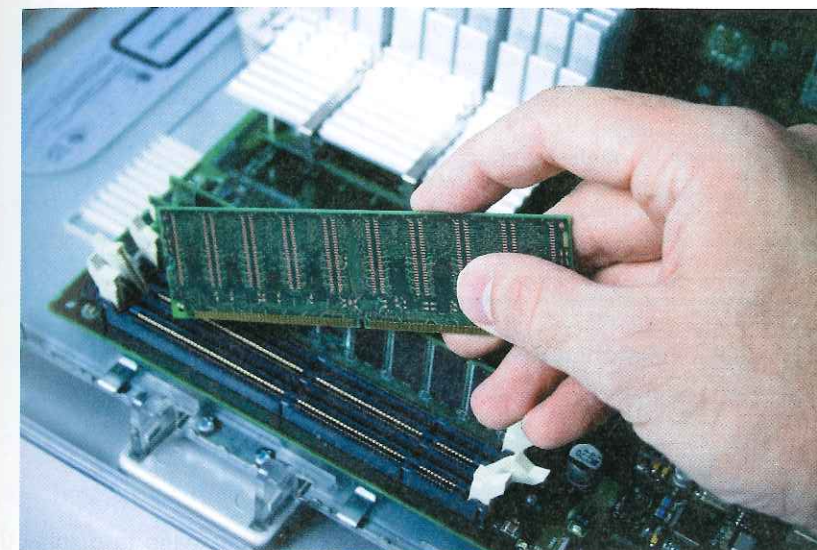
FIGURE 4–7   RAM chips on the motherboard

The hard drive can be compared to long-term memory and RAM to short-term memory. Recall that data stored in RAM is temporary. When the computer is processing data, it reads and writes to RAM. If RAM fills up, the processor continually uses the hard drive to replace old data in RAM with new data. Because hard drive access is considerably slower than RAM, you may notice a processing slowdown when a computer's RAM is overloaded. Congested RAM even can affect the speed of the monitor when the disk operates continuously, writing and copying RAM data out to the disk.

Adding RAM to a computer generally helps increase performance, speed, and usability. However, every system has a maximum amount of RAM that it can support. Check the computer's documentation, or verify with a professional technician prior to purchasing additional memory. Complete the following Step-by-Step exercise to explore the amount of RAM contained in your computer.
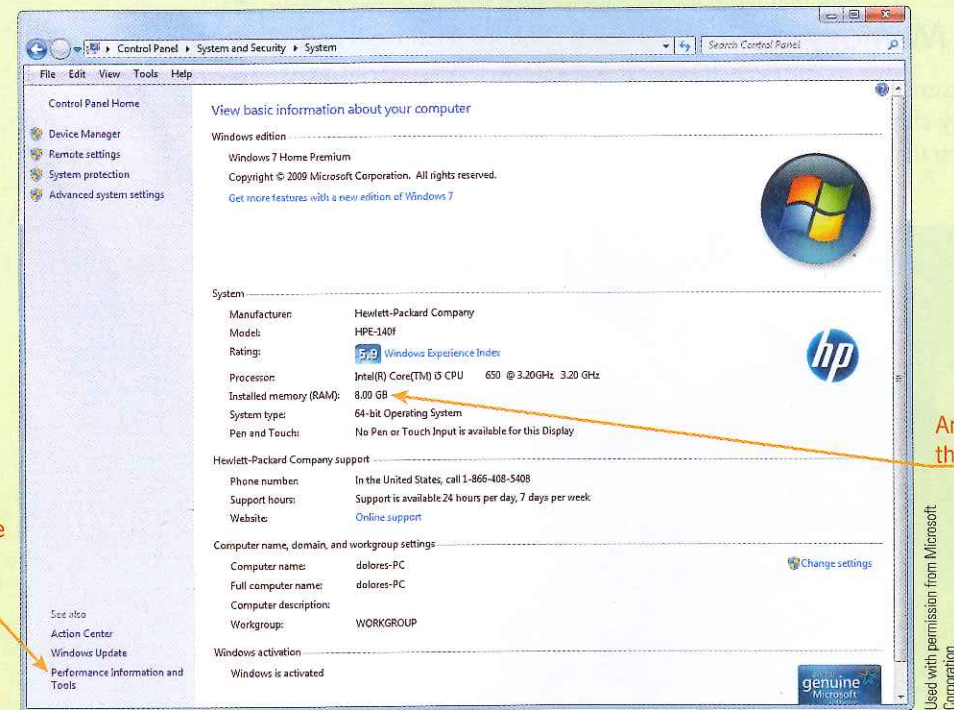
Step-by-Step 4.1

1. Click the **Start** button 🔵 on the taskbar, and then click **Computer**. The Computer window opens.

2. Click the **System properties** button on the toolbar to display the System window, shown in **Figure 4–8**. Note the amount of RAM on your computer, which should be listed after "Installed memory (RAM)".

FIGURE 4–8
System window

Performance Information and Tools

Amount of RAM on this computer

3. Click **Performance Information and Tools** in the left pane to display the Rate and improve your computer's performance page, shown in **Figure 4–9**. Read the information contained on this page. Write down your computer's base score.

FIGURE 4–9
Rate and improve your computer's performance
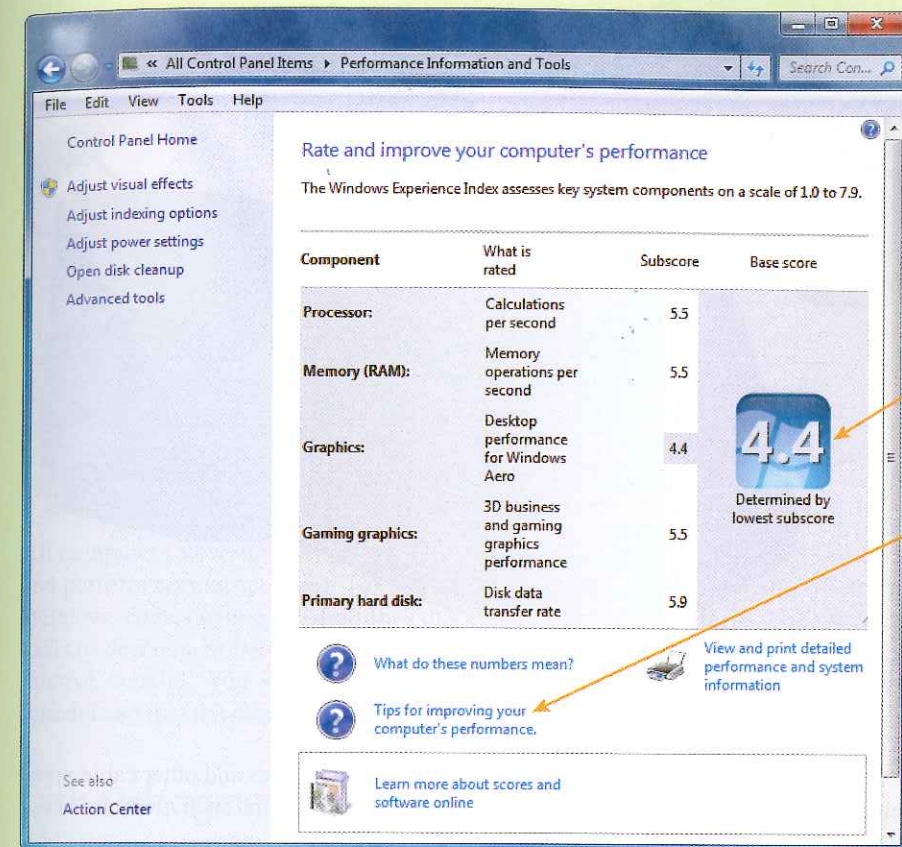
Computer's base score

Tips for improving your computer's performance link

4. Click the **Tips for improving your computer's performance** link. Read the information contained in the Windows Help and Support window.

5. List the tasks that you think can help improve your computer's performance.

6. Close all open windows, and then submit your assignment to your instructor.

Keyboards

If a keyboard is no longer working properly even after routine maintenance, you can replace it without replacing any other hardware components. You also might want to replace a keyboard to take advantage of enhanced features. Choosing a keyboard is complicated by the vast range of choices. The person who will use the keyboard should be the one to select it. Design, performance, and comfort should be considered.

FIGURE 4–12   (a) External touchpad (b) Touchpad built into keyboard

> VOCABULARY
> ergonomic keyboard
> wireless keyboard
> touchpad

Ergonomic keyboards allow for a more natural positioning of your arms and hands. Many ergonomic keyboards have a smaller width, which keeps the mouse closer to you. This reduces your reach and places the mouse in a more accessible position. The ergonomic keyboard shown in **Figure 4–10** also includes a touchpad, which you can use as a pointing device.

FIGURE 4–10   Ergonomic keyboard

A *wireless keyboard* reduces the clutter of unsightly wires and other cable problems and improves mobility. If necessary, you can move around with a wireless keyboard and not be bound to the desk.

Mouse

As with a keyboard, you can replace a mouse without replacing any other computer hardware. Recall from Lesson 2 that a variety of pointing devices are available, including wireless and optical. Some are ergonomic devices such as the one in **Figure 4–11**, which is a wireless ergonomic mouse.

FIGURE 4–11   Wireless ergonomic mouse

A *touchpad* is a pointing device you can use instead of a mouse. These devices sense the position of your finger and then move the pointer accordingly. Most notebook computers contain built-in touchpads, which cannot be replaced or upgraded without replacing the entire computer. However, you can use an external touchpad as an alternative (see **Figure 4–12**).
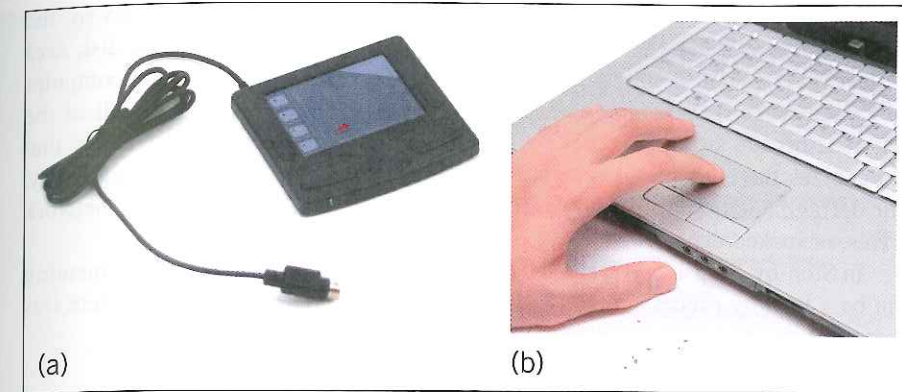
Performing Preventive Maintenance

All computers slow down as you add and delete files, install and uninstall software, and perform normal activities. To eliminate and minimize these problems, Microsoft Windows comes with a set of utilities that perform maintenance tasks. You use these tools to defragment hard drives, empty the Recycle Bin, delete temporary files, and remove cookies. You should run these utilities following a routine maintenance schedule so that the computer can run faster and more efficiently.

Disk Defragmentation

As you use a computer, you add and delete files on the computer's hard disk. When the computer is new (or contains a new hard drive), the operating system, such as Windows 7, writes the file data in a set of side-by-side clusters. As the drive begins to become cluttered and space becomes limited, Windows divides the data for newly created files into sectors. Disk *fragmentation* occurs when data is broken up into many pieces that are not stored close together. The *sectors* are stored in blocks of nonadjacent clusters, thus creating fragmented files (see **Figure 4–13**). This pattern continues until you begin deleting files and adding new ones.
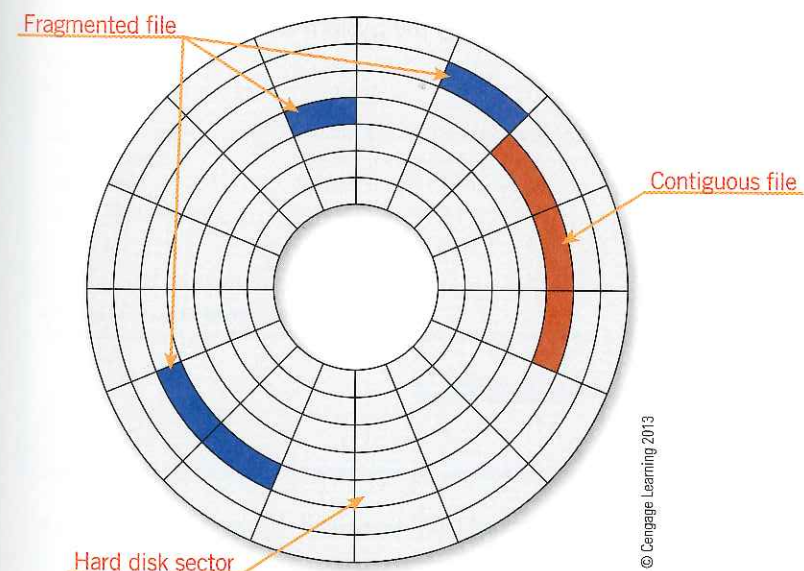
> VOCABULARY
> fragmentation
> sector

FIGURE 4–13   Fragmented file

▶ **VOCABULARY**

seek time

defragmentation

The computer reads the fragmented file as a single valid file. To do so, the read-write head has to scan multiple parts of the drive which extends disk *seek time.* This can significantly slow the speed of the processing cycle and computer performance. Disk *defragmentation* organizes fragmented files so that all of the file's sectors are stored together. Windows contains a defragmentation utility that reorganizes the contents of the disk to store the pieces of each file contiguously. The defragmentation utility, however, does not work with read-only disks, network drives, or locked drives.

In Step-by-Step 4.2, you run the defragmentation utility. (*Note:* Defragmenting can be a lengthy process. Verify with your instructor if you should complete this exercise.)
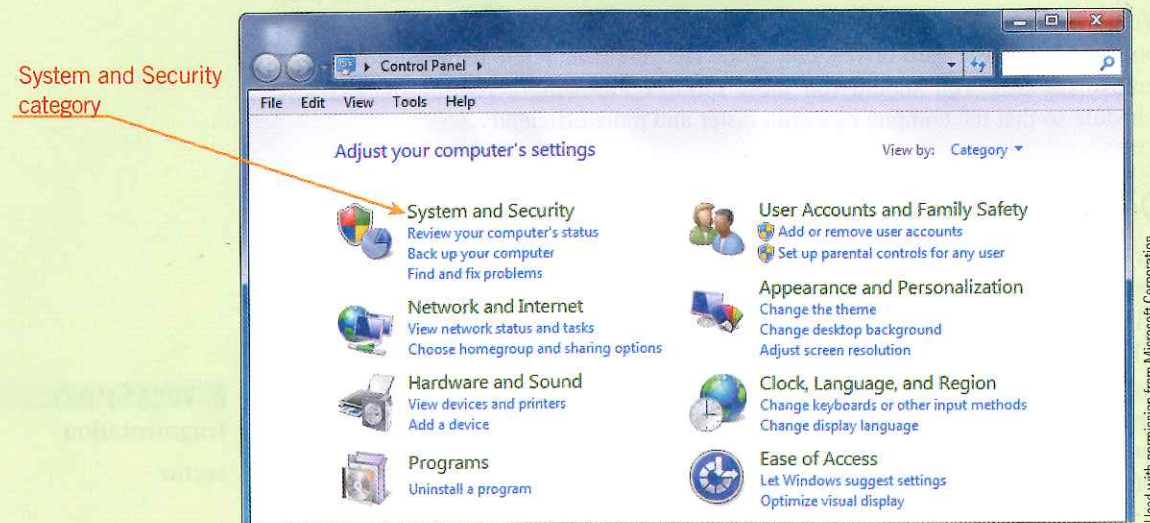
Step-by-Step 4.2

1. Click the **Start** button 🪟 on the taskbar, and then click **Control Panel** to display the Control Panel window (see **Figure 4–14**).

FIGURE 4–14
Control Panel

System and Security category

2. Click **System and Security** to display the System and Security window (see **Figure 4–15**).

FIGURE 4–15
System and Security window

Administrative Tools

Defragment your hard drive
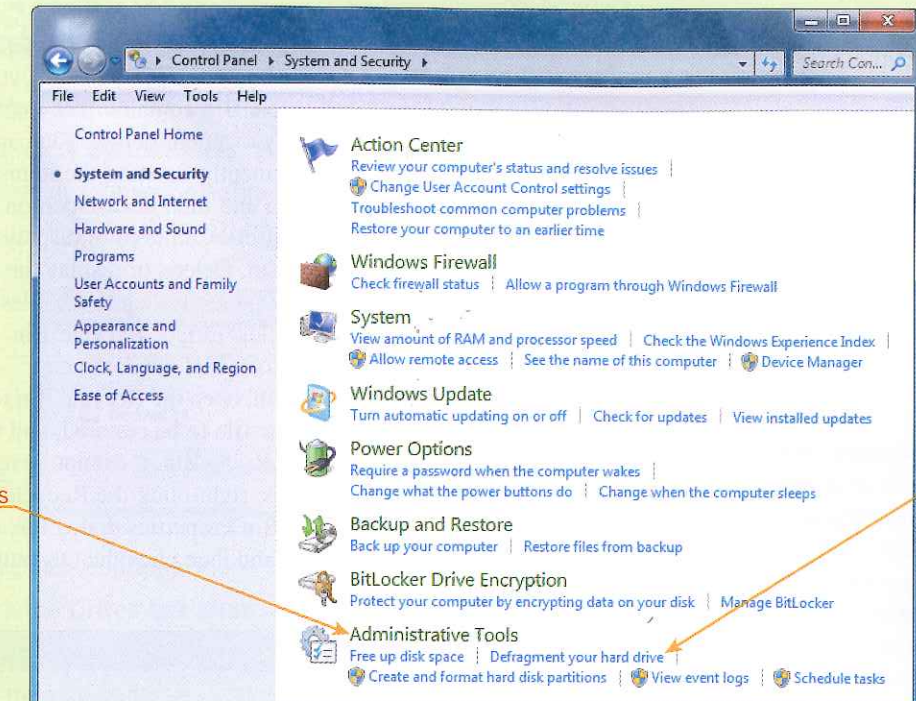
3. Scroll down, if necessary, to Administrative Tools, and then click **Defragment your hard drive** to display the Disk Defragmenter dialog box (see **Figure 4–16**). (If a User Account Control dialog box is displayed, click **Continue**.)
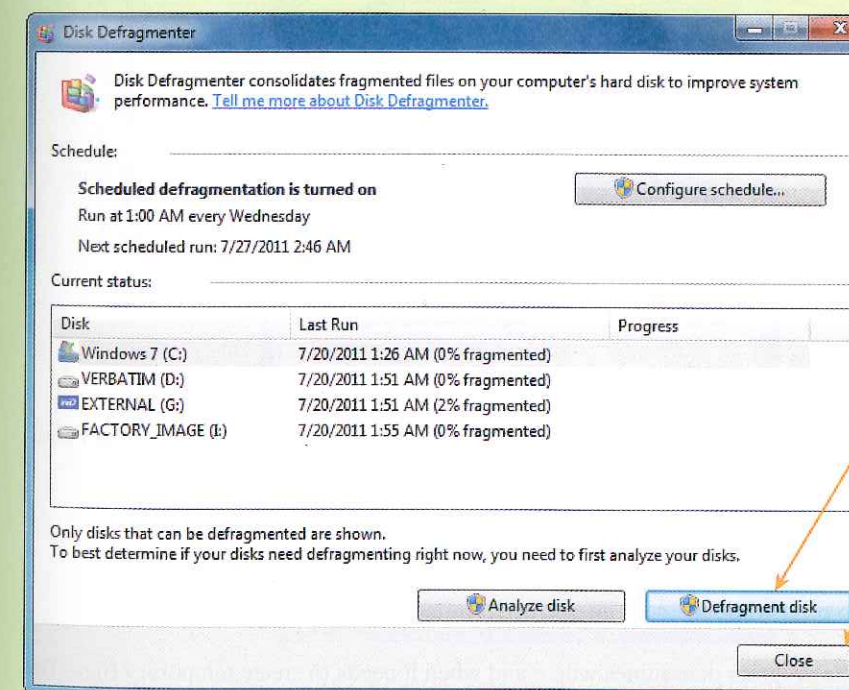

FIGURE 4–16
Disk Defragmenter dialog box

Defragment disk button

Close button

4. If indicated by your instructor, click the **Defragment disk** button. Otherwise, click the **Close** button.

5. Close any other open window.

Recycle Bin

The Windows *Recycle Bin* is a holding area for files and folders before their final deletion from a storage device. Generally, you access the Recycle Bin through an icon located on the desktop. The Recycle Bin contains files that have been deleted from the hard disk, whether accidentally or intentionally. You can open the Recycle Bin to review its contents before permanently deleting the items. Double-click the Recycle Bin icon or right-click the icon and then click Open on the shortcut menu to view the Recycle Bin contents. Right-click an item to display its shortcut menu, which includes commands to Restore, Cut, Delete, or display the item's Properties.

To empty the Recycle Bin and permanently delete the files it contains, right-click the Recycle Bin icon and then click Empty Recycle Bin. A warning box is displayed. Click Yes to continue or No to cancel the command.

To restore a file from the Recycle Bin, open the Recycle Bin to display the list of deleted files. Right-click the name of the file to be restored, and then click Restore. Once a file has been deleted from the Recycle Bin, it cannot be restored.

To modify the Recycle Bin settings, right-click the Recycle Bin icon and then click Properties to display the Recycle Bin Properties dialog box (see **Figure 4–17**). Select the settings that you want to use and then click the OK button.
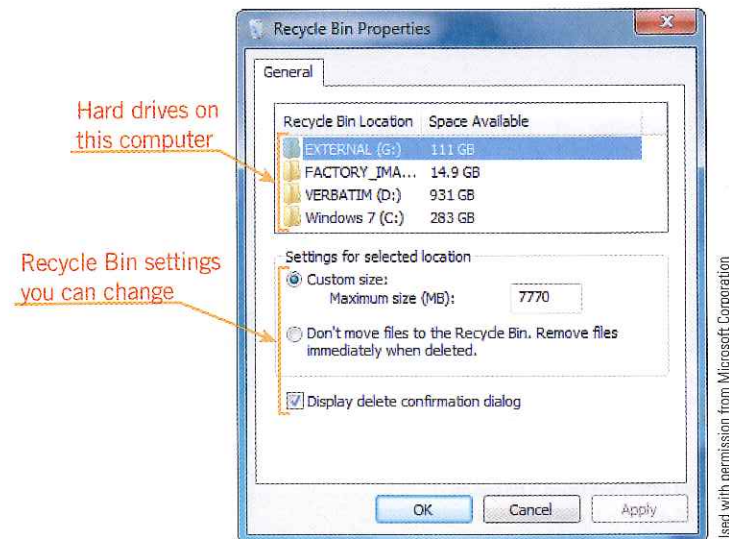
FIGURE 4–17   Recycle Bin Properties dialog box

Temporary Files

Various programs, such as those in the Microsoft Office suite, create temporary files. This action is used for the following three reasons:

- To free memory for other programs
- To act as a safety net to prevent data loss
- To print while the computer is performing other tasks

The program determines where and when it needs to create temporary files. The temporary files normally exist only during the current session of the program. When the program is closed through a standard process, the temporary files are closed and then deleted automatically. However, if the computer loses power or the program is not properly closed, the temporary files remain on the hard drive. The following Step-by-Step exercise provides information on how to use a Windows program named Disk Cleanup to delete the temporary files and other files that are not needed.

Step-by-Step 4.3

1. Click the **Start** button on the taskbar, point to *All Programs*, click **Accessories**, click **System Tools**, and then click **Disk Cleanup** to display the Disk Cleanup: Drive Selection dialog box (see **Figure 4–18**) or, if your computer has only one hard drive, the Disk Cleanup dialog box.
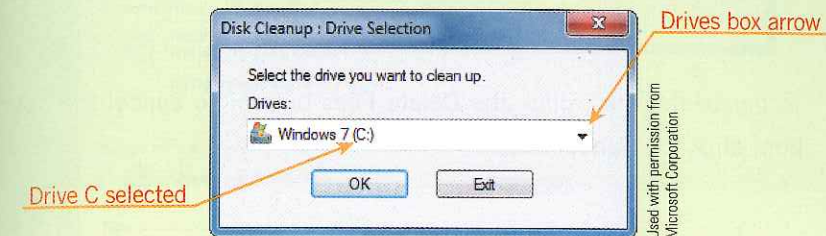

FIGURE 4–18
Disk Cleanup: Drive Selection dialog box

2. If your computer contains more than one drive or the drive is partitioned, click the **Drives box arrow**, and then select the drive or partition you want to clean. If your computer does not contain more than one hard drive, then skip to step 3.

3. Click the **OK** button. Disk Cleanup scans the selected drive and calculates the amount of space that can be freed up through this process, and then displays the Disk Cleanup for (*your computer name*) dialog box (see **Figure 4–19**).
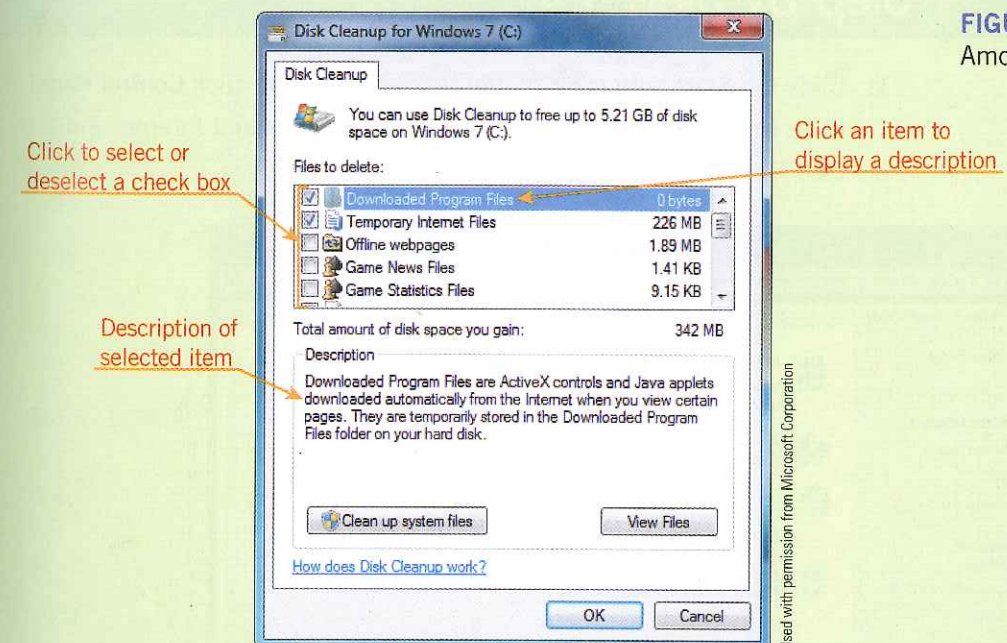

FIGURE 4–19
Amount of disk space to free

Clicking an item in the Files to delete list displays a description of the selection. Click a check box to select the item for deletion. You can use the check boxes to select all of the displayed categories or select specific files to be deleted. Verify that you want to delete the files.

4. Click the **OK** button. The Disk Cleanup dialog box is displayed (see **Figure 4–20**), asking if you want to permanently delete the files.

FIGURE 4–20
Disk Cleanup dialog box
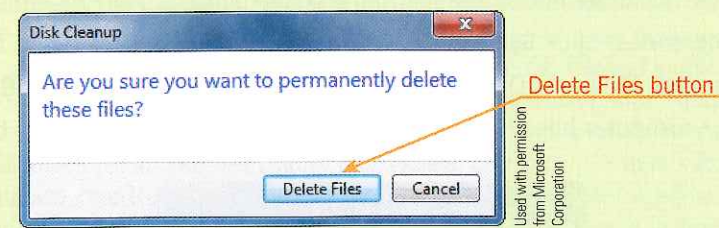
5. To delete the files, click the **Delete Files** button. To cancel the operation, click the **Cancel** button.

Cookies

A *cookie* is a small text file that a Web site uses to identify a specific computer. The file is created or updated on your computer's hard drive each time you visit the Web site. Cookies are not a threat to your computer's security. The text file contains a code that identifies you to the Web server each time a Web page is accessed. Primarily, cookies are used to gather information about your surfing habits and for targeted advertising. The following Step-by-Step exercise provides information on how to delete cookies from the hard drive.

Step-by-Step 4.4

1. Click the **Start** button 🌐 on the taskbar, and then click **Control Panel**. Click **Network and Internet** to display the Network and Internet window (see **Figure 4–21**).

FIGURE 4–21
Network and Internet window
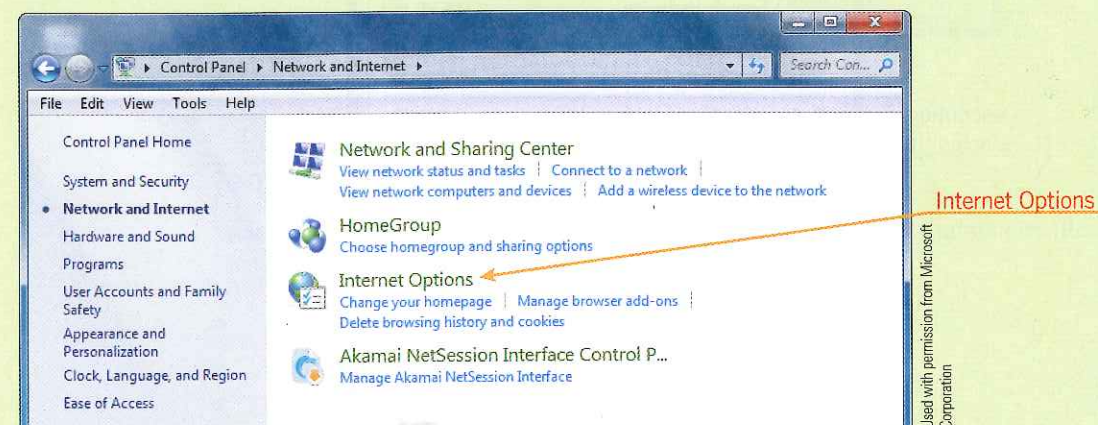
2. Click **Internet Options** to display the Internet Properties dialog box (see **Figure 4–22**).

FIGURE 4–22
Internet Properties dialog box
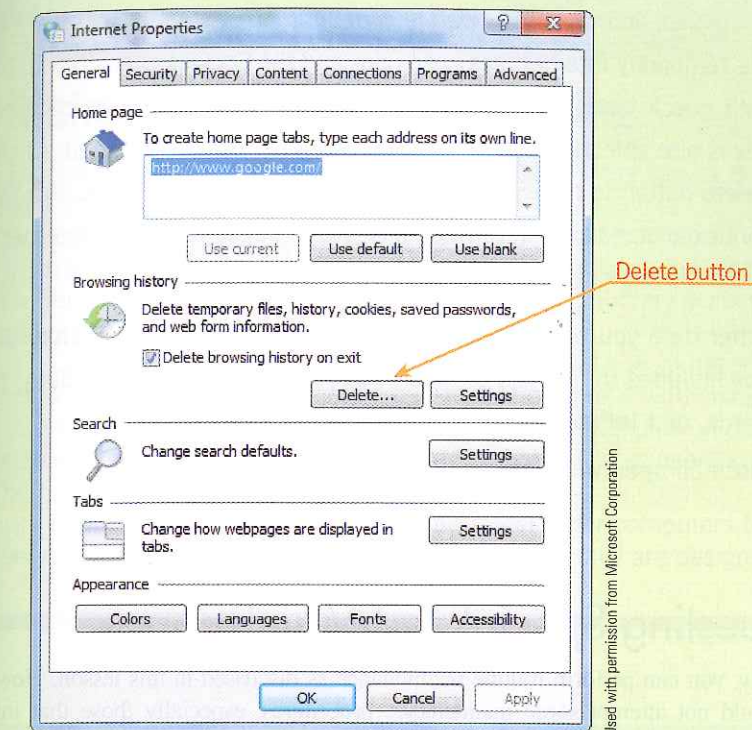
3. In the Browsing history section of the General tab, click the **Delete** button to display the Delete Browsing History dialog box (see **Figure 4–23**).

FIGURE 4–23
Delete Browsing History dialog box

4. **_Verify with your instructor before completing this step_**. If necessary, click the **Temporary Internet files** check box and the **Cookies** check box to select both check boxes. Make sure the Preserve Favorites website data check box is also selected and that no other check boxes are s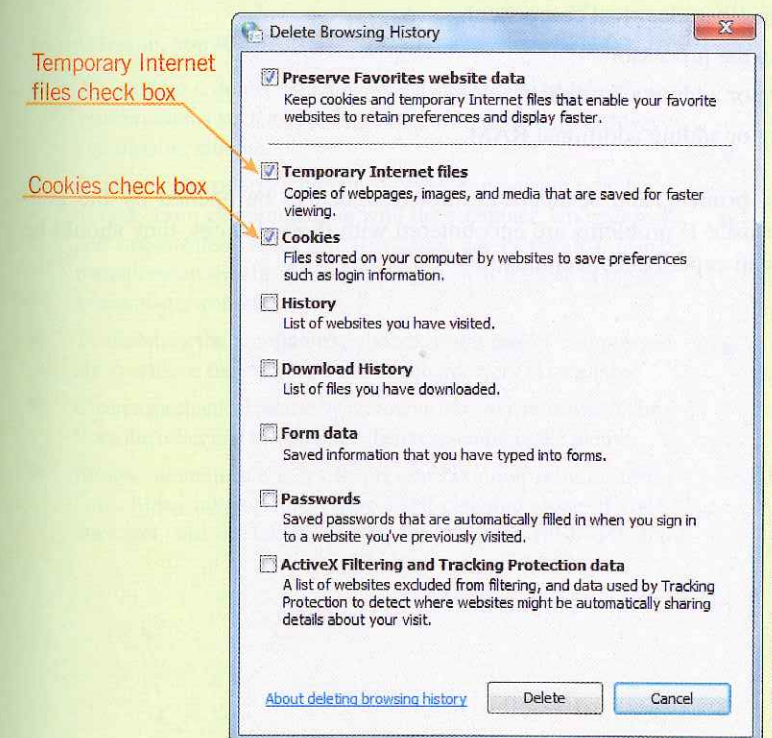elected. Click the **Delete** button to close the Delete Browsing History dialog box. If a Delete confirm dialog box is displayed, click **Yes** to delete temporary Internet files and cookies except those for Web sites in your Favorites list.

Other data you can delete through the Delete Browsing History dialog box includes the history of Web sites you have visited, form data, passwords, and InPrivate Filtering data.

5. Close all open windows.

Requesting Specialized Maintenance

Generally, you can perform routine maintenance as discussed in this lesson. However, you should not attempt some maintenance procedures, especially those that involve working with electrical components. The following is a list of internal hardware maintenance or repair that generally should be performed by a computer professional:

- Replacing the power supply or opening the power supply case
- Replacing other electrical components
- Replacing the processor
- Replacing or adding a hard disk
- Replacing or adding additional RAM

Monitors, printers, and scanners are not designed to be opened by the general computer user. If problems are encountered with these devices, they should be worked on by an experienced technician.

ETHICS IN TECHNOLOGY

Risks of Networked Computing

The security of a computer network is challenged every day by equipment malfunctions, system failures, computer hackers, and virus attacks.

Equipment malfunctions and system failures are caused by a number of factors including natural disasters, such as floods, storms, or fires, and electrical disturbances, such as a brownout or blackout. Server malfunctions or failures mean users lose temporary access to network resources, such as printers, drives, and information.

Computer hackers and viruses represent a great risk to networked environments. People who break into computer systems are called hackers. They gain unauthorized access to systems to steal services and information, such as credit card numbers, test data, and even national security data. Some hackers want to harm a company or organization they do not like or support; sometimes, they do it just for the thrill of being able to get into the system.

People create computer viruses and infect other computers for some of the same reasons. Viruses are very dangerous to networked computers—they usually are designed to sabotage files that are shared.

SUMMARY

In this lesson, you learned:

- A computer requires maintenance on a regular schedule to prevent problems such as the degrading of hard disk performance and monitor trouble.

- Damaged and poorly maintained cables can prevent peripheral devices from communicating with the computer. Unorganized and unprotected cables can also create safety hazards. Cable management should therefore be part of a regular computer maintenance routine.

- To maintain the computer keyboard, use a can of compressed air to remove the dust from the keyboard every six months.

- Clean a mechanical mouse by removing its cover, removing debris from the roller and the ball, and then reassembling the mouse.

- Printer maintenance helps to prevent common printing problems. Many inkjet printers have a self-cleaning mode. If yours does not, use an inkjet cleaning cartridge to flush dirt and debris out of clogged printer nozzles. Clean a laser printer when you change the toner cartridge.

- Adding computer memory (RAM) often provides the best value for increasing overall system performance.

- All computers slow down as you work with them. To improve or maintain computer efficiency, periodically use Windows tools to defragment hard drives, empty the Recycle Bin, delete temporary files, and remove cookies.

- Some maintenance procedures are not suitable for the average computer user and should be performed by a computer professional, such as replacing the power supply or opening the power supply case, replacing other electrical components, including the processor and RAM, and adding an internal hard disk.

LESSON REVIEW

TRUE / FALSE

Circle T if the statement is true or F if the statement is false.

T   F   **1.**   Adding RAM to a computer generally helps increase performance, speed, and usability.

T   F   **2.**   Only qualified computer repair specialists should change the toner on a laser printer.

T   F   **3.**   You cannot recover files from the Recycle Bin.

T   F   **4.**   As a general rule, you should clean a computer every three to six months.

T   F   **5.**   Windows includes a disk defragmentation utility.

MULTIPLE CHOICE

Select the best response for the following statements.

1. If a computer loses power or a program is not closed properly, _____ files can remain on the hard drive.

   A.   virus   C.   recycled

   B.   temporary   D.   permanent

2. Deposits of dry ink can accumulate on the print head of a(n) _____ printer, causing print quality to deteriorate.

   A.   laser   C.   inkjet

   B.   default   D.   network

3. You should check and clean the _____ periodically.

   A.   mouse   C.   keyboard

   B.   monitor   D.   all of the above

4. You can use a Windows program called _____ to delete temporary files and other files that your computer does not need.

   A.   Disk Cleanup   C.   Disk Maintenance

   B.   Disk Defragmenter   D.   Recycle Bin Cleanup

5. Disk _____ can significantly slow the speed of a computer's processing cycle.

   A.   cleanup   C.   maintenance

   B.   defragmentation   D.   seek time

FILL IN THE BLANK

Complete the following sentences by writing the correct word or words in the blanks provided.

1. A(n) _____ is a small text file that a Web site uses to identify a specific computer.

2. A(n) _____ is a pointing device you can use instead of a mouse.

3. Damaged and poorly maintained _____ can prevent peripheral devices from communicating with the computer.

4. Disk _____ organizes fragmented files so that all of the file's sectors are stored together.

5. You can use a can of compressed air to remove the dust from the _____.

PROJECTS

PROJECT 4–1

In Step-by-Step 4.4, you explored how to delete cookies and temporary Internet files from your computer. Complete the following to learn more about deleting browsing history:

1. Open the Internet Properties dialog box, and then open the Delete Browsing History dialog box.

2. Click the *About deleting browsing history* link to display a Windows Help and Support topic on browsing history.

3. What types of information does Internet Explorer store when you browse the Web?

4. Summarize two tips Windows Help and Support gives about your browsing history.

PROJECT 4–3

Printers need more frequent maintenance than most types of electronic devices. Complete the following:

KC³
1-1.2.5
1-1.2.6
1-1.2.7

1. Using Google or another search engine, find instructions or tips on maintaining the type of printer you have or use regularly.

2. As you research, identify periodic and occasional maintenance tasks.

3. Note any hazards or cautions you should observe when maintaining a printer.

4. Summarize the maintenance routine and cautions in a one-page explanation.

PROJECT 4–2

Some people say you should leave your computer on at all times—that turning the computer on and off creates stress on the components. Others argue that computers use a lot of energy, and that computers should be turned off when not in use. Your computer operating system, however, includes power-management settings. Your instructor has requested that you and your team investigate these options.

1. Use Windows Help and Support and prepare a report describing these power-management options.

2. Describe how to create a power plan.

3. Describe how you can change what happens when you press the power button on a mobile PC such as a laptop.

TEAMWORK PROJECT

KC³
1-1.2.6

You and your team are responsible for maintaining the computers in your school's computer lab. Work together to create a checklist of tasks that should be performed to maintain the hardware and operating systems of the computers. Be sure to indicate how often each task should be performed.

■ CRITICAL THINKING

This lesson discussed fragmentation and defragmentation and provides steps for defragmenting a hard drive. Using the Internet and other resources, write a one-page report summarizing your responses to the following:

1. Windows 7 includes a defragmentation tool. Should you supplement that tool with other defragmentation utilities? If so, explain why.

2. How often should you defragment your hard drive? What is a good rule of thumb to follow?

3. Does defragmentation pose any risks to your computer? What can you do to overcome any risks?

IC³
1-1.2.6

■ ONLINE DISCOVERY

Most computer manufacturers provide information on their Web sites about maintaining computer equipment. For example, HP provides a PC Health series of online articles, including one on keeping your hard drive healthy. Dell offers an online article about optimizing your computing. Gateway provides maintenance information online. Explore the Web site of your computer manufacturer to find maintenance information. Use your word-processing program to summarize the advice you found.

IC³
1-1.2.5

■ JOB SKILLS

When you use a computer such as a PC or mobile device on the job, your company owns the computer and trusts you to use it properly. Who should be responsible for maintaining your work computer? Which types of maintenance tasks should you perform? Which types of tasks should your company perform? Who should be responsible for computer problems that result from poor maintenance?