**Chapter 17**

**Graphics and Multimedia**

*Lesson 17.1:* Fundamentals of Graphics

*Lesson 17.2:* Introduction to Multimedia

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***Lesson 17.1***

***Fundamentals of Graphics***

**17.1.0 Objectives**

*On completion of this lesson you will know:*

* *Basic concepts of computer graphics*
* *Graphics application packages*
* *Basics of color*
* *Image and Texture*

**17.1.1 Computer Graphics**

A computer can generate numeric and alphanumeric outputs. Bar charts, building plans, circuit diagram, contour map etc are the example of alphanumeric outputs. Thus it is desirable that a computer processes graphical inputs and also displays output in a pictorial form. The advances of computer hardware and software have led to the development of inexpensive graphic input and output devices. Computer graphics are generated using computers and, more generally, the representation, manipulation and display of pictures with the aid of a computer. With the appearance of graphical user interface (GUI), computer graphics has become integral parts of all computers today. GUI is a type of user interface that allows users to interact with electronic devices using images rather than text commands. By pointing to an icon using pointing device, various operations are initiated. Most application programs now have GUI which makes them easy to use.

Many powerful tools have been developed to visualize data. Computer generated images can be categorized into several different types: two-dimensional (2D), 3D, and animated graphics. 3D computer graphics have become more common now-a-days, but 2D computer graphics are still widely used.

**17.1.2 Pixel and Vector Graphics:**

Computer graphics are mainly classified into two distinct categories: raster graphics and vector graphics. Many graphics programs focus exclusively on either vector or raster graphics, but there are a few that combine both. It is easy to convert from vector graphics to raster graphics, but the reverse conversion is harder. Images are typically produced by optical devices, such as cameras, mirrors, lenses, telescopes, microscopes, etc; natural objects, such as the human eye, and phenomena, such as water surfaces. A digital image is a representation of a 2D image in binary format as a sequence of ones and zeros. Digital images include both vector images and raster images, but raster images are more commonly used.

**Pixel (or picture element):** In computer graphics, a raster graphics image, or bitmap is a dot matrix data structure. In the enlarged portion of an image, individual pixels are rendered as squares and can be seen easily. Pixels are normally arranged in a regular 2D grid, and are often represented using dots or squares as shown in Figure 17.1.1.



Figure 17.1.1: 8 × 5 pixel image, that is, 40 pixels total

The image, in Figure 17.1.1, consists of just 40 pixels so in reality would appear as no more than a small grey dot. The gaps between the pixels do not really exist – they are just shown for clarity. One can imagine each pixel to be like a tiny square light bulb of any colour and any brightness. Real images are, of course, a lot more complex and consist of many more pixels. Each pixel is a sample of an original image, where more samples typically provide a more accurate representation of the original. In color systems, each pixel has typically three components such as red, green, and blue.

**Vector graphics**: Vector graphics is also called geometric modeling and object-oriented graphics. It uses of geometrical primitives, such as points, lines, curves and polygons, which are all based upon mathematical equations to represent image. Vector graphics editors typically allow rotation, movement, mirroring, stretching, skewing, affine transformation, changing of z-order and combination of primitives into more complex objects. More sophisticated transformations include set operation, such as union, intersection etc, on closed shape.

**17.1.3 Concepts and Principles of Computer Graphics**

**Rendering:** Rendering is the process of generating an image from a model or a scene file by means of computer programs. A scene file contains objects in a strictly defined language or data structure. It contains geometry, viewpoint, texture, lighting, and shading information as a description of the virtual scene. The data contained in the scene file is then passed to a rendering program to be processed and output to a digital image or raster graphics image file. The rendering program is usually built into the computer graphics software.

**3D projection**: 3D projection is a method of mapping 3D points to a 2D plane. As most current methods for displaying graphical data are based on planar 2D media, the use of this type of projection is widespread, especially in computer graphics, engineering and drafting.

**Ray tracing**: Ray tracing is a technique for generating an image by tracing the path of light through pixels in an image plane. The technique is capable of producing a very high degree of photorealism; usually higher than that of typical scan line rendering methods, but at a greater computational cost.

**Shading:** Shading refers to depicting depth in 3D models or illustrations by varying levels of darkness. It is a process used in drawing for depicting levels of darkness on paper by applying media more densely or with a darker shade for darker areas, and less densely or with a lighter shade for lighter areas.

**Texture mapping:** Texture mapping is a method for adding detail, surface texture, or colour to a computer-generated graphic or 3D model. Its application to 3D graphics was pioneered by Dr Edwin Catmull in 1974. A texture map is mapped to the surface of a shape, or polygon.

**17.1.4 Major graphic file formats**

A file format is a standardized method of encoding data for storage. It tells what kind of data is contained in the file and how the data be organized. The file format used to store images information is called graphic file format.

**Raster formats**

***BMP (BitMap file) Format****:* It is one of the most commonly used graphics file format by using windows. Typically, BMP files are uncompressed and hence they are large. The advantage is their simplicity and wide acceptance in Windows programs. Images in the .BMP format are generally stored with a colour depth of 2 (1-bit), 16 (4-bit), 256 (8-bit), 65536 (16-bit), or 16.7 million (24-bit) colours (the bits represent the bits per pixel), 8-bit images can also be grayscale instead of indexed color.

***PICT (PICTure) Format***: It is a graphics file format on Apple Macintosh computer as its standard metafile format. It allows the interchange of graphics (both bitmapped and vector), and some limited text support, between Mac applications, and was the native graphics format of QuickDraw.

***TIFF (Tagged Image File Format)***: The TIFF is one of the most widely bitmap format available that normally saves 24-bit (8 bits red+ 8 bits green+8 bits blue) or 48-bit (16 bits red+ 16 bits green+16 bits blue) usually using either the TIFF or TIF filename extension. The TIFF stores a wide variety of image data in tagged files. It is versatile, open-ended and flexible, since hundreds of different types of tagged files are available and more can be developed as needed. This versatility allows the TIFF format to be used over a wide variety of computer systems and to define a wide range of bitmap images.

The TIFF is intended to be independent of specific operating systems, filing systems, compilers and processors. Since TIFF uses pointer (byte offsets) quite liberally, a TIFF file is most easily read from a random access device such as hard disk or flexible diskette or USB flash drive.

***JPEG (Joint Photographic Experts Group)*:** In computing, JPEG is a commonly used method of compression for photographic images. It is a lossy image compression method where the compressed images are usually stored in the JFIF (JPEG File Interchange Format) file format. The JPEG/JFIF filename extension is JPG or JPEG. Almost all digital camera save default images in the JPEG/JFIF format, which supports 8-bit grayscale images and 24-bit color images (8 bits each for red+8 bits each for green+8 bits each for blue). JPEG files suffer generational degradation when repeatedly edited and saved. The JPEG/JFIF format is available as one of several alternative image formats in Portable Document File (PDF) .

***JPEG 2000***: JPEG 2000 is a compression standard enabling both lossless and lossy storage. They improve quality and compression ratios, but also require more computational power to process. It is used currently in professional movie editing, e.g., JPEG 2000 for individual movie frames.

***GIF (Graphics Interchange Format)*:** It is limited to an 8-bit palette or (28=) 256 colors and makes it suitable for storing graphics with relatively few colors such as simple diagrams, shapes, logos and cartoon style images. The GIF format supports animation and is still widely used to provide image animation effects.

The GIF provides the option to specify how many colours will be saved. By doing this, it is possible to decrease the image size. GIF uses a non-lossy compression algorithm. This means that images do not loose bits when they are compressed. In order to accomplish this, GIF uses a proprietary encoding/decoding scheme called LZW (Lempel Zev Welch). LZW is an excellent compression algorithm which typically results in very small file.

**Vector file Format:**

***CGM***: Computer Graphics Metafile (CGM) is a [free](http://en.wikipedia.org/wiki/Free_file_format) and [open](http://en.wikipedia.org/wiki/Open_standard) [international standard](http://en.wikipedia.org/wiki/International_standard) file format for 2D [vector graphics](http://en.wikipedia.org/wiki/Vector_graphics), [raster graphics](http://en.wikipedia.org/wiki/Raster_graphics), and [text](http://en.wikipedia.org/wiki/Character_(computing)). It specifies all graphical elements in a textual source file which is compiled into a [binary file](http://en.wikipedia.org/wiki/Binary_file) or one of two text representations. It provides a means of graphics data interchange for computer representation of 2D graphical information independent from any particular application, system, platform, or device..

**SVG:** Scalable Vector Graphics (SVG) is an [XML](http://en.wikipedia.org/wiki/XML)-based [vector image format](http://en.wikipedia.org/wiki/Vector_image_format) for 2D graphics that supports interactivity and animation. The SVG specification is an [open standard](http://en.wikipedia.org/wiki/Open_standard) developed by the [World Wide Web Consortium](http://en.wikipedia.org/wiki/World_Wide_Web_Consortium) (W3C) since 1999. SVG images and their behaviors are defined in XML text files and they can be searched, indexed, [scripted](http://en.wikipedia.org/wiki/Scripting_language), and, if need be, [compressed](http://en.wikipedia.org/wiki/Data_compression). As XML files, SVG images can be created and edited with any [text editor](http://en.wikipedia.org/wiki/Text_editor), but it is often more convenient to create them with drawing programs such as [Inkscape](http://en.wikipedia.org/wiki/Inkscape).

**17.1.5 Graphics Software:**

Creating a digital image or editing an existing image is not a simple task. Some sophisticated graphics programs are developed to create digital image. These programs are Paint Programs, Photo-editing programs, and Draw Programs etc.

**Paint Program:** Paint program work by turning on or off Pixels displayed on the screen. A cursor which has been assigned a particular color or pattern that moves across the screen, painting each square it passes over. A paint program that enables us to draw pictures on the display screens which are represented as bit maps.

Most paint programs provide the tools in the forms of icon. By selecting an icon, we can perform functions associated with the tools. In addition to these tools, paint programs also provide easy ways to draw common shapes such as straight lines, rectangles, circles, and other shapes.

Sophisticated paint applications are often called image editing programs. These applications support many of the features of draw programs such as the ability to work with objects. Each object, however, is represented as a bit map rather than as a vector image.

**Draw Programs:** In contrast to paint programs, draw programs use vector graphics. Draw programs allow the user to create geometrically based objects. After they are created, they can be moved, resize, altered and adjusted. These programs are better suited to projects that are more graphically oriented with text included as an important element. And not suited for someone who wants to create a free hand drawing or painting. In addition, graphics produces with a draw program have no inherent resolution. Rather, they can be represented at any resolution which makes them ideal for high resolution output.

**17.1.6 Computer Animation**

Computer animation is the art of creating moving images via the use of computers. It is a subfield of computer graphics and animation. Increasingly it is created by means of 3D computer graphics, though 2D computer graphics are still widely used for stylistic, low bandwidth, and faster real-time rendering needs. Sometimes the target of the animation is the computer itself, but sometimes the target is another medium, such as film. It is also referred to as CGI (Computer-generated imagery or computer-generated imaging), especially when used in films.

Animation software is used either for computer animation or to assist animators with the considerable work needed to create more traditional pieces of animation. Animation softwares are available for 2D and 3D animations. 2D software provides animators with the ability to use computers to carry out the time consuming repetitive tasks that are needed when building a sequence of frames.

**17.1.7 Virtual Reality:**

In virtual reality, a computer system merges computer generated material and a mixture of real world experiences in order to allow for simulated real world representation. A Virtual Reality system is considered to be an expansion of a multimedia system into a multi-sensory system. A Virtual Reality PC or workstation may include some of the following:

* Tactile interaction by using Head Mounted Display (HMD) and Tactile feedback devices, vibrotactile displays
* Force feedback by Teleoperation systems
* Motion platforms - flight simulators, motion simulators
* Wired clothing – datasuit
* Biological input (biosensor) - voice recognizer, skin temperature probe, myoelectric (muscle) sensor, cerebroelectric (brain) sensor
* Multimedia GIS, graphical output
* Graphics such as Visual Display Unit (VDU), 3D display
* Interactive interface tools such as keyboard, mouse, light pen, 3D pen position sensor and data glove, which transmits positional data from the wearer's hand movements, for access and manipulation.
* Data storage such as Hard Disk with capacities of up to tens of GB, CD and DVD.
* Multimedia on networks such as hypermedia systems and distributed databases on LANs, WANs or Internet. Hypermedia systems are multimedia systems with link-based navigation.

Some applications of a VR system are:

* Self-led interaction with the real world, especially for children and mentally challenged person, can be employed by using VR
* VR can be bring into play for architectural simulation, urban planning, resource modeling.
* VR can be utilized for improving realism of interaction with spatial data.
* In Military, VR can be used for training purposes and scenario building, particularly VR representations of terrain.
* In scientific research, VR can be employed for environmental monitoring, hazard and risk assessment, atmospheric modelling, planning and forecasting. Pollution analysis, terrain visualization and multi-variate analysis can also be made by using VR.

**17.1.8 Computer Graphics Applications**

Computer graphics may be subdivided into three broad areas. These are:

1. ***Generative graphic*:** It refers to graphic that as a whole or a part has been created by using an autonomous system. The main objectives of generative graphics are: generation of pictures from mathematical representation using computer, transformation of picture data and retrieval of pictures. In this case a computer takes numbers, mathematical formulae, digitized pictures in order to generate monochrome and colour computer generated 2D and 3D pictures and animation. Generative graphic is used in computer aided design, such as design electrical, electronic, mechanical and structural components and systems, and computer aided manufacturing, such as manufacturing information of parts or subassembly list.
2. ***Cognitive Graphics***: It deals with algorithm to recognize and classify pictures, for example algorithm to classify pictures of thumbprints, classify peoples’ faces. In such application, the pictures are converted to digital form using optical scanners. The digital information is transformed and classified by specially written patter recognition programs.
3. ***Image Processing***: It deals with acquiring pictures, representing them in appropriate formats for storing and transmitting, and cleaning up noisy or blurred images and creating clear picture. For example, X-ray picture of certain human organs may be obscured by intervening tissue. The X-ray is digitized with a scanner. The digital information is transformed with appropriately chosen algorithms which sharpens the image. The digital information is converted back to a picture and displayed. The new image would be much clear.

**17.1.9 Key points**

* A computer can not only generate numeric output but also generate alphanumeric.
* Computer graphics are graphics generated using computers and, more generally, the representation, manipulation and display of pictures with the aid of a computer.
* Computer generated images can be categorized into several different types: 2D, 3D, and animated graphics.
* Computer graphics are mainly classified into two distinct categories: raster graphics and vector graphics.
* Pixels are normally arranged in a regular 2D grid, and are often represented using dots or squares.
* vector graphics use geometrical primitives such as points, lines, curves and polygons,
* Rendering is the process of generating an image from a model or a scene file by means of computer programs.
* 3D projection is a method of mapping 3-D points to a 2-D plane.
* Ray tracing is a technique for generating an image by tracing the path of light through pixels in an image plane.
* Shading refers to depicting depth in 3D models or illustrations by varying levels of darkness.
* Texture mapping is a method for adding detail, surface texture, or colour to a computer-generated graphic or 3D model.
* BMP is one of the most commonly used graphics file format by using windows.
* The TIFF is one of the most widely bitmap format available that normally saves 24-bit (8 bits red+ 8 bits green+8 bits blue) or 48-bit (16 bits red+ 16 bits green+16 bits blue) usually using either the TIFF or TIF filename extension.
* JPEG is a commonly used method of compression for photographic images.
* It is limited to an 8-bit palette or (28=) 256 colors and makes it suitable for storing graphics with relatively few colors such as simple diagrams,
* Computer animation is the art of creating moving images via the use of computers.
* Virtual entities may contain and be controlled by assorted attributes, such as transform values (location, orientation, and scale) stored in an object's transformation matrix.

**17.1.10 Practice Set**

**Multiple Choice Questions**

1. 3D projection is a method of mapping \_\_\_\_\_\_\_\_\_\_\_.
   1. 3D points to a 1D plane
   2. 3D points to a 2D plane
   3. 2D points to a 3D plane
   4. 3D points to a 3D plane
2. Which one is not the component of a multimedia system?
   1. capture devices
   2. digitizing/sampling hardware, storage devices, communication networks
   3. Computer System
   4. None of above.
3. JPEG is \_\_\_\_\_\_\_\_\_\_
   1. text compression model
   2. a lossy image compression method
   3. used method of decompression for photographic images
   4. None

**Review Question**

1. What is computer graphics?
2. Distinguish between Raster and Vector graphics.
3. What do you understand by Rendering?
4. What do you mean by Texture mapping?
5. What are the Major graphic file formats

**Analytical Question**

1. Explain the Rendering process.
2. Explain the Virtual Reality.
3. What are the three broad areas of Computer graphics? Explain them.
4. Name the major graphic file formats. Explain any two of them.
5. Write some applications of computer graphics.

** *Lesson 17.2***

***Introduction to Multimedia***

**17.2.0 Objectives**

*On completion of this lesson you will know:*

* *Basic concepts of multimedia*
* *Multimedia applications*
* *Multimedia authoring*

**17.2.1 Basic Concepts of Multimedia**

Multimedia means that computer information can be represented through audio, video, and animation in addition to text, graphics drawings and images as shown in Figure 17.2.1. In general, multimedia is the field concerned with the computer-controlled integration of text, graphics, drawings, still and moving images, animation, audio etc where every type of information can be represented, stored, transmitted and processed digitally. A multimedia application is an application which uses a collection of multiple media sources e.g. text, graphics, images, sound/audio, animation and/or video. Hypermedia can be considered as one of the multimedia applications.



Figure 17.2.1: Multimedia

A Multimedia system has four basic characteristics, these are:

* Multimedia systems must be computer controlled.
* Multimedia systems are integrated.
* The information they handle must be represented digitally.
* The interface to the final presentation of media is usually interactive.

**17.2.1 Components of a Multimedia System:**

The components of a multimedia system are:

* **Capture devices:** Video Camera, video recorder, audio microphone, keyboards, mice, graphics tablets, 3D input devices, tactile sensors, virtual reality (VR) devices.
* **Digitizing/Sampling Hardware:** Scanner
* **Storage Devices:** Hard disks, CD-ROMs, Jaz/Zip drives, DVD, etc
* **Communication Networks:** Ethernet, Token Ring, FDDI, ATM, Intranets, Internets.
* **Computer Systems:** Multimedia Desktop machines, Workstations, MPEG/VIDEO/DSP Hardware
* **Display Devices:** CD-quality speakers, HDTV, SVGA, Hi-Resolution monitors, Colour printers etc.

Figure 17.2.2 shows a multimedia system consists of a multimedia PC, plotter, printer, projector and scanner. Storage devices, communication devices are integrated with the PC.



**Figure 17.2.2**: Components of a multimedia system

**Hypertext and HyperMedia**

**Hypertext:** A special type of database system, invented by Ted Nelson in the 1960s, in which objects (text, pictures, music, programs, and so on) can be creatively linked to each other as shown in Figure 17.2.2. When a user selects an object, the user can see all the other objects that are linked to it. One can move from one object to another even though they might have very different forms. For example, while reading a document about Mozart, one might click on the phrase Violin Concerto in A Major, which could display the written score or perhaps even invoke a recording of the concerto. Clicking on the name Mozart might cause various illustrations of Mozart to appear on the screen. The icons that are selected to view associated objects are called Hypertext links or buttons.



Figure 17.2.2 Hypertext

Hypertext systems are particularly useful for organizing and browsing through large databases that consist of disparate types of information. There are several Hypertext systems available for Apple Macintosh computers and PCs that enable to develop databases. Such systems are often called authoring systems. HyperCard software from Apple Computer is the most famous.

**HyperMedia:** An extension to hypertext that supports linking graphics, sound, and video elements in addition to text elements. The World Wide Web is a partial hypermedia system since is supports graphical hyperlinks and links to sound and video files. New hypermedia systems under development will allow objects in computer videos to be hyperlinked. The World Wide Web (WWW) is the best example of hypermedia applications.

**17.2.3 Multimedia software**

A user can create a presentation by putting collected a mixture of text, graphic and audio files together. There are a number of software packages which allow us to create our own multimedia presentation.

**Presentation packages:** Presentation packages are application packages that allow a user to create multimedia presentations. This is done by creating slides or pages, which can include text, sound and graphics. The most common presentation package is Microsoft PowerPoint.

**Multimedia authoring packages:** Multimedia authoring packages are similar to presentation packages but have more sophisticated facilities for creating multimedia presentation. To create stand-alone multimedia applications such as Microsoft Encarta, professionals use multimedia authoring packages such as Hyperstudio and Macromedia Director.

**Desktop publishing packages:** DTP packages, such as Microsoft Publisher and Quark Express use material such as text and graphics that have already been created and saved to another file. The material already created is imported into the DTP package, which allows lying out page in any format a user choose. Most DTP packages come with a number of templates such as Newspaper Front Page, Birthday Cards and Calendars ready to import material to create own design.

**Templates:** Most packages will provide the user with templates, which can be adapted to suit the user’s needs. Templates are ready-made blank documents with placeholders for the insertion of text and graphics. Examples of templates are: calendars, birthday cards, newspaper page, etc.

**17.2.4 Authorware:**

Authorware or Authoring tools are programs that help to write hypertext or multimedia applications. These enable to create a final application linking together objects, such as a paragraph of text, an illustration, or a song. One can produce attractive and useful graphics applications by defining relationships of objects to each other, and sequencing them in an appropriate order. Most authoring systems also support a scripting language for more sophisticated applications.

Scripting language is a high-level programming language that is interpreted by another program at runtime rather than compiled by the computer's processor. Scripting languages can be embedded within HTML. It is used to add functionality to a Web page, such as different menu styles or graphic displays or to serve dynamic advertisements. JavaScript, ASP, JSP, PHP and Python are examples of scripting languages. Table 17.2.1 shows the differences between authoring and programming.

***Table 17.2.1 authoring versus programming.***

|  |  |
| --- | --- |
| **Authoring** | **Programming** |
| It is a assembly of Multimedia | It involves low level assembly of Multimedia |
| It is possibly high level graphical interface design | It is the construction and control of Multimedia |
| It is some high level scripting | It involves real languages like C and Java. |

**17.2.6 Applications of multimedia:**

Multimedia can be used in a variety of ways, and a multimedia presentation can be put together in a variety of different formats.

**Commercial uses:** Much of the electronic media used by commercial artists is multimedia. Exciting presentations are used to grab and keep attention in advertising. Business to business, and interoffice communications are often developed by creative services firms for advanced multimedia presentations beyond simple slide shows to sell ideas or liven-up training. Commercial multimedia developers may be hired to design for governmental services and nonprofit services applications as well.

**Entertainment and fine arts:** In addition, multimedia is heavily used in the entertainment industry, especially to develop special effects in movies and animations. Multimedia games are a popular pastime and are software programs available either as CD-ROMs or online. Some video games also use multimedia features. Multimedia applications that allow users to actively participate instead of just sitting by as passive recipients of information are called Interactive Multimedia. In the Arts there are multimedia artists, whose minds are able to blend techniques using different media that in some way incorporates interaction with the viewer. One of the most relevant could be Peter Greenaway who is melding Cinema with Opera and all sorts of digital media. Another approach entails the creation of multimedia that can be displayed in a traditional fine arts arena, such as an art gallery. Although multimedia display material may be volatile, the survivability of the content is as strong as any traditional media. Digital recording material may be just as durable and infinitely reproducible with perfect copies every time.

**Education:** In Education, multimedia is used to produce computer-based training courses and reference books like encyclopedia and almanacs. Students can search encyclopedias such as Encarta, which provide facts on a variety of different topics using multimedia presentations. Teachers can use multimedia presentations to make lessons more interesting by using animations to highlight or demonstrate key points. A multimedia presentation can also make it easier for pupils to read text rather than trying to read a teacher’s writing on the board. It is more intuitive than old ways and teachers can simulate situations in real life. It also allows students to learn by themselves after the class.

**Business:** Many companies use multimedia for advertising and selling products on the Internet. Some businesses also use multimedia for training their staff using CD-ROMs or online tutorials. This form of training saves the company money, as they do not have to pay the additional expenses of an employee attending a course away from the workplace.

**Leisure:** People use the Internet for a wide range of reasons, including shopping and finding out about their hobbies. The Internet has many multimedia elements embedded in web pages and web browsers support a variety of multimedia formats. Many computer games use sound tracks, 3D graphics and video clips.

**Industry:** In the Industrial sector, multimedia is used as a way to help present information to shareholders, superiors and coworkers. Multimedia is also helpful for providing employee training, advertising and selling products all over the world via virtually unlimited web-based technology.

**Medicine:** In Medicine, doctors can get trained by looking at a virtual surgery or they can simulate how the human body is affected by diseases caused by micro-organism.

**Journalism:** News reporting is not limited to traditional media outlets. Freelance journalists can make use of different new media to produce multimedia pieces for their news stories. It engages global audiences and tells stories with technology, which develops new communication techniques for both media producers and consumers.

**Mathematical and scientific research:** In mathematical and scientific research, multimedia is mainly used for modeling and simulation. For example, a scientist can look at a molecular model of a particular substance and manipulate it to arrive at a new substance.

**17.2.7 Keypoints**

* Multimedia means that computer information can be represented through audio, video, and animation in addition to traditional media (i.e., text, graphics drawings, images).
* The components of a multimedia system are: capture devices, digitizing/sampling hardware, storage devices, communication networks, and computer systems.
* Hypertext systems are particularly useful for organizing and browsing through large databases that consist of disparate types of information.
* An extension to hypertext that supports linking graphics, sound, and video elements in addition to text elements.
* The World Wide Web is a partial hypermedia system since is supports graphical hyperlinks and links to sound and video files.
* Text is one of the mostly used mediums of appearance. In 99% of the occasions text provides the core structure to the package.
* An Authoring System is a program which has pre-programmed elements for the development of interactive multimedia software titles.
* Multimedia authoring involves collating, structuring and presenting information in the form of a digital multimedia, which can incorporate text, audio, and still and moving images.
* The Scripting paradigm is the authoring method closest in form to traditional programming. The paradigm is that of a programming language, which specifies (by filename) multimedia elements, sequencing, hotspots, synchronization, etc.

**17.2.8 Practice Set**

**Multiple Choice Questions**

1. Multimedia means that computer information can be represented through \_\_\_\_\_\_\_\_\_\_\_.
   1. Audio and video only
   2. Audio, video and animation only.
   3. audio, video, and animation in addition to text, graphics and images
   4. None of above.
2. Which one is not the component of a multimedia system?
   1. capture devices
   2. digitizing/sampling hardware, storage devices, communication networks
   3. Computer System
   4. None of above.
3. An extension to hypertext that supports \_\_\_\_\_\_\_\_\_\_
   1. linking graphics, sound, and video elements
   2. linking graphics, sound, and video elements in addition to text elements.
   3. linking of text
   4. None

**Review Question**

1. What do you understand by Multimedia?
2. What are the four basic characteristics of multimedia system?
3. Define Hypertext and HyperMedia
4. What is an Authoring System?
5. Distinguish between authoring versus programming.
6. What is Authorware?
7. What is a scripting paradigm?

**Analytical Question**

1. Write down the features and components of a Multimedia System.
2. Explain briefly Multimedia Authoring Paradigms.
3. Write a short note on Multimedia software.
4. List main applications of Multimedia.