TOPIC TITLE: INPUT, OUTPUT, AND STORAGE

LEARNING OBJECTIVES:

At the end of the topic session, the students should be able to:

LO1: Determine the relationship between input and output;
LO2: Assess new technologies used for input and output; and
LO3: Identify important characteristics of storage.

MATERIALS/EQUIPMENT:

- Computer
- LCD projector
- File/s (03 Input, Output, and Storage)
  - 03 LCD Slides 1.ppsx
  - 03 Handout 1.pdf
  - 03 Task Performance 1.pdf
  - 03 Quiz 1.pdf
  - 03 Quiz 1 Answer Key.pdf
- Software requirements
  - MS PowerPoint
- White board marker and eraser

TOPIC PREPARATION:

- The instructor is encouraged to research for materials that will help supplement the topics in this session.
- Prepare the topic slides and handout for the topic.
- Encourage the students to take notes and inform them that the handout for this topic can be downloaded from eLMS.
- The instructor may use the suggested learning activities below to facilitate a thorough and creative discussion of the topic to create a student-centered class. However, it is imperative that you prepare additional examples or ideas as supplementary materials on the topic to be presented.
- Motivate the students to participate in all class activities and let them feel they are important. Religiously follow all activities as these were geared towards the achievement of the course learning outcomes.
- Anticipate possible questions that students might raise during discussion.
- The instructor is required to answer the seatwork and laboratory exercises.
- Bring examples of input, output, and storage devices to show to the students.

PRESENTATION OVERVIEW:

A.	Introduction	20 min
B.	Instructional Input	
	Input	40min
	Define what input and input devices are	
	Explain the different technologies used to input data	
	Output	40 min
	Define what output and output devices are	
	Explain the different technologies used to produce an output and how to select appropriate output devices	
	Storage	40 min
	Discuss what primary storage and secondary storage are	
	Explain how to choose appropriate storage devices and how these are evaluated	
	Discuss the basics of data storage	
	Explain what hard disks, solid-state storage, and optical discs are	
C.	Generalization	20 min
D.	Application	100 min
	Total duration	300 min

TOPIC PRESENTATION:

A. Introduction

Steps 1-2
Assessment: Recitation
Learning Objectives: LO1 and LO2

1. Ask the students the following:

   - How do you send instructions and information to the CPU?
   - How do you get information out?

   Note: Acknowledge and assess the answers coming from the class.

2. Afterwards, tell to the students the following statement:

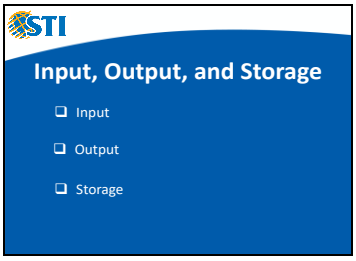
   We input text, music, and even speech. Input devices translate numbers, letters, special characters, and gestures that people understand into a form that computers can process.

   How does an information processed by the system unit is converted into a form that a user can use? That is the role of output devices. While input devices convert what we understand into what the system unit can process, output devices convert what the system unit has processed into a form that we can

understand. Output devices translate machine language into letters, numbers, sounds, and images that people can understand.

To efficiently and effectively use computers, you need to know about the most commonly used input devices and output devices. And in this topic, you will learn how to choose the right component for a particular computer system and task.

Slide 1



3. Present the topic coverage to the class using ***Slide 1*** of ***03 LCD Slides***
    - Input
    - Output
    - Storage

B. Instructional Input

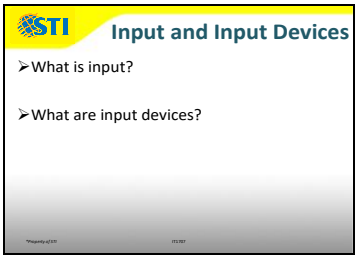
Input

Steps 1-2
Assessment: Recitation
Learning Objectives: LO1 and LO2

1. To start the discussion, ask at least three (3) students to define what input is. Encourage the students to participate.

    Note: Acknowledge and assess the answers coming from the class.

Slide 2



2. Define what input and input devices are. Provide additional examples. Use ***Slide 2***.

    Input is any data or instructions that are used by a computer. They can come directly from user or from other sources. Users provide input whenever they use system or application programs.

    For example, when using a word processing program, users enter data in the form of numbers and letters and issue commands such as save and to print documents. Users can also enter data and issue commands by pointing to items or using voice commands. Other sources of input include scanned or photographed images.

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

    For example, when using a word processor, users typically use a keyboard to enter text and mouse to issue commands. Keyboard and mouse are both input devices.

3. Ask at least three (3) students to enumerate their known example of input devices. Encourage them to participate.

   Note: Acknowledge and assess the answers coming from the class.

Slide 3

4. Using ***Slides 3-8***. Explain the different technologies used to input data. Provide additional examples of new technologies of input devices. Encourage the students to provide example of input devices.

   The following are the different technologies used to input data:

   - **Keyboard Entry** – A keyboard enables user to enter typed data (such as letters, numbers, and symbols).

     Keyboards convert numbers, letters, and special characters that people understand into electrical signals. These signals are sent to and processed by the system unit.

     There are a wide variety of keyboard designs. They range from the full-sized to miniature and can even be virtual. There are four (4) basic categories of keyboards: traditional, laptop keyboards, virtual, and thumb.

     - **Traditional keyboards** – these full-sized keyboards are widely used on desktops and larger computer. Traditional keyboards provide function keys, navigation keys, and numeric keypad.

     - **Laptop keyboards** – these keyboards are smaller than traditional keyboards and are widely used on laptop computers. Laptop keyboards 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** – these keyboards are used primarily with mobile devices and tablets. The keys are displayed on a screen and selected by touching their image on the screen.

Slide 4

   - **Pointing Devices** – Pointing devices provide a natural interface with the system unit by accepting physical movements or gestures.

     For example, a finger pointing or moving across a screen and converting these movements into machine-readable input.

There are wide variety of pointing devices, including the mouse, touch screen, game controller, and stylus.

- **Mouse** – a mouse controls a pointer that is displayed on the monitor. The **mouse pointer** usually appears in the shape of an arrow. A mouse can have one (1) or more buttons, which are used to select command options and to control the mouse pointer on the screen.

  The different designs of mouse are the following:

  - **Optical mouse** – it emits and senses light to detect mouse movement. The detected movements are communicated to the system unit through a cord.

  - **Cordless** or **Wireless mouse** – this uses radio waves or infrared light waves to communicate with the system unit.

  - **Touch pad** – this operates by moving or tapping the finger on the surface of a pad.

- **Touch Screen** – this allows users to select actions or commands by touching the screen with a finger or pen like device. **Multitouch screens** can be touched with more than one (1) finger, which allows for interactions such as rotating graphical objects on the screen with a hand or zooming in and out by pinching and stretching the fingers. These are commonly used with tablets and smartphones, as well as some laptop computers and desktop computers.

- **Game Controllers** – these are devices that provide input to computer games. While keyboard and mouse can be used as game controllers, there are four (4) specialized game controllers: joysticks, gaming mice, gamepads, and motion-sensing devices.

  - **Joysticks** – control game actions by users varying the pressure, speed, and direction of a control stick.

  - **Gaming mouse** – are similar to traditional mouse with higher precision,

faster responsiveness, programmable buttons, and better ergonomics.

- **Gamepads** – are designed to be held by two (2) hands and provide a wide array of inputs including motion, turning, stopping, and firing.

- **Motion-sensing devices** – control games by user movements. For example, Microsoft's Kinetic motion-sensing device accepts user movements and spoken commands to control games on the Xbox.

- **Stylus** – It is a pen-like device typically used with tablets and smartphones. A stylus uses pressure to draw images on a screen. Often, a stylus interacts with the computer through handwriting recognition software. **Handwriting recognition software** translates handwritten notes into a form that the system unit can process.

Slide 5

- **Scanning Devices** – These convert scanned text and images into a form that the system unit can process. There are five (5) types of scanning devices: optical scanners, card readers, bar code readers, RFID readers, and character and mark recognition devices.

  - **Optical Scanners** – these are also known as **scanners**. These 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. Typically, scanned documents are saved in files that can be further processed, displayed, printed, or stored for later use.

    There are four (4) basic types of optical scanners: flatbed, document, portable, and 3D.

    - **Flatbed scanner** – it is like a copy machine. The image to be scanned is placed on a glass surface, and the scanner records the image.

- **Document scanner** – is similar to a flatbed scanner except that it can quickly scan multipage documents. It automatically feeds one (1) page of a document at a time through a scanning surface.

- **Portable scanner** – is typically a handheld device that slides across the image, making direct contact.

- **3D scanners** – use lasers, cameras, or robotic arms to record the shape of an object. Like 2D scanners, most 3D scanners can recognize light, dark, and colored areas.

Optical scanners are powerful tools for a wide variety of end users, including graphics and advertising professional who scan images and combine them with text.

Slide 6

- **Card readers** – credit card, debit card, access card, and some type of identification card have some encoded information stored on them. **Card readers** interpret this encoded information.

  Magnetic card reader is the most common type. The 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.

- **Barcode readers** – These devices are either **handheld wand readers** or **platform scanners**. They contain photo-electric cells that scan or read **bar codes** (the vertical zebra-striped marks). Smartphones with the appropriate application can also scan codes.

- **RFID readers** – the **radio-frequency identification (RFID) tags** are tiny chips that can be embedded in most everything. They can be found in customer products, driver's licenses, passports, and etc. These chips contain electronically stored information that can be read using **RFID reader** located several yards away. They are widely used to monitor production and update inventory, and to record prices, product descriptions, and locations of

retail items. RFID are also used as a tracking device.

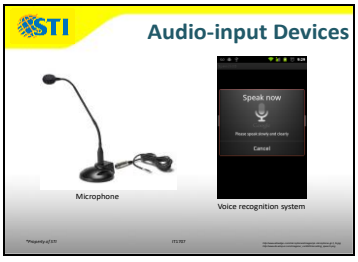
- **Character and Mark Recognition Devices** – these are scanners that are able to recognize special characters and marks. They are specially devices that are essential tools for certain applications. There are three (3) types: MICR, OCR, and OMR.
  - **Magnetic-ink character recognition (MICR)** – used by banks to automatically read those unusual numbers on the bottom of checks and deposit slips.
  - **Optical-character recognition (OCR)** – uses special preprinted character that can be read by a light source and changed into machine-readable code. A common OCR device is the handheld wand reader. These are used in department stores to read retail price tags and those printed on utility bills by reflecting light on the printed characters.
  - **Optical-mark recognition (OMR)** – senses the presence or absence of a mark, such as a pencil mark. OMR is often used to score standardized multiple-choice tests. These are used to scan bubble sheets.

Slide 7

- **Image Capturing Devices** – The scanners read existing data and scan existing photographs and documents. Image capturing devices, on the other hand, capture new content.

  A capture device can capture either still images or motion video. These devices include **digital cameras** and **webcams**.

Slide 8



- **Audio-input Devices** – These convert sounds into a form that can be processed by the system unit. By far the most widely used audio-input device is the microphone. Audio input can take many forms, including the human voice and music.
  - **Voice Recognition Systems** – these systems use a microphone, a sound card, and special

software. These systems allow users to operate computers and other devices as well as to create documents using voice commands.

Step 5
Assessment: Recitation
Learning Objectives: LO1 and LO2

5. Afterwards, ask at three (3) students to answer the following:

    - How are image capturing devices different from an optical scanner?
    - Describe two (2) image capture devices.
    - What are voice recognition systems?

    Note: Acknowledge and assess the answers coming from the class.

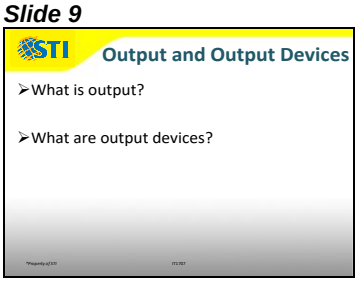
Output

Steps 1-3
Assessment: Recitation
Learning Objectives: LO1 and LO2

1. Ask at least three (3) students what output and output devices are and give examples. Encourage the students to participate.

    Note: Acknowledge and assess the answers coming from the class.

Slide 9



2. Using ***Slide 9***, define what output and output devices are. Provide additional examples.

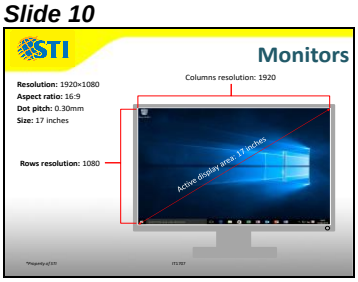
    Output is processed data or information. Output typically takes the form of text, graphics, photos, audios, and video. For example, when a user creates a presentation using a presentation graphics program, the user typically input text and graphics.

    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. There are wide range of output devices. The most widely used are monitors, printers, and audio-output devices.

3. Explain the different technologies used to produce an output and how to select appropriate output devices. Prepare additional examples of output devices. Use the examples in ***Slide 10-12***.

    The following are the different technologies used to produce an output:

Slide 10



- **Monitors** – These are also known as **display screens**, monitors present visual images of text and graphics. The output of a monitor is often referred to as **soft copy**.

  Features

  The most important characteristic of a monitor is its clarity. **Clarity** refers to the quality and sharpness of the displayed images. It is a function of several monitor features, including resolution, dot pitch, contrast ratio, size, and aspect ratio.

  - **Resolution** – is one (1) of the most important features. Images are formed on a monitor by a series of dots or **pixels (picture elements)**. Resolution is expressed as a matrix of these dots or pixels. For example, a monitor has a resolution of 1,920 pixel columns by 1,080 pixel rows for a total of 2, 073, 600 pixels. The higher a monitor's resolution (the more pixel), the clearer the image produced.

  - **Dot (pixel) pitch** – is the distance between each pixel. Most newer monitors have a dot pitch of 0.30 mm (30/100th of a millimeter) or less. The lower the dot pitch (the short the distance between pixels), the clearer the images produced.

  - **Contrast ratios** – indicate a monitor's ability to display images. It compares the light intensity of the brightest white to the darkest black. The higher the ratio, the better the monitor. Good monitor typically has contrast ratios between 500:1 and 2000:1.

  - **Size** or **active display area** – is measured by the diagonal length of a monitor's viewing area. Sizes can be represented by inches, centimeters, or millimeters. Common sizes are 15, 17, 19, 21, and 24 inches.

  - **Aspect ratio** – indicates the proportional relationship between a display's width and height. Typically, this relationship is expressed by two (2) numbers separated by a colon (:). Most monitors have a 16:9 aspect ratio designed to display wide-screen content.

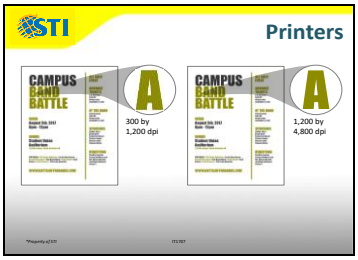
- **Printers** – These translate information that has been processed by the system unit and present the information on paper. Printer output is often called the **hard copy**.

  Features

  There are many different types of printers. Printers have some basic distinguishing features, including resolution, color capability, speed, memory, and duplex printing.

  - **Resolution** – is the measure of the clarity of images produced. Printer resolution is measured in **dots per inch (dpi)**. Most printers designed for personal use average 1,200 by 4,800 dpi. The higher the dpi, the better the quality of images produced.
  - **Color** – this capability is provided by most printers today. Users typically have the option to print either with just black ink or with color.
  - **Speed** – this is measured in the number of pages printed per minute. Typically, printers for personal use has the average 15 to 19 pages per minute for single-color (black) output and 13 to 15 pages per minute for color output.
  - **Memory** – the memory within a printer is used to store printing instructions and documents waiting to be printed. The more memory, the faster it will be able to print large documents.
  - **Duplex printing** – this allows automatic printing on both sides of a sheet of paper.

Slide 11



Slide 12

- **Audio-Output Devices** – These devices translate audio information from the computer into sounds that people can understand. The most widely used audio-output devices are **speakers** and **headphones**. These devices connect to a sound card within the system unit. This connection can be by cable to an audio jack on the system unit, or the connection can be wireless.

Step 4
Assessment: Recitation
Learning Objectives: LO1 and LO2

4. Afterwards, ask at three (3) students to answer the following:

   - Describe the features to consider in selecting a monitor.

- Describe the features to consider in selecting a printer.
- Explain what is the relationship between input devices and output devices.

Note: Acknowledge and assess the answers coming from the class.

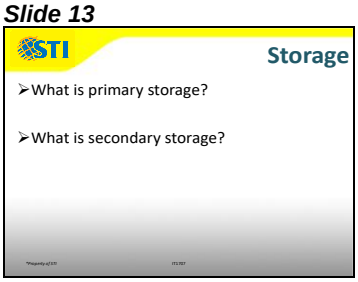
Storage

Steps 1-5
Assessment: Recitation
Learning Objective: LO3

1. Ask at least three (3) students to define what primary and secondary storages are. Encourage the students to participate.

   Note: Acknowledge and assess the answers coming from the class.

Slide 13



2. Afterwards, show ***Slide 13*** and discuss to the students what primary storage and secondary storage are, and what are the examples of each.

   When a computer process data, random access memory (RAM) holds that data temporarily or volatile. RAM is referred to as **primary storage** because its where the data must be in order to interact with the CPU. Data waits for the CPU's attention in memory, and then it waits again in memory when the CPU has finished processing it.

   Primary storage holds data and program instructions for processing data. It also holds processed information before it is output.

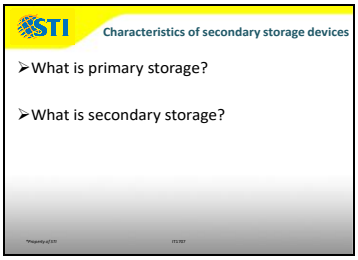
   For the data to be safely and permanently stored, it must be placed in a secondary storage. **Secondary storage** devices are non-volatile, so they don't lose their contents when the computer's power is turned off. Secondary storage can include hard-disk drives, solid state drives, CDs, DVDs, and network and cloud-based storage.

   Secondary storages are permanent storage used to preserve programs and data that can be retained after the computer is turned off.

   Using secondary storage devices, data can be retained after the computer has been shut off. This is accomplished by **writing** files and **reading** files from the storage devices.

Writing is the process of saving information to the secondary storage device. **Reading** is the process of accessing information from secondary storage device.

Slide 14



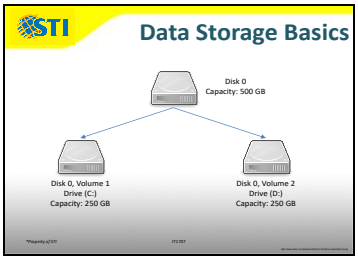
3. Using ***Slide 14***, explain how to choose appropriate storage devices and how these are evaluated.

   Storage devices are evaluated in these ways:

   - **Media type** – these are the physical material that holds the data and programs. Is the media magnetic, optical, or solid state?
   - **Capacity** – it is the measure of how much a particular storage medium can hold.
   - **Access speed** – measures the amount of time required by the storage device to retrieve data and programs. How quickly can the data be written and retrieved?
   - **Portability** – is the storage inside the system unit, or connected to it externally?
   - **Removability** – is the disc removable from the drive that reads and writes it, or are they one (1) attached unit?

   Most desktop personal computer systems have hard-disk drives and optical disk drives, as well as ports where additional storage devices can be connected.

Slide 15



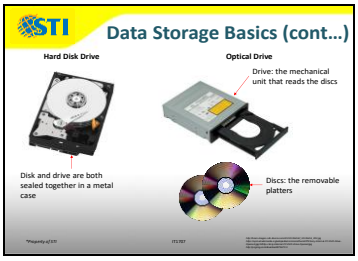
4. Discuss the basics of data storage and provide additional examples. Use ***Slides 15-16***.

   Data Storage Basics
   Data such as files and folders are stored on **volumes**. Each volume has a letter followed by a colon, such as (C:) or (D:). Each volume may have different purpose, for example, volume 1, drive (C:) is the volume used to store the operating system files and the installed applications.

   The term **disk** refers to a platter or set of platters on which data is stored. Examples include a hard disk drive (HDD) and a DVD.

   The term **drive** refers to the mechanical components that read and write the data on a disk.

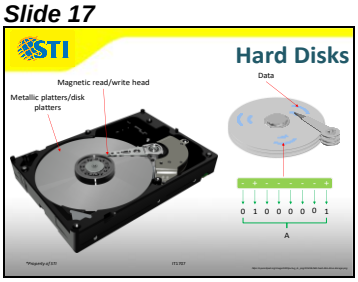
Slide 16



5. Use ***Slides 17-22***. Explain what hard disks, solid-state storage, and optical discs are. Provide additional examples of each.

   The following are the different storage media type:

Slide 17



Hard Disks

Hard disks save files by altering the **magnetic charges** of the disk's surface to represent binary (**1s** and **0s**). Hard disk retrieve data and programs by reading these charges from the magnetic disk. Characters are represented by positive (+) and negative (-) charges using the ASCII or Unicode binary codes. For example, the letter A would require a series of 8 charges. In hard disks, the information is written to and read from a platter as it rotates past devices called read/write heads.

Hard disks use rigid **metallic platters** that are stacked one (1) on top of another.

Hard disks are sensitive instruments. Their **read/write heads** (a component in a disk drive that reads and writes to the disk) ride on a cushion of air about 0.000001 inch thick. It is so thin that a smoke particle, fingerprint, dust, or human hair could cause what is known as a **head crash**.

Slide 18

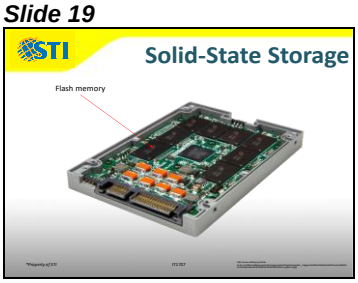
A head crash occurs when a read-write head makes contact with the hard disk's surface or with particles on its surface. The disk surface is scratched, and some or all data is destroyed.

There are two (2) basic types of hard disks: internal and external:

- **Internal hard disks** – these are installed/located inside the system unit. These hard disks are able to store and retrieve large quantities of information quickly. They are used to store programs and data files. For example, a personal computer uses its internal hard disk to store its operating system and major applications such as Word and Excel. Internal hard disks provide fast access, have a fixed amount of storage and cannot be easily removed from the system unit.

- **External hard drives** – these hard disks provide slower access and are typically connected to a USB port outside the system unit. These hard disks are removable. External hard drives are used for backing up the contents of the internal hard disk and providing additional hard-disk capacity.

Slide 19



Solid-State Storage

Unlike hard disks, solid-state storage devices have no moving parts and the access time is very fast because there are no read/write heads that have to move anywhere to get the data. Data and information are stored and retrieve electronically directly from these devices much as they would be from

conventional computer memory. Solid-state storage is a storage media made from silicon microchips.

Solid-state storage devices provide access to **flash memory**, also known as **solid-state storage**.

There are three (3) different solid-state storage devices:

Slide 20

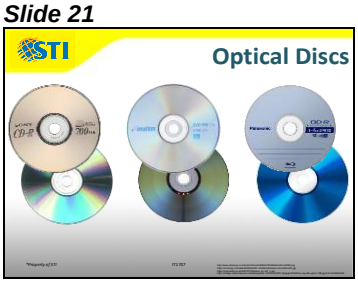
- **Solid-State Drives** – these are designed to be connected inside a personal computer system the same way an internal hard disk would be, but contain solid-state memory instead of magnetic disks to store data. SSDs are faster and more durable than hard disks. SSDs also require less power, which can lead to increased battery life for laptops and mobile devices.

- **Flash Memory Cards** – these are small solid-state storage devices widely used in portable devices. Some of the cards are used within devices such as laptops, smartphones, and GPS navigation systems. Other cards provide removable storage. For example, flash memory cards of digital cameras.

- **USB Drives** – also called as **flash drives**. These drives conveniently connect directly to a computer's USB port to transfer files and can have capacities ranging from 1GB to 256GB.

Optical Discs

Slide 21



In optical disc technology, a laser beam alters the surface of a plastic or metallic disc to represent data. Unlike hard disks, which use magnetic charges to represent 1s and 0s, optical discs use reflected light. The disc is read by an **optical disc drive** using a laser that projects a tiny beam of light on these areas. The amount of reflected light determines whether the area represents a 1 or a 0.

The most widely used optical discs are CD, DVD, and Blu-ray discs:

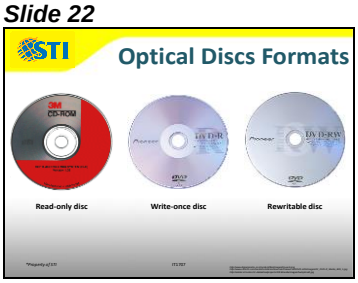
- **Compact discs (CDs)** – these store up to 700MB of storage. Use to store music.

- **Digital versatile discs (DVDs)** – these can store up to 4.7GB. Use to store movies or software.

- **Blu-ray discs (BDs)** – these are designed to store high definition video, which uses the HD 720 and HD 1080 resolutions. These has the capacity of 50GB or higher. These are used to store high definition video and video games.

Each of these optical discs has three (3) basic formats: read only, write once, and rewritable.

Slide 22



- **Read-only discs (ROM** for **read-only memory)** – these are optical discs that cannot be written on or erased by the user. Optical discs on a store, such as music CDs, DVD movies, and Blue-ray video games, are often read only.
- **Write-once discs (R** for **recordable)** – these can be written once. After that, the disc can be read many times but cannot be re-written on or erased.
- **Rewritable discs (RW** for **rewritable** or **RAM** for **random-access memory)** – these are similar to write-once discs, but can be re-written.

C. Generalization

Step 1
Assessment: Quiz
Learning Objectives: LO1, LO2, and LO3

1. To assess the students understanding about the topic, facilitate the class with a quiz using **03 Quiz 1**.
2. Collect the students' quizzes.
3. Ask the students if there are any clarifications about the discussion.

D. Application

Step 1
Assessment: Hands-on activity
Learning Objective: LO3

1. Distribute to the students the printed copies of **03 Task Performance 1**.
2. Ask the students to individually perform the hands-on activities instructed in **03 Task Performance 1**. Give them ample time to finish. Move around the class to check their activities. Tell them that they can consult you with their concerns regarding the activities.

REFERENCES

O'Leary, T., O'Leary L., and O'Leary D. (2017). *Computing essentials 2017.* USA: McGraw-Hill Education.

Wempen, F. (2014). *Computing Fundamentals Digital Literacy Edition.* United Kingdom: John Wiley & Sons, Ltd.