

Chapter 6

Input and Output

Lecture Guide

- **Learning Objectives**

- Define input.
- Describe keyboard entry including types and features of keyboards and keyboard features.
- Identify different pointing devices including game controllers and styluses.
- Describe scanning devices including optical scanners RFID readers, and recognition devices.
- Recognize image capturing and audio-input devices.
- Define output.
- Identify different monitor features and types including flat-panels and e-books.
- Define printing features and types including ink-jet and cloud printers.
- Recognize audio and video devices including portable media devices, and Mobile DTV.
- Define combination input and output devices including multifunctional devices, Internet telephones , robots, VR headgear and gloves.
- Explain ergonomics and ways to minimize physical damage.

Chapter Outline

- **What is Input?**

- Any data or instructions that are used by a computer.
- Can come directly from you or from other sources.
- Input devices are hardware used to translate words, numbers, sounds, images, gestures, and actions that people understand into a form that the system unit can process.

- **Keyboard Entry**

- One of the most common ways to input data is by keyboard.
- Keyboards convert numbers, letters, and special characters that people understand into electrical signals.
- Electrical signals from the keyboard are sent to, and processed by, the system unit.
- Most keyboards use an arrangement of keys given the name QWERTY.
- Variety of keyboard designs:
 - **Traditional keyboards**—full-sized, rigid, rectangular keyboards that include function, navigational, and numeric keys.
 - **Laptop keyboards** – are smaller than traditional keyboards and widely used on laptop computers. They typically have fewer keys, do not include a numeric keypad, and do not have a standard location for the function and navigation keys
 - **Virtual keyboards** – displays an image of a keyboard on a touch screen which functions as the actual input device. Virtual keyboards are common on tablet computers and mobile devices.

- **Thumb keyboards** – used on smartphones and other small mobile devices. Thumb keyboards are designed primarily for communicating via texting and connecting to the web. These keyboards are very small.
- **Pointing Devices**
 - Provide an intuitive interface with the system unit by accepting physical movements and gestures such as finger pointing or moving across a screen and converting them into machine-readable input.
 - Wide variety of point devices, including the mouse, game controller, touch screen, and stylus.
 - **Mice**
 - **Mouse** - controls a pointer that is displayed on the monitor.
 - The mouse pointer usually appears in the shape of an arrow. Frequently changes shape, however, depending on the application.
 - Can have one, two, or more buttons, which are used to select command options and to control the mouse pointer on the monitor.
 - Some mice have a wheel button that can be rotated to scroll through information that is displayed on the monitor.
 - Variety of mice designs:
 - **Optical mouse** has no moving parts and is currently the most widely used. It emits and senses light to detect mouse movement.
 - **Cordless or wireless mouse** uses radio waves or infrared light waves to communicate with the system unit.
 - Devices similar to mice:
 - **Touch pad** is used to control the mouse pointer and to make selections. Touch pad operates by moving or tapping your finger on the surface of a pad. Used on laptops and some types of mobile devices.
 - **Touch screens**
 - Allow users to select actions or commands by touching the screen with a finger or penlike device.
 - **Multitouch screens** – touch with more than one finger, which allows for interactions such as rotating graphical objects with the hand and zooming in and out by pinching and stretching the fingers
 - Commonly used with tablets and smartphones as well as some laptop computers and desktop monitors.
 - **Game Controllers**
 - Used with computer games. Additional controls, such as buttons and triggers, are used to specify commands or initiate specific actions.
 - The most popular game controllers are joysticks, dance pads, gamepads, and motion sensing devices.
 - **Joysticks** control game actions by users varying the pressure speed, and direction of the joystick.

- **Dance pads** provide input for dance games. Users move on a pressure-sensitive mat that provides the input to the game.
- **Gamepads** are designed to be held by two hands and provide a wide array of inputs including motion, turning, stopping, and firing.
- **Motion-sensing devices** control games by user movements and spoken commands.
- **Stylus**
 - Penlike device typically used with tablets and mobile devices.
 - Uses pressure to draw images on a screen.
 - Often a stylus interacts with the computer through **handwriting recognition software** which translates handwritten notes into a form the system unit can process.
- **Scanning Devices**
 - **Optical scanner**, also known simply as a **scanner**, accepts documents consisting of text and/or images and converts them to machine-readable form.
 - These devices do not recognize individual letters or images. Rather, they recognize light, dark, and colored areas that make up individual letters or images.
 - Three basic types of optical scanners: flatbed, document and portable
 - **Flatbed** – image to be scanned is placed on a glass surface and the scanner records the image from below.
 - **Document** – can scan multipage documents. Automatically feeds one page of a document at a time through a scanning surface.
 - **Portable** – typically a hand held device that slides across the image, making direct contact.
 - **Card Readers**
 - Credit cards, access cards, id cards, debit cards typically have the user's name, some type of identification number, and signature embossed on the card.
 - Additionally, encoded information is often stored on the card as well. Card readers interpret this encoded information.
 - **Magnetic card reader** – encoded information is stored on a thin magnetic strip located on the back of the card. When the card is swiped through the magnetic card reader, the information is read.
 - **Bar Code Readers**
 - Either handheld wand readers or **platform scanners**.
 - They contain photoelectric cells that scan **bar codes** printed on product containers.
 - Used with bar code system called the **Universal Product Code (UPC)**.

- **MaxiCode** is widely used by the United Parcel Service (UPS) and others to automate the process of routing packages, tracking in transit packages, and locating lost packages.
- **QR codes** are widely used to provide consumer information.
- Smartphones can also scan codes. See Figure 6-9.
- **RFID Readers**
- **Radio-frequency identification tags** are tiny chips that can be embedded in most everything. They contain electronically stored information. They are used to track and locate lost pets; to monitor production and update inventory; and to record prices, product descriptions, and locations of retail items.
- **Character and Mark Recognition Devices**
 - Character and mark recognition devices are scanners that are able to recognize special characters and marks.
 - Specialty devices that are essential tools for certain applications. Three types are:
 - **Magnetic-ink character recognition (MICR)**—used by banks to automatically read numbers on the bottom of checks and deposit slips.
 - **Optical-character recognition (OCR)**—uses special preprinted characters that can be read by a light source and changed into machine-readable code.
 - **Optical-mark recognition (OMR)** - senses the presence or absence of a mark, such as a pencil mark, and is often used to score multiple-choice tests.
- **Image Capturing Devices**
 - Image capturing devices create or capture original images. These devices include:
 - **Digital cameras** - images are recorded digitally on a disk or in the camera's memory rather than on film and then downloaded, or transferred, to your computer or place it on a Web page.
 - **Webcams** are specialized digital video cameras that capture images and send them to a computer for broadcast over the Internet.
- **Audio-Input devices**
 - Audio-input devices convert sounds into a form that can be processed by the system unit. The most widely used audio-input device is the microphone.
 - **Voice recognition systems** use a microphone, a sound card, and special software. These systems allow users to operate computers and to create documents using voice commands. Examples include:
 - Dialing features on mobile phones
 - Navigation on GPS devices
 - Control of car audio systems
 - Record dictation

- Some systems are able to translate dictation from one language to another
- **What is Output?**
 - Output is processed data or information, and typically takes the form of text, graphics, photos, audio, and/or video.
 - **Output devices** are any hardware used to provide or to create output.
 - They translate information that has been processed by the system unit into a form that humans can understand.
 - Most widely used output devices are monitors, printers, and audio-output devices.
- **Monitors**
 - Most frequently used output device. Also known as **display screen**
 - Present visual images of text and graphics.
 - Output is often referred to as **soft copy**.
 - Monitors vary in size, shape, and cost.
 - Basic distinguishing features include:
 - **Clarity** refers to the quality and sharpness of the displayed images, and is composed of five elements:
 - **Resolution** - Images are formed on a monitor by a series of dots or pixels. Resolution is expressed as a matrix of these dots or **pixels**. The higher a monitor's resolution, the clearer the image produced.
 - **Dot (pixel) pitch** is the distance between each pixel. The lower the dot pitch (the shorter the distance between pixels), the clearer the images produced.
 - **Contrast ratios** – indicate a monitor's ability to display colors. It compares the light intensity of the brightest white to the darkest black. The higher the ratio, the better the monitor.
 - **Size or active display area** is measured by the diagonal length of a monitor's viewing area.
 - **Aspect ratio** indicates the proportional relationship between a display's width and height.
 - **Flat-panel monitors** are much thinner and require less power to operate than other types of monitors.
 - Most of today's flat-panel monitors are **LCD (liquid crystal display)**. One characteristic of LCD technology is that the monitors are back-lit meaning that a common source of light is dispersed over all the pixels on the screen. Widely used for older monitors and is typically less expensive.
 - **LED (light emitting diode)**
- **E-book Readers/E-books** – are dedicated mobile devices for storing and displaying e-books and other electronic media including electronic newspapers and magazines.
 - **E-ink** produces images that reflect light like ordinary paper, making the display easy to read.
 - To learn more about e-books, see Making IT Work for You: E-BOOKS.
- **Other Monitors** – these monitors are used for more specialized applications, such as making presentations and watching television. devices are digital whiteboards, and high-definition television (HDTV).

- **Digital or interactive whiteboards** – are specialized devices with a large display connected to a computer or projector.
 - Computer's desktop is displayed on the digital whiteboard and controlled using a special pen, a finger, or some other type of device.
 - Widely used in classrooms and corporate board rooms.
- **High-definition television (HDTV)** - the merger of personal computers and television. HDTV delivers a much clearer and more detailed wide-screen picture than regular television.
 - Users can readily freeze video sequences to create high-quality still images.
 - Video and images can be edited, and stored for later use.
 - Very useful for graphic artists, designers, and publishers.
 - Recent and dramatic advance is 3D HDTV.
- **Cathode-ray tubes (CRTs)** are similar in size and technology to older televisions. They have been replaced by flat-panel monitors. Discarded CRTs, however, are a serious threat to our environment. Each color CRT contains approximately four pounds of lead and numerous other hazardous materials. Don't just throw out an obsolete CRT. Dispose of it in a responsible manner through an EPA-certified recycling program. Most large cities and manufacturers including IBM, Microsoft, and Dell have certified programs.
- **Printers**
 - Translates information that has been processed by the system unit and presents the information on paper. Printer output is often called **hard copy**.
 - **Features** – Basic distinguishing features include:
 - **Resolution** - the clarity of images produced and measured in dpi (dots per inch). The higher the dpi, the better the quality of images produced.
 - **Color** capability – provided by most printers today. Users typically have the option to print either with just black ink or with color.
 - **Speed** - measured in the number of pages printed per minute.
 - **Memory** – printer memory is used to store printing instructions and documents waiting to be printed. The more memory in a printer, the faster it will be able to print large documents.
 - **Duplex printing** – Allows automatic printing on both sides of a sheet of paper.
 - **Ink-jet printers**
 - Spray ink at high speed onto the surface of paper.
 - The most widely used printers.
 - Available in Black only or Color.
 - Reliable, quiet, and relatively inexpensive.
 - Most costly aspect is replacing ink cartridges.
 - **Laser printers**

- Use a laser light beam to produce images with excellent letter and graphics quality.
- Available in Black only or Color.
- Reliable, quiet, but more expensive than ink-jets.
- Faster than ink-jets and are used in applications requiring high-quality output.
- Two categories
 - Personal – used by single users
 - Shared – used by a group of users, typically support color, and are more expensive
- **Other Printers**
 - **Cloud printers** are printers connected to the Internet that provide printing services to others on the Internet. Google Cloud Print is a service that supports cloud printing. The user must activate a printer using Google Chrome OS and then it can be accessed with a smartphone or other type of computer connected to the Internet.
 - **Thermal printers** use heat elements to produce images on heat-sensitive paper.
 - **Plotters** are special-purpose printers for producing maps, images, and architectural and engineering drawings.
- **Audio-Output Devices** - translate audio information from the computer into sounds that people can understand.
 - The most widely used audio-output devices are **speakers** and **headsets**.
 - Audio-output devices can connect to a sound card
 - Sound card is used to capture and play back recorded sounds,
 - Plays music, vocalize translations from one language to another, and communicate information from the computer system to users.
- **Combination Input-Output devices**
 - Many devices combine input and output capabilities. Sometimes this is done to save space, and other times it is done for very specialized applications.
 - Common combined devices include:
 - **Multifunctional devices (MFD)**, - typically combine the capabilities of a scanner, printer, fax, and copy machine into one unit
 - **Internet telephones** are specialized input and output devices for receiving and sending voice communication.
 - **Voice over IP (VOIP)** is the transmission of telephone calls over computer networks. Also known as telephony, Internet telephony, and IP telephony.
 - Uses the Internet rather than traditional communication lines to support voice communication.
 - **Skype** provides audio and video service that does not require any dedicated hardware. Free subscription service and you can use your computer to connect to any other Skype subscribers for free domestic calls.
 - **Virtual Reality Headgear and Gloves (VR)** is an artificial, or simulated, reality created in 3-D by computers. Creates a virtual or **immersive**

experience by using specialized hardware that includes headgear and gloves.

- **Headgear** has earphones and three-dimensional stereoscopic screens
- **Gloves** has sensors that collect data about hand movements
 - Coupled with software, this interactive sensory equipment lets you immerse yourself in a computer-generated world.
- **Ergonomics** is the study of human factors related to things people use. It is concerned with fitting the task to the user rather than forcing the user to contort to do the task. For computer users and manufacturers this means devising ways that input and output devices can be used and designed to increase ease of use and to avoid health risks. Sitting in front of a screen in awkward positions for long periods may lead to physical problems such as eyestrain, headaches, and back pain. Computer users can alleviate these problems by taking frequent rest breaks and by using well-designed computer furniture.
 - **Eyestrain and headache** – Take a 15-minute break every hour or two. Keep everything you’re focusing on at about the same distance.
 - **Back and neck pain** – Adjust your chair for height and angle, and the chair should have good back support. The monitor should be at eye-level or slightly below eye level. Use a footrest to reduce leg fatigue.
 - **Repetitive strain injury** – (RSI) is an injury that is caused by fast, repetitive work that can generate neck, wrist, hand and arm strain. Use ergonomic keyboards and take frequent short rest breaks and gently massage your hands.
- **Careers in IT**
 - **Technical writers** prepare instruction manuals, technical reports, and other scientific or technical documents.
 - Work for computer software firms, government agencies, or research institutions.
 - They translate technical information into easily understandable instructions or summaries.
 - Requires an associate or a college degree in communications, journalism, or English and a specialization in, or familiarity with, a technical field.
 - Annual salary in the range of \$41,000 – \$78,000.
- **A Look to the Future**
 - **Augmented Reality Displays**
 - Have you ever run into someone who looks familiar, but you cannot remember her name or where you know her from? What about finding yourself in an unfamiliar town, constantly having to look at your smartphone or GPS device to get directions?
 - With wearable augmented reality displays data from your computer and the Internet will become instantly accessible and viewable without you having to access another device. The reality you see in front of you is improved, or augmented, with additional visual information using projected images.
 - Many companies and universities are working on various types of augmented reality displays. There are a few that have received funding from the military in order to assist soldiers and pilots.

Teaching Tips

- **What is Input?**

Input devices are hardware used to translate words, sounds, images, and actions that people understand into a form that the system unit can process.

- You can emphasize that it is how users put data into the system.
- **Keyboard Entry** – Students are familiar with most types of keyboards. If they aren't then you can use the textbook to view the illustrations. Figure 6-2
 - One of the most common ways to input data is by keyboard
 - Variety of keyboard designs
 - **Traditional keyboards**—full-sized, rigid, rectangular keyboards that include function, navigational, and numeric keys.
 - **Laptop keyboards** – widely used on notebook computers including netbooks. They typically have fewer keys, do not include a numeric keypad, and do not have a standard location for the function and navigation keys
 - **Virtual keyboards** – displays an image of a keyboard on a touch screen which functions as the actual input device. Virtual keyboards are common on tablet computers and mobile devices.
 - **Thumb keyboards** – widely used on smartphones and other small portable devices. Thumb keyboards are designed primarily for communicating via texting and connecting to the Web.
- **Pointing Devices** – Most students are familiar with the various pointing devices, so you can have them list the different types of devices they know and discuss their uses.
 - Mice
 - Optical
 - Mechanical
 - Cordless or wireless
 - Device that works similar to a mouse
 - Touch pads
 - Touch Screen
 - Multi-touch screen – commonly used on mobile devices
 - Game Controllers – input device for games, students have a great deal of knowledge in this area and can lead discussions on how each, joysticks, dance pads, gamepads and motion-sensing devices are used.
 - Stylus – penlike device commonly used with tablets
 - Stylus often used with handwriting recognition software

- **Scanning Devices** Most students are familiar with the various scanning devices, so you can have them list the different types of devices they know and discuss their uses. Have students give every day examples of each of the following.
 - **Optical scanner**
 - Flatbed
 - Document
 - Portable
 - **Card Reader**
 - Magnetic card reader
 - **Bar code reader**
 - **RFID (radio-frequency identification reader)**
 - Used to track and locate pets, monitor production, track inventory, record prices, etc.
 - **Character and mark recognition devices**
 - Magnetic-ink character recognition (MICR)
 - Optical-character recognition (OCR)
 - Optical-mark recognition (OMR)
- **Image Capturing Devices**
 - **Digital**
 - **Webcams (Web cameras)** – specialized cameras that capture images and send them to a computer for broadcast
- **Audio-Input devices**
 - Convert sounds into a form that can be processed by the system unit. The most widely used audio-input device is the microphone.
 - Voice Recognition Systems
 - Voice Recognition can be used as a lab to further the students' knowledge on the subject. Ask students to conduct research on the Internet to find applications where voice recognition systems are being widely used.
- **What is Output?**
 - Most students are familiar with the various output devices, so you can have them list the different types of devices they know and discuss their uses.
 - Monitors
 - **Resolution** – one of the most important features of a monitor. Images are formed on a monitor by a series of dots or pixels. Resolution is expressed as a matrix of those dots or pixels.
 - **Dot (pixel) pitch** – is the distance between each pixel. Most new monitors have a dot pitch of .31 mm or less. The lower the dot pitch (the shorter the distance between pixels), the clearer the images produced.
 - **Contrast ratios** – indicate a monitor's ability to display colors. It compares the light intensity of the brightest white to the darkest black. The higher the ratio, the better the monitor.
 - **Active display area (size)** – is measured by the diagonal length of a monitor's viewing area. Common **sizes or active display areas** are 15, 17, 19, 21, and 24 inches. Aspect ratio – is determined by the width of a monitor divided by its height. Common aspect ratios for monitors are 4:3 (standard, similar to traditional television pictures) and 16:10 (wide screen)

- Different types of monitors include:
 - **Flat-panel monitors** – are the most widely used type of monitor today. They are thin, more portable, and require less power to operate.
 - **E-book Readers** – are dedicated mobile devices for storing and displaying e-books and other electronic media including electronic newspapers and magazines.
 - **Other Monitors** – these monitors are used for more specialized applications, such as making presentations, and watching television. Two of these specialized devices are digital whiteboards, and high-definition television (HDTV).
- **Printers**
 - Printers translate information that has been processed by the system unit and present the information on paper.
 - Features
 - Resolution
 - Color
 - Speed
 - Memory
 - Duplex printing
 - **Ink-jet printers**
 - **Laser printers**
 - **Other Printers**
 - Cloud printers – Ask students to discuss the benefits associated with these types of printers. Do they anticipate the need to use this type of technology? If so, explain why.
 - Thermal printers
 - Plotters
- **Audio and Video Devices**
 - Speakers
 - Headsets
 - Portable media players – Ask students to name or research some of the best known audio and video players
 - Mobile Digital Television (Mobile DTV)
- **Combination Input-Output devices**
 - **Multifunctional devices (MFD)**
 - **Internet Telephones**
 - Voice over IP (VoIP) also known as telephony, Internet telephony, and IP telephony
 - Have the students discuss if they currently use any of the providers discussed in the text (Phone Power, Phone.com, Skype).

Virtual Reality Headgear and Gloves

Discuss Google Glass

- **Ergonomics** - the study of human factors related to things people use. It is concerned with fitting the task to the user rather than forcing the user to contort to do the task. For computer users and manufacturers this means devising ways that input and output devices can be used and designed to increase ease of use and to avoid health risks. Sitting in front of a screen in awkward positions for long periods may lead to physical problems

such as eyestrain, headaches, and back pain. Computer users can alleviate these problems by taking frequent rest breaks and by using well-designed computer furniture.

- **Eyestrain and headache** – Take a 15-minute break every hour or two. Keep everything you're focusing on at about the same distance.
 - **Back and neck pain** – Adjust your chair for height and angle, and the chair should have good back support. The monitor should be at eye-level or slightly below eye level. Use a footrest to reduce leg fatigue.
 - **Repetitive strain injury** – (RSI) is an injury that is caused by fast, repetitive work that can generate neck, wrist, hand and arm strain. Use ergonomic keyboards and take frequent short rest breaks and gently massage your hands.
- **Careers in IT**
 - **Technical writers** prepare instruction manuals, technical reports, and other scientific or technical documents.
 - Work for computer software firms, government agencies, or research institutions.
 - They translate technical information into easily understandable instructions or summaries.
 - Requires a college degree in communications, journalism, or English and a specialization in, or familiarity with, a technical field.
 - Annual salary in the range of \$41,000-\$78,000.
 - **A Look to the Future**
 - **Augmented Reality Displays**
 - This is a good technology to discuss in the classroom. Assign the students to research the topic and present the pros and cons of the issue.

Key Terms

Key Term	Definition
3D printers	Create three-dimensional shapes
active display area	Diagonal length of a monitor's viewing area. Also known as size.
additive manufacturing	Creating objects by adding layers of materials onto one another
aspect ratio	This is a ratio determined by the width of a monitor divided by its height.
bar code	Codes on products
bar code reader	Contains photoelectric cells that scan or read bar codes. (See also bar code scanner)
bar code scanner	Contains photoelectric cells that scan or read bar codes. (See also bar code reader)
Bluetooth	Type of wireless connection (Discussed in Chapter 8)
card reader	A device that interprets the encoded information contained on credit, debit, access, and identification cards.
carpal tunnel syndrome	A repetitive strain injury consisting of damage to the nerves and tendons in the hands.
cathode-ray tube (CRT) monitor	The most common type of monitor that are typically placed directly on the system unit or on the desktop.
clarity	The quality and sharpness of the displayed images.
cloud printer	Printers connected to the Internet that provide printing services to others on the Internet.
combination key	A key, that when held down in combination with another key, performs an action.
contrast ratio	Indicates a monitor's ability to display colors. It compares the light intensity of the brightest white to the darkest black.
cordless mouse	A battery-powered device that typically uses radio waves or infrared light waves to communicate with the system unit. (See also wireless mouse)
dance pad	An input device for dance games where signals are sent via a pressure-sensitive mat.
digital camera	Images are recorded digitally on a disk or in the camera's memory rather than on film.
digital whiteboard	Specialized devices with a large display connected to a computer or projector (see also interactive whiteboard)
display screen	A computer device that presents visual images of text and graphics. (See also monitor)
document scanner	Scanner that quickly scans multipage documents by automatically feeding one page at a time through a scanning surface.
dot pitch	A function of a monitor that is the distance between each pixel. (See also pixel pitch)
dots-per-inch (dpi)	The measurement of printer resolution, the more dots-per-

	inch the better the quality of the image printed.
duplex printing	Printing feature that allows automatic printing on both sides of a sheet of paper.
e-book reader	Store and display e-books and other electronic media
e-books	Dedicated, handheld, book-size devices that display text and graphics (See also e-book reader)
e-ink	Produces images that reflect light making it easy to read
e reader	Dedicated, handheld, book-sized devices that display text and graphics. (See also e-book)
electronic books	Traditional printed books in electronic format
ergonomics	Study of human factors related to things people use
flat-panel monitor	A type of monitor that is much thinner and requires less power to operate than CRTs.
flatbed scanner	The image to be scanned is placed on a glass surface and the scanner records the image from below.
game controller	. A device that provides input to computer games.
gamepads	An input device designed to be held by two hands and provide a wide array of inputs including motion, turning, stopping, and firing.
gloves	See virtual reality.
Google Cloud Print	A service that supports cloud printing.
grayscale	Most common black ink selection in which images are displayed in many shades of gray.
handwriting recognition software	Translates handwritten notes into a form that the system unit can process.
hard copy	Printer output is often called hard copy
headgear	See virtual reality
headsets	An audio-output device.
high-definition television (HDTV)	A digitized television output that delivers a much clearer and more detailed wide-screen picture than regular television.
immersive experience	Allows the user to walk into a virtual reality room or view simulations on a virtual reality wall.
ink-jet printer	A type of printer that sprays ink at high speed onto the surface of paper.
input	Any data or instructions that are used by a computer.
input device	Hardware used to translate words, sounds, images, and actions that people understand into a form that the system unit can process.
interactive whiteboard	Specialized devices with a large display connected to a computer or projector (see also digital whiteboard)
internet telephone	Specialized input and output devices for receiving and sending voice communication.
internet telephone	Send and receive voice communication over computer networks
IP telephony	A type of communications system that uses the Internet

	rather than traditional communication lines to support voice communication.
joystick	Input device for computer games.
keyboard	Convert numbers, letters, and special characters that people understand into electrical signals.
laptop keyboard	Smaller than traditional keyboards and widely used on laptop computers
laser printer	A type of printer that uses a laser light beam to produce images with excellent letter and graphics quality.
light-emitting diode (LED)	Use more advanced backlighting technology with better quality images and are more environmentally friendly requiring less power and use fewer toxic chemicals
liquid crystal display (LCD)	A thin, flat display made up of any number of color or monochrome pixels arrayed in front of a light source or reflector.
magnetic-card reader	A machine that reads encoded information stored on a thin magnetic strip located on the back of a card.
magnetic-ink character recognition (MICR)	Used by banks to automatically read numbers on the bottom of checks and deposit slips.
maxicode	Type of bar code
monitor	A computer device that presents visual images of text and graphics. (See also display screen)
motion sensing device	An input device that controls games with user movements.
mouse	An input device that controls a pointer that is displayed on the monitor.
mouse pointer	Often in the form of an arrow, it moves on the screen as the user moves the computer mouse.
multifunctional device (MFD)	A type of combination input/output device that combines the capabilities of a scanner, printer, fax, and copy machine.
multitouch screen	A screen commonly used on mobile devices. These screens can be touched with more than one finger allowing for interaction.
optical-character recognition (OCR)	Uses special preprinted characters that can be read by a light source and changed into machine-readable code.
optical-mark recognition (OMR)	Senses the presence or absence of a mark.
optical mouse	A mouse that emits and senses light to detect mouse movement.
optical scanner	Accepts documents consisting of text and/or images and converts them to machine-readable form.
output	Processed data or information.
output device	Any hardware used to provide or to create output.
personal laser printer	A type of laser printer that does not support color, is less expensive, and slower than a standard laser printer.
picture elements	A series of dots that form images on a monitor. (See also pixel)
pixel	A series of dots that form images on a monitor. (See also

	picture elements)
pixel pitch	A function of a monitor that is the distance between each pixel. (See also dot pitch)
platform scanner	A wall or table mounted bar code scanner
plotter	A type of special-purpose printer for producing maps, images, and architectural and engineering drawings.
pointing device	A device that provides an intuitive interface with the system unit by accepting pointing gestures and converting them into machine-readable input.
portable scanner	Typically a handheld device that slides across the image, making direct contact.
printer	A device that translates information that has been processed by the system unit and presents the information on paper.
QR codes	Type of bar code
Repetitive strain injury	Injury that is caused by fast, repetitive work that can generate wrist, hand, and arm pain
resolution	A matrix of pixels.
RFID reader	A device used to read radio frequency identification information.
RFID (radio-frequency identification) tag	Information chips that are embedded in merchandise to track their location.
scanner	A scanning device that converts scanned text and images into a form that can be processed by the system unit.
scanning devices	Convert scanned text and images into a form that the system unit can process.
shared laser printer	A type of laser printer that is used by many people.
Skype	An audio and video communication service that does not require any dedicated hardware.
soft copy	Monitor output is described as soft copy.
speakers	An audio-output device.
stylus	A pen-like device commonly used with tablet PCs and PDAs.
technical writer	A person who prepares instruction manuals, technical reports, and other scientific or technical documents.
telephony	The transmission of telephone calls over computer networks.
thermal printer	A type of printer that uses heat elements to produce images on heat-sensitive paper.
thumb keyboard	Used on smartphones and other small portable devices. Designed primarily for communicating via texting and connecting to the Web, these keyboards are very small.
toggle key	A key that turns a feature on or off.
touch pad	Controls the pointer by moving and tapping a finger on the surface of a pad.
touch screen	Allows users to select actions or commands by touching the screen with a finger or penlike device.

traditional keyboard	A full-sized, rigid, rectangular keyboard that includes function, navigational, and numeric keys.
Universal Product Code (UPC)	A bar code system that almost all supermarkets use.
virtual keyboard	A keyboard image displayed on a touch screen.
virtual reality (VR)	Interactive sensory equipment (headgear and gloves) allowing users to experience alternative realities generated in 3-D by a computer, thus imitating the physical world.
Voice over IP (VoIP)	A type of communications system that uses the Internet rather than traditional communication lines to support voice communication. (See also IP telephony, Internet telephony)
voice recognition system	Uses a microphone, a sound card, and special software to allow users to operate computers and to create documents using voice commands.
wand reader	A hand-held bar code reader.
webcam	Specialized digital video cameras that capture images and send them to a computer.
wheel button	A button located in the middle of a mouse that can be rotated to scroll through information that is displayed on the monitor.
wireless mouse	A battery-powered device that typically uses radio waves or infrared light waves to communicate with the system unit. (See also cordless mouse)

Answers to End-of-Chapter Materials Chapter 7

Num	Multiple Choice Answers (Book)	Matching Answers (Book)	Multiple Choice Answers (www.mhhe.com/ce2015 Only)	Matching Answers (www.mhhe.com/ce2015 Only)
1	D	I	D	H
2	B	E	D	J
3	C	H	C	G
4	D	G	B	C
5	A	J	B	F
6	C	B	A	E
7	B	C	C	I
8	A	A	B	B
9	D	F	D	A
10	A	D	C	D

Open Ended Questions:

1. **Define input and input devices.**

Input is any data or instructions that are used by a computer. They can come directly from you or from other sources.

Input devices are hardware used to translate words, sounds, images, and actions that people understand into a form that the system unit can process

2. **Describe the different types of keyboard, pointing, scanning, image capturing, and audio-input devices.**

Variety of keyboard designs:

- **Traditional keyboards**—full-sized, rigid, rectangular keyboards that include function, navigational, and numeric keys.
- **Laptop keyboards** – widely used on laptop computers. They typically have fewer keys, do not include a numeric keypad, and do not have a standard location for the function and navigation keys.
- **Virtual keyboards** – displays an image of a keyboard on a touch screen which functions as the actual input device. Virtual keyboards are common on tablet computers and mobile devices.
- **Thumb keyboards** – widely used on smartphones and other small portable devices.

Variety of different pointing devices:

- Mouse – a mouse controls a pointer that is displayed on the monitor (optical mouse, a cordless or wireless mouse). Similar to a mouse are trackballs, touch pads, and pointing sticks.
- Touch screen allows users to select actions or commands by touching the screen with a finger or penlike device. Multitouch screens can be touched with more than one finger, which allows for interactions such as rotating graphical objects on the screen with your hand or zooming in and out by pinching and stretching your fingers.
- Stylus - penlike device commonly used with tablets PCs. Uses pressure to draw images on a screen.

There are five types of scanning devices:

- Optical scanners – also known simply as a scanner, accept documents consisting of text and/or images and convert them to machine-readable form. These devices do not recognize individual letters or images. Rather, they recognize light, dark, and colored areas that make up individual letters or images. Three basic types of optical scanners include: flatbed, document, and portable.
- Card readers – interpret encoded information on some type of identification card. Additionally, encoded information is often stored on the card as well. Two types include: magnetic (reads magnetic strip) and radio frequency (reads RFID microchip) card readers.
- Bar code readers– are used with electronic cash registers in supermarkets. Wand readers or platform scanners read UPC codes that are used to determine product descriptions and prices and to update inventory levels.

- RFID readers – radio-frequency identification tags are tiny chips that can be embedded in most everything. They contain electronically stored information. They are used to track and locate lost pets; to monitor production and update inventory; and to record prices, product descriptions, and locations of retail items.
- Character and mark recognition devices – recognize special characters and marks. Three basic types include: MICR (magnetic ink character recognition, read by readers/sorters), OCR (optical character recognition), and OMR (optical mark recognition)
- Image capturing devices – create or capture original images. These devices include digital cameras (images downloaded to system unit for further processing and/or printing) and digital video cameras. Webcams capture and send images over the Internet; one design is built-in and the other is attached.
- Audio-input devices – convert sounds into a form that can be processed by the system unit. By far the most used audio-input device is the microphone. Audio input takes many forms, including the human voice and music. Voice recognition systems use a combination of microphone, a sound card, and special software..

3. Define output and output devices.

Output is processed data or information. Output typically takes the form of text, graphics, photos, audio, and/or video.

- Output devices are hardware used to provide or to create output. They translate information that has been processed by the system unit into a form that people can understand. There are a wide range of output devices. The most widely used monitors, printers, and audio-output devices.

4. Describe the features and different types of monitors and printers.

Monitors are also known as display screens. They present visual images of text and graphics. The output is often referred to as soft copy. Monitors vary in size, shape, and cost. The most important characteristic is clarity which is a function of the following features:

- **Resolution** – one of the most important features of a monitor. Images are formed on a monitor by a series of dots or pixels. Resolution is expressed as a matrix of those dots or pixels.
- **Dot (pixel) pitch** – is the distance between each pixel. Most new monitors have a dot pitch of .31 mm or less. The lower the dot pitch (the shorter the distance between pixels), the clearer the images produced.
- **Contrast ratios** – indicate a monitor's ability to display colors. It compares the light intensity of the brightest white to the darkest black. The higher the ratio, the better the monitor.
- **Active display area (size)** – is measured by the diagonal length of a monitor's viewing area. Common sizes are 15, 17, 19, 21, and 24 inches. **Aspect ratio** – is determined by the width of a monitor divided by its height. Common aspect ratios for monitors are 4:3 (standard, similar to traditional television pictures) and 16:10 (wide screen)
- Different types of monitors include:

- **Flat-panel monitors** – are the most widely used type of monitor today. They are thin, more portable, and require less power to operate.
 - Most of today's flat-panel monitors are **LCD (liquid crystal display)**. One characteristic of LCD technology is that the monitors are back-lit meaning that a common source of light is dispersed over all the pixels on the screen. LED, light-emitting diode, advanced technology, slimmer, better picture quality and environmentally friendly.
- **E-book Readers** – are dedicated mobile devices for storing and displaying e-books and other electronic media including electronic newspapers and magazines.
- **Other Monitors** – these monitors are used for more specialized applications, such as reading books, making presentations, and watching television. Two of these specialized devices are digital whiteboards, and high-definition television (HDTV).
- **Printers:** translate information that has been processed by the system unit and present the information on paper. Printer output is often called hard copy.

Features – Basic distinguishing features include:

- **Resolution** - the clarity of images produced and measured in dpi (dots per inch). The higher the dpi, the better the quality of images produced.
- **Color capability** – provided by most printers today. Users typically have the option to print either with just black ink or with color.
- **Speed** - measured in the number of pages printed per minute.
- **Memory** – printer memory is used to store printing instructions and documents waiting to be printed. The more memory in a printer, the faster it will be able to create large documents.
- **Duplex printing** – Allows automatic printing on both sides of a sheet of paper.
- **Ink-jet printers**
 - Spray ink at high speed onto the surface of paper.
 - The most widely used printers.
 - Available in Black only or Color.
 - Reliable, quiet, and relatively inexpensive.
 - Most costly aspect is replacing ink cartridges.
- **Laser printers**
 - Use a laser light beam to produce images with excellent letter and graphics quality.
 - Available in Black only or Color.
 - Reliable, quiet, but more expensive than ink-jets.
 - Faster than ink-jets and are used in applications requiring high-quality output.
 - Two categories
 - Personal – used by single users
 - Shared – used by a group of users, typically support color, and are more expensive

- **Other Printers**

- **Cloud printers** are printers connected to the Internet that provide printing services to others on the Internet.
- **Thermal printers** use heat elements to produce images on heat-sensitive paper.
- **Plotters** are special-purpose printers for producing maps, images, and architectural and engineering drawings.

5. **Describe audio and video devices including portable media devices and Mobile DTV..**

Audio-Output Devices [I left this as this was marked to being confirmed. Is ti will be Bluetooth?] - translate audio information from the computer into sounds that people can understand.

- The most widely used audio-output devices are speakers and headphones.
- Audio-output devices are used to play music, vocalize translations from one language to another, and communicate information from the computer system to users.
- Mobile Digital Television (Mobile DTV) – technology that supports television broadcasting directly to smartphones, computers, and digital media players.

6. **Discuss combination input and output devices including multifunctional devices, Internet telephones, robots, and virtual reality headgear and gloves.** Combination input and output devices are hardware that combines input and output capabilities. Some of these include multifunctional devices, Internet telephones, and robots.

- **Multifunctional devices (MFD)**, - typically combine the capabilities of a scanner, printer, fax, and copy machine into one unit
- **Internet telephones** are specialized input and output devices for receiving and sending voice communication. Voice over IP (VoIP) is the transmission of telephone calls over computer networks.

7. **Define ergonomics and describe ways to minimize physical discomfort.**

Ergonomics is the study of human factors related to things people use. It is concerned with fitting the task to the user rather than forcing the user to contort to do the task. For computer users and manufactures this means devising ways that input and output devices can be used and designed to increase ease of use and to avoid health risks. Sitting in front of a screen in awkward positions for long periods may lead to physical problems such as eyestrain, headaches, and back pain. Computer users can alleviate these problems by taking frequent rest breaks and by using well-designed computer furniture.

- Eyestrain and headache – Take a 15-minute break every hour or two. Keep everything you're focusing on at about the same distance.
- Back and neck pain – Adjust your chair for height and angle, and the chair should have good back support. The monitor should be at eye-level or slightly below eye level. Use a footrest to reduce leg fatigue.
- Repetitive strain injury – (RSI) is an injury that is caused by fast, repetitive work that can generate neck, wrist, hand and arm strain. Use ergonomic keyboards and take frequent short rest breaks and gently massage your hands.