SHRIMATI INDIRA GANDHI COLLEGE

(NATIONALLY ACCREDITED AT "A" GRADE (3RD CYCLE) BY NAAC)

TIRUCHIRAPPALLI-2

INSTRUCTION MATERIAL

COMPUTER GRAPHICS AND MULTIMEDIA

DEPARTMENT OF COMPUTER SCIENCE

COMPUTER GRAPHICS & MULTIMEDIA

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TIRUCHIRAPPALLI - 2

COMPUTER GRAPHICS AND MULTIMEDIA

Unit I

Overview of graphics systems: Video display devices – Raster-scan systems – Random-scan systems – Graphics monitors and workstation – Input devices – Hard-copy devices – Graphics software.

Unit II

Output primitives: Points and lines – Line-drawing algorithms – DDA algorithm – Bresenham's line algorithm – Attributes of output primitives: Line attributes – Area-fill attributes – Character attributes – Bundled attributes.

Unit III

Two-dimensional Geometric transformations: Basic transformations – Matrix representations – Composite transformations – Other transformations.

Unit IV

Multimedia in Use : Introducing Multimedia for Today and Tomorrow – What is Multimedia – using Multimedia: Applications, Benefits and Problems – Technology : System Components – Multimedia Platforms.

Unit V

Technology: Development Tools – Image – Audio – Video.

Text Books:

1. Computer Graphics C Version Second Edition, Dona ld Hearn and M.Pauline Baker, Pearson Education, 2006.
2. Multimedia in Practice : Technology and Practice . Judith Jeffcoate, Pearson Education, 2007.

Reference Books:

1. William M. Neuman, Robert R. Sprout, "Principle s of interactive Computer Graphics", McGraw Hill International Edition.
2.Buford J. F Koegel, Multimedia Systems, Twelfth Indian Reprint, Pearson Education.

SECTION –A (2 MARKS)

1. Define Computer graphics.

Computer graphics remains one of the most existing and rapidly growing Computer fields. Computer graphics may be defined as a pictorial representation or graphical representation of objects in a computer.

2. What is meant by scan code?

When a key is pressed on the keyboard, the keyboard controller places a code carry to the key pressed into a part of the memory called as the keyboard buffer. This code is called as the scan code.

3. What is meant by refreshing of the screen?

Some method is needed for maintaining the picture on the screen. Refreshing of screen is done by keeping the phosphorus glowing to redraw the picture repeatedly. (i.e.)By quickly directing the electronic beam back to the same points

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4. Define Random scan/Raster scan displays?

Random scan is a method in which the display is made by the electronic beam which is directed only to the points or part of the screen where the picture is to be drawn. The Raster scan system is a scanning technique in which the electrons sweep from top to bottom and from left to right. The intensity is turned on or off to light and unlight the pixel.

5. List out the merits and demerits of Penetration techniques.

The merits and demerits of the Penetration techniques are as follows :
It is an inexpensive technique It has only four colors The quality of the picture is not good when it is compared to other techniques It can display color scans in monitor's Poor limitation etc.

6. List out the merits and demerits of DVST?

The merits and demerits of direct view storage tubes [DVST] are as follows
It has a flat screen Refreshing of screen is not required Selective or part erasing of screen is not possible It has poor contrast Performance is inferior to the refresh CRT.

7. What do you mean by emissive and non-emissive displays?

The emissive display converts electrical energy into light energy. The plasma panels, thin film electro-luminescent displays are the examples. The Non emissive are optical effects to convert the sunlight or light from any other source to graphic form. Liquid crystal display is an example.

8. What is persistence?

The time it takes the emitted light from the screen to decay one tenth of its original intensity is called as persistence.

9. What is resolution?

The maximum number of points that can be displayed without an overlap on a CRT is called as resolution.

10. List out the merits and demerits of Plasma panel display:

Merits: Refreshing is not required Produce a very steady image free of Flicker
Less bulky than a CRT.

Demerits: Poor resolution of up to 60 d.p.i,It requires complex addressing and wiring It is costlier than CRT.

11. What is Aspect ratio?

The ratio of vertical points to the horizontal points necessary to produce length of lines in both directions of the screen is called the Aspect ratio. Usually the aspect ratio is ¾.

12. What is meant by Addressability?

The Addressability is the number of individual dots per inch (d.p.i) that can be created. If the address of the current dot is (x, y) then the next dot will be (x+y), (x+y+1) etc.

13. What is a dot size?

Dot size may be defined as the diameter of a single dot on the devices output. Dot size is also called as the Spot size.

14. What is inter dot distance?

Inter dot distance is the reciprocal of addressability. If the addressability is large, the inter dot distance will be less. The inter dot distance should be less to get smooth shapes.

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15. What is the difference between impact and non-impact printers?

Impact printer press formed character faces against an inked ribbon on to the paper. A line printer and dot-matrix printer are examples.

Non-impact printer and plotters use Laser techniques, inkjet sprays, Xerographic process, electrostatic methods and electro thermal methods to get images onto the papers. Examples are: Inkjet/Laser printers.

16. What are the features of Inkjet printers?

They can print 2 to 4 pages/minutes. Resolution is about 360d.p.i. Therefore better print quality is achieved. The operating cost is very low. The only part that requires replacement is ink cartridge. 4 colors cyan, yellow, magenta, black.

17. Define pixel

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Pixel is shortened forms of picture element. Each screen point is referred to as pixel or pel.

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18. What is frame buffer?

Picture definition is stored in a memory area called frame buffer or refresh buffer.

19. What are the advantages of laser printer?

High speed, precision and economy.
Cheap to maintain.
Quality printers.
Lasts for longer time.
Toner power is very cheap.

20. What are the advantages of electrostatic plotters?

They are faster than pen plotters and very high quality printers. Recent electrostatic plotters include a scan conversion capability. Color electrostatic plotters are vailable. They make multiple passes over the paper to plot color pictures.

21. What is bitmap and what is pixmap?

The frame buffer used in the black and white system is known as bitmap which take one bit per pixel. For systems with multiple bits per pixel, the frame buffer is often referred to as a pixmap.

22. What is a Vector display or stroke writing or calligraphic display?

Random scan monitors draw a picture one line at a time and for this reason are also referred as vector displays.

23. Where the video controller is used?

A special purpose processor, which is used to control the operation of the display device, is known as video controller or display controller.

24. What do you mean by scan conversion?

A major task of the display processor is digitizing a picture definition given in an application program into a set of pixel intensity values for storage in the frame buffer. This digitization process is called scan conversion.

25. What is an output primitive?

Graphics programming packages provide function to describe a scene in terms of these basic geometric structures, referred to as output primitives.

26. What do you mean by 'jaggies'?

Line with stair step appearance is known as jaggies.

27.What is point in the computer graphics system?

The point is a most basic graphical element & is completely defined by a pair of user Coordinates (x , y).

28. Write short notes on lines?

A line is of infinite extent can be defined by an angle of slope q and one point on the line P=P(x,y). This can also be defined as Y=mx+C where C is the Yintercept.

29. Define Circle.

Circle is defined by its center xc, yc and its radius in user coordinate units.

30. Define polygon.

A polygon is any closed continues sequence of line segments ie, a polyline whose last node point is same as that of its first node point. The line segments form the sides of the polygon and their intersecting points from the vertices of the polygon.

31. Distinguish between convex and concave polygons.

If the line joining any two points in the polygon lies completely inside the polygon then, they are known as convex polygons. If the line joining any two points in the polygon lies outside the polygon then, they are known as concave polygons.

32. What is seed fill?

One way to fill a polygon is to start from a given point (seed) known to be inside the polygon and highlight outward from this point i.e neighboring pixels until encounter the boundary pixels, this approach is called seed fill.

33. What is scan line algorithm?

One way to fill the polygon is to apply the inside test. i.e to check whether the Pixel is inside the polygon or outside the polygon and then highlight the pixel which lie inside the polygon. This approach is known as scan-line algorithm.

34. Define coherence properties

A coherence property of a scene is apart of a scene by which relate one part of the scene with the other parts of the scene.

35. What is an active edge list in the scan line algorithm?

The active edge list for a scan line contains all edges crossed by that scan line.

36. What is cell array?

The cell array is a primitive that allows users to display an arbitrary shape defined as a two dimensional grid pattern.

37. What is type face?

Letters, numbers and other characters can be displayed in a variety of sizes and styles. The overall design style for a set of characters is called a type face.

38. What do you mean by font?

The term font referred to a set of cast metal character forms in a particular size and format, such as 10 point courier italic.

39. What is a bitmapped font?

A simple method for representing the character shapes in a particular typeface is to use rectangular grid patterns. The set of characters are then referred to as a bitmap font.

40. What is an outline font?

A flexible scheme is to describe character shapes using straight-line and curve sections. In this case, the set of character is called an outline font.

41. What is an attribute parameter?

Any parameter that affects the way a primitive is to be displayed is referred to as an attribute parameter.

42. What are the various attributes of a line?

The line type, width and color are the attributes of the line. The line type include solid line, dashed lines, and dotted lines.

43. What is pixel mask?

Pixel mask is a string containing the digits 1 and 0 to indicate which positions to plot along the line path. The mask 1111000 could be used to display a dashed line with a dash length of 4 and inter dot spacing of three.

44. What is a Line cap?

Line caps can be used to adjust the shape of the line ends to give a better appearance. There are three types of line caps. Butt cap which has a square end, round cap which has a semi circle end, projecting square cap which has one half of the line width beyond the specified end points.

45. List out the methods used for smoothly joining two line segments?

Mitter join-by extending the outer boundaries of each of the two lines until they meet.

Round join-by capping the connection between the two segments with a circular boundary whose diameteris equal to the line width.

Bevel join–by displaying the line segments with butt caps and filling in the triangular gap where the segment meet.

46. What is Color Look up table?

In color displays, 24 bits per pixel are commonly used, where 8 bits represent 256 level for each color. It is necessary to read 24bit for each pixel from frame buffer. This is very time consuming. To avoid this video controller uses look up table to store many entries to pixel values in RGB format. This look up table is commonly Known as colour table.

47.What is tiling patterns?

The process of filling an area with rectangular pattern is called tiling and rectangular fill patterns are sometimes referred to as tiling patterns.

48. What is soft fill?

Soft fill is a filling method in which fill color is combined with the background Colors

49. What is kerned character?

The characters which extend beyond the character body limits is known as kerned Character. Example f and j.

50. What is character up vector?

The orientation for a displayed character string is set according to the direction of the character up vector.

51. Define bundled attributes.

Individual attribute commands provide a simple and direct method for specifying attributes when a single output device is used. When several kinds of output device are available at a graphics installation, it is convenient to set up a table for each output device that lists set of attribute values that are to be used on that device to display each primitive type. Attribute specified in this manner is known as bundled attribute.

52. What is aliasing?

In the line drawing algorithms, all raster zed locations do not match with the true line and have to represent a straight line. This problem is severe in low resolution screens. In such screens line appears like a stair-step. This effect is known as aliasing.

53. What is antialiasing?

The process of adjusting intensities of the pixels along the line to minimize the effect of aliasing is called antialiasing.

54. What is pixel phasing?

Pixel phasing is an antialiasing technique, stair steps are smoothed out by moving the electron beam to more nearly approximate positions specified by the object geometry.

55. What is Transformation?

Transformation is the process of introducing changes in the shape size and orientation of the object using scaling rotation reflection shearing & translation etc.

56. Write short notes on active and passive transformations?

In the active transformation he points x and x represent different coordinates of the same coordinate system. Here all the points are acted upon by the same transformation and hence the shape of the object is not distorted. In a Passive transformation the points x and x| represent same points in the space but in a

different coordinate system. Here the change in the coordinates is merely due to the change in the type of the user coordinate system.

57. What is translation?

Translation is the process of changing the position of an object in a straight-line path from one coordinate location to another. Every point (x , y) in the object must undergo a displacement to x|,y|). the transformation is: x| = x + tx y| = y+ty

58. What is scaling?

The scaling transformations changes the shape of an object and can be carried ou t by multiplying each vertex (x,y) by scaling factor Sx,Sy where Sx is the scaling factor of x and Sy is the scaling factor of y.

59. What is shearing?

The shearing transformation actually slants the object along the X direction or the Y direction as required.ie; this transformation slants the shape of an object along a required plane.

60. What is reflection?

The reflection is actually the transformation that produces a mirror image of an object. For this use some angles and lines of reflection.

61. Distinguish between window port & view port?

A portion of a picture that is to be displayed by a window is known as window port. The display area of the part selected or the form in which the selected part is viewed is known as view port.

62. Define clipping.

Clipping is the method of cutting a graphics display to neatly fit a predefined Graphics region or the view port.

63. What is covering (exterior clipping)?

This is just opposite to clipping. This removes the lines coming inside the windows and displays the remaining. Covering is mainly used to make labels on the complex pictures.

64. What is the need of homogeneous coordinates?

To perform more than one transformation at a time, use homogeneous coordinates or matrixes. They reduce unwanted calculations intermediate steps saves time and memory and produce a sequence of transformations.

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65. Define Projection

The process of displaying 3D into a 2D display unit is known as projection. The projection transforms 3D objects into a 2D projection plane.

66. what are the steps involved in 3D transformation?

Modeling Transformation
Viewing Transformation
Projection Transformation
Workstation Transformation

67. **Define Multimedia.**

Multimedia is the field concerned with the computer-controlled integration of text, graphics, drawings, still and moving images (Video), animation, audio, and any other media where every type of information can be represented, stored, transmitted and processed digitally.

68. Write the elements of multimedia.

Text, Audio, Video, image, graphics.

69. Define Text:

Text is the sequence of characters used as basic tools of multimedia. Text can be used at any place of Multimedia

Example: Menu bar, Message Box

70. Define Audio.

Audio is the sound system that can be added to a computer. An *audio* card contains a special built-in processor and memory for processing *audio* files and sending them to speakers in the computer.

An *audio* file is a record of captured sound that can be played back.

Example: mp3 and wav files

71.Give example for video file or format

- AVI (Audio Video Interleave) ...
- FLV (Flash Video Format) ...
- WMV (Windows Media Video) ...
- MOV (Apple QuickTime Movie) ...
- MP4 (Moving Pictures Expert Group 4)

72. What is animation?

Animation is the process of designing, drawing, making layouts and preparation of photographic sequences which are integrated in the multimedia and gaming products.

Example: gif , swf (flash files)

73.What is meant by multimedia systems?

A **Multimedia System** is a **system** capable of processing **multimedia** data and applications. A **Multimedia System** is characterised by the processing, storage, generation, manipulation and rendition of **Multimedia** information.

74. What is graphic and multimedia software?

Graphic art **software** is a subclass of application **software** used for **graphic** design, **multimedia** development, stylized image development, technical illustration, general image editing, or simply to access **graphic** files.

75. What graphics are used for?

Uses. **Graphics** are visual elements often **used** to point readers and viewers to particular information. They are also **used** to supplement text in an effort to aid readers in their understanding of a particular concept more clear and interesting.

76.What is meant by JPG format?
JPG is a file extension for a lossy graphics file. The JPEG file extension is used interchangeably with **JPG**. JPEG stands for Joint Photographic Experts Group who created the standard.

77. What is compression?
Compression is a reduction in the number of bits needed to represent data. **Compressing** data can save storage capacity, speed up file transfer, and decrease costs for storage hardware and network bandwidth.

78. Write the Significance of compression techniques in multimedia system
There is much significance of compression techniques in multimedia system. With the techniques we get less disk space for data, faster reading and writing, faster file transfer, variable dynamic range and byte order independence.

79. Write about Classification of coding method or compression:
There are two kinds of coding method in multimedia system. They are,

1. Lossless
2. Lossy

Lossless compression is that type of compression where the amount of data or information is not reduced and from where the original data can be reconstructed. Lossy compression is that type of compression where the amount of information is reduced during the compression and an approximate of original data can be reconstructed during decompression.

80. What do you mean by image compression?

Image compression is a type of data **compression** applied to digital **images**, to reduce their cost for storage or transmission. Algorithms may take advantage of visual perception and the statistical properties of **image** data to provide superior results compared with generic **compression** methods.

81.What is text compression in multimedia?
Data **Compression in Multimedia** (**Text**,Image,Audio and Video) Data **compression** is the process of encoding data using a representation that reduces the overall size of data. This reduction is possible when the original dataset contains some type of redundancy.

82.What is a data compression?
In signal processing, **data compression**, source coding, or bit-rate reduction involves encoding information using fewer bits than the original representation. **Compression** can be either lossy or lossless. ... The process of reducing the size of a **data** file is referred to as **data compression**.

83.Why do we need compression in multimedia?
In order to manage large **multimedia** data objects need to be **compressed** to reduce file size and at the receiver end it needs to be reconstructed, decompressed . ... **Compression** is useful because it helps reduce the consumption of expensive resources, such as hard disk space or transmission bandwidth.

SECTION –B(5 MARKS)

1. Explain refresh cathode ray tube?

A beam of electrons, emitted by an electron gun, passes through focusing and deflection systems that direct the beam toward specified positions on the phosphor coated area. The phosphor that emits a small spot of light at each position contacted by the electron beam One way to keep phosphor glowing is to redraw the picture repeatedly by quickly directing the electron beam back over the same points This type of display is called is called refresh CRT

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Primary components of electron gun are:

♣Heated metal cathode: Heat is supplied to the cathode by directing the beam through a coil of wire called the filament inside the cylindrical cathode structure.

♣Control grid: Intensity of the electron beam is controlled by setting the voltage levels on the control grid, which is a metal cylinder that fits to the cathode.

Different kinds of phosphorus are available besides color the major difference between phosphors is their persistence the maximum number of points that can be displayed without overlap on a CRT is referred to as resolution. Another property is
aspect ratio.

2. Explain color CRT monitors?

A CRT monitor displays color pictures by using a combination of phosphors that emit different colored light. By combining the emitted light from the different phosphors, a range of colors can be generated. Two techniques:

Beam penetration method
Shadow mask method

Beam penetration method Display color pictures Two layers of phosphors, usually red and green A beam of slow electrons excites the outer red layer Fast electron penetrates through the red layer and excites the inner green layer An intermediate beam speeds, combinations of red and green light

Shadow mask method They Produce a wider range of colors Has three phosphor color dots at each pixel position One emits red light, another emits green light, and the third emits a blue light The three beams are deflected and focused as a group on to the shadow mask, which contains a series of holes aligned with a phosphor dot patterns. When the three beams passes through a hole in the shadow mask, they activate a dot triangle, which appears as a small color spot on the screen.

3. Explain direct view storage tubes and liquid crystal displays.

Liquid crystal displays Refers to the compounds having crystalline arrangement of molecules flow of liquid. Two plates each glass plate contains a light polarized that are right angles to each other.¬
Two types
Passive matrix LCD
Active matrix LCD
Direct view storage tubes alternative method for maintaining a screen image Stores picture information as a charge distribution Very complex pictures can be displayed at very high resolutions To eliminate the picture section the entire screen must be erased The erasing and redrawing process can take several seconds for a picture.

4. Explain Raster scan systems.

Several processing units contain a special purpose processor, called video controller or display controller. Video controller fixed area of the system memory is reserved for the frame buffer, and the video controller is given access to the frame buffer memory Tow registers are used to store the coordinates of the screen pixels The value is stored in the frame buffer for this pixel position is then retrieved and used to set the intensity of the CRT beam Initially the x register is set to 0 and the y register is set to ymax Then the x register is incremented by 1, and the process repeated for the next pixel on the top scan line This process is repeated for each pixel along the scan line After the last pixels on the top scan line have been processed, the x register is reset to 0 and the x register is decremented by 1. The procedure is repeated fro each successive line Frame buffer locations and the corresponding screen positions are referenced as Cartesian coordinates.

5. Explain Non-Interactive vs interactive:

	Non-Interactive Entertainment (Film as example)	Interactive Entertainment (Video Games as example)
Definition	A fixed, self-contained and pre-conceived passive experience, fictional or not, typically featuring a narrative, often with a beginning, a middle and an end.	An incomplete but reactive construct of mechanics, defined by rules and driven by external input; often a pre-conceived but incomplete -- and therefore not

		functional -- narrative structure is weaved into the construct.
Audience & Participants	The audience members are observers and not able to interact and participate and therefore incapable of influencing or changing the experience directly.	The audience members are participants and their interaction is a vital element of the experience.
	The construct of the experience contains all necessary elements correctly structured and ordered. It is therefore complete even without the audience observing. *A film doesn't just stop by itself should you in the middle of it decide to walk out of the cinema.*	Although the experience contains all the necessary elements, they are not in the desired structure and order. The interaction of the participant is required to complete the construct. *If you stop playing a video game, it will just pause or idle, unable to continue meaningfully without turning non-interactive.*
Author control of content	The author has full control over the structure of the experience and contributes all the pieces required to make the structure complete and functional. *In a film or book the author has full control over setting, structure, narrative and characters, including protagonist & antagonist.*	The author only has control over rules, structure and, if available, the narrative shell construct. The author can lay down the premise and define the basic structure but he is unable to provide the full set of instructions without breaking the interactivity. *Although in games the author can define the mechanics, rules, setting, characters, narrative and structure, he is not allowed to directly control certain important elements, most notably the*

		player's role (e.g. protagonist)
Author control of structure	The author can easily dictate structure, pace, progress, perception and perspective and interchange at will.	While the author author can setup the structure, pace and perspective, it is ultimately up to the player to control progress, perspective and perception.
Immersive & Emotional Delivery Language	The various forms of non-interactive entertainment have their own immersion and emotional delivery language: For novels it'd be choice of structure, words, perspective, pace, perception, etc whilst audiovisual media like film and TV use narrative structure, camera framing, editing, lighting, sound, music, actor performance, etc.	Video games have not yet fully established their own immersion and emotional delivery language; instead they borrow heavily – and mostly – from established audiovisual non-interactive forms of entertainment (e.g. language of film for creation of cutscenes)
Evocable emotions	Because the audience only observes the experience, the emotions evoked are indirect and reactive towards experience. The audience will feel for the characters and situations but it will not necessarily feel *the same*.	Because the participant is one of the main pillars in interactive experiences, any emotions evoked are direct and personal. This means games can unlock an additional set of emotions in the participant: guilt, regret, success, euphoria, revenge, personal satisfaction and others.
Interpretation (encoding / decoding of output / input)	The individual platforms (film, TV, book, play, etc) define the encoding standard for the output of the experience. An audience member needs to have the necessary knowledge,	The individual platforms (e.g. type of interactive entertainment) often have two separate encoding standards, one for output (presentation) and one for input (interaction).

	consciously or subconsciously, to decode the experience successfully. Often this decoding requires is a two-step process: First factual decoding (e.g. objects, their properties and their actions) followed by an interpretation pass (the meaning). *For example, in order to read a novel you have to have a few basic skills: You need to be able to read, to understand the language the novel is written in and you need to know how a basic narrative structure works. This will allow you to access and decode the factual information which is the first decoding step mentioned above. That doesn't necessarily mean that you fully understand the novel from an interpretation point of view, maybe because it deals with cultural aspects you are not familiar with.*	The input encoder can be two-fold: The first layer defines interaction with the platform specific interface (e.g. controller, keyboard, mouse) with the second experience-dependent decoding layer translating interactions into experience-specific inputs. *Most video games platforms have a form of a controller to read the inputs from the player, which he has to first understand. Then the inputs the player gives are read and interpreted in the game (e.g. A for Jump)*

PASSIVE / ACTIVE form of enter-tainment	PASSIVE form of entertainment.	ACTIVE form of entertainment.
	In order for the audience to enjoy this form of entertainment, their frame of mind needs to be in a state of willingness to accept that the experience is pre-constructed, self-sufficient and complete without any need of interaction.	In order for people to enjoy this form of entertainment, they need to want to actively participate in the experience for it to function properly - which requires a different state of mind than non-interactive entertainment. This means that interactive entertainment does not replace non-interactive entertainment but rather compliments it.

6. Difference between Vector Scan Display and Raster Scan Display

Vector Scan Display	Raster Scan Display
1. In vector scan display the beam is moved between the end points of the graphics primitives.	1. In raster scan display the beam is moved all over the screen one scan line at a time, from top bottom and then back to top,
2. Vector display flickers when the number of primitives in the buffer becomes too large.	2. In raster display, the refresh process is independent of the complexity of the image.
3. Scan conversion is not required.	3. Graphics primitives are specified in terms of their endpoints and must be scan converted into their corresponding pixels in the frame buffer.
4. Scan conversion hardware is not required.	4. Because each primitive must be scan-converted,real time dynamics is for more computational and requires separate scan conversion hardware.
5. Vector display draws a continuous and smooth lines.	5. Raster display can display mathematically smooth lines, polygons, and boundaries of curved primitives only by approximating them with pixels on the raster grid.
6. Cost is more.	6. Cost is low.
7. Vector display only draws lines and characters.	7. Raster display has ability to display areas filled with solid colours or patterns.

7.Explain the following

INPUT DEVICES:

- **Keyboard**
- **Mouse**
- **Joy Stick**
- **Light pen**
- **Track Ball**
- **Scanner**
- **Graphic Tablet**
- **Microphone**
- **Magnetic Ink Card Reader(MICR)**
- **Optical Character Reader(OCR)**
- **Bar Code Reader**
- **Optical Mark Reader(OMR)**

Keyboard

Keyboard is the most common and very popular input device which helps in inputting data to the computer. The layout of the keyboard is like that of traditional typewriter, although there are some additional keys provided for performing additional functions.

Keyboards are of two sizes 84 keys or 101/102 keys, but now keyboards with 104 keys or 108 keys are also available for Windows and Internet.

The keys on the keyboard are as follows:

S.No	Keys	Description
1	Typing Keys	These keys include the letter keys (A-Z) and digit keys (0-9) which generally give same layout as that of typewriters.
2	Numeric Keypad	It is used to enter numeric data or cursor movement. Generally, it consists of a set of 17 keys that are laid out in the same configuration used by most adding machines and calculators.
3	Function Keys	The twelve function keys are present on the keyboard which is arranged in a row at the top of the keyboard. Each function key has unique meaning and is used for some specific purpose.
4	Control keys	These keys provide cursor and screen control. It includes four directional arrow keys. Control keys also include Home, End, Insert, Delete, Page Up, Page Down, Control(Ctrl), Alternate(Alt), Escape(Esc).
5	SpecialPurpose Keys	Keyboard also contains some special purpose keys such as Enter, Shift, Caps Lock, Num Lock, Space bar, Tab, and Print Screen.

Mouse

Mouse is most popular pointing device. It is a very famous cursor-control device having a small palm size box with a round ball at its base which senses the movement of mouse and sends corresponding signals to CPU when the mouse buttons are pressed.

Generally it has two buttons called left and right button and a wheel is present between the buttons. Mouse can be used to control the position of cursor on screen, but it cannot be used to enter text into the computer.

Advantages

- Easy to use
- Not very expensive
- Moves the cursor faster than the arrow keys of keyboard.

Joystick

Joystick is also a pointing device which is used to move cursor position on a monitor screen. It is a stick having a spherical ball at its both lower and upper ends. The lower spherical ball moves in a socket. The joystick can be moved in all four directions.The function of joystick is similar to that of a mouse. It is mainly used in Computer Aided Designing(CAD) and playing computer games .

Light Pen

Light pen is a pointing device which is similar to a pen. It is used to select a displayed menu item or draw pictures on the monitor screen. It consists of a photocell and an optical system placed in a small tube. When the tip of a light pen is moved over the monitor screen and pen button is pressed, its photocell sensing element detects the screen location and sends the corresponding signal to the CPU.

Track Ball

Track ball is an input device that is mostly used in notebook or laptop computer, instead of a mouse. This is a ball which is half inserted and by moving fingers on ball, pointer can be moved. Since the whole device is not moved, a track ball requires less space than a mouse. A track ball comes in various shapes like a ball, a button and a square.

Scanner

Scanner is an input device which works more like a photocopy machine. It is used when some information is available on a paper and it is to be transferred to the hard disc of the computer for further manipulation. Scanner captures images from the source which are then converted into the digital form that can be stored on the disc. These images can be edited before they are printed.

Digitizer

Digitizer is an input device which converts analog information into digital form. Digitizer can convert a signal from the television or camera into a series of numbers that could be stored in a computer. They can be used by the computer to create a picture of whatever the camera had been pointed at. Digitizer is also known as Tablet or Graphics Tablet because it converts graphics and pictorial data into binary inputs. A graphic tablet as digitizer is used for doing fine works of drawing and image manipulation applications.

Microphone

Microphone is an input device to input sound that is then stored in digital form. The microphone is used for various applications like adding sound to a multimedia presentation or for mixing music.

Magnetic Ink Card Reader(MICR)

MICR input device is generally used in banks because of a large number of cheques to be processed every day. The bank's code number and cheque number are printed on the cheques with a special type of ink that contains particles of magnetic material that are machine readable. This reading process is called Magnetic Ink Character Recognition (MICR). The main advantages of MICR is that it is fast and less error prone.

Optical Character Reader(OCR)

OCR is an input device used to read a printed text. OCR scans text optically character by character, converts them into a machine readable code and stores the text on the system memory.

Bar Code Readers

Bar Code Reader is a device used for reading bar coded data (data in form of light and dark lines). Bar coded data is generally used in labelling goods, numbering the books etc. It may be a hand held scanner or may be embedded in a stationary scanner. Bar Code Reader scans a bar code image, converts it into an alphanumeric value which is then fed to the computer to which bar code reader is connected.

Optical Mark Reader(OMR)

OMR is a special type of optical scanner used to recognize the type of mark made by pen or pencil. It is used where one out of a few alternatives is to be selected and marked. It is specially used for checking the answer sheets of examinations having multiple choice questions.

8.OUTPUT DEVICES:

- Monitors
- Graphic Plotter
- Printer

Monitors

Monitors, commonly called as Visual Display Unit (VDU), are the main output device of a computer. It forms images from tiny dots, called pixels that are arranged in a rectangular form. The sharpness of the image depends upon the number of pixels.

There are two kinds of viewing screen used for monitors.

- Cathode-Ray Tube (CRT)
- Flat- Panel Display

Cathode-Ray Tube (CRT) Monitor

The CRT display is made up of small picture elements called pixels. The smaller the pixels, the better the image clarity, or resolution. It takes more than one illuminated pixel to form whole character, such as the letter 'e' in the word help.

A finite number of characters can be displayed on a screen at once. The screen can be divided into a series of character boxes - fixed location on the screen where a standard character can be placed. Most screens are capable of displaying 80 characters of data horizontally and 25 lines vertically. There are some disadvantages of CRT:

- Large in Size
- High power consumption

Flat-Panel Display Monitor

The flat-panel display refers to a class of video devices that have reduced volume, weight and power requirement in comparison to the CRT. You can hang them on walls or wear them on your wrists. Current uses of flat-panel displays include calculators, video games, monitors, laptop computer, graphics display.

The flat-panel display is divided into two categories:

- **Emissive Displays -** The emissive displays are devices that convert electrical energy into light. Example are plasma panel and LED(Light-Emitting Diodes).

- **Non-Emissive Displays -** The Non-emissive displays use optical effects to convert sunlight or light from some other source into graphics patterns. Example is LCD(Liquid-Crystal Device)

Printers

Printer is an output device, which is used to print information on paper.

There are two types of printers:

- Impact Printers
- Non-Impact Printers

Impact Printers

The impact printers print the characters by striking them on the ribbon which is then pressed on the paper.

Characteristics of Impact Printers are the following:

- Very low consumable costs
- Very noisy
- Useful for bulk printing due to low cost
- There is physical contact with the paper to produce an image

These printers are of two types

- Character printers
- Line printers

Character Printers

Character printers are the printers which print one character at a time.

These are further divided into two types:

- Dot Matrix Printer(DMP)
- Daisy Wheel

Dot Matrix Printer

In the market one of the most popular printers is Dot Matrix Printer. These printers are popular because of their ease of printing and economical price. Each character printed is in form of pattern of dots and head consists of a Matrix of Pins of size (5*7, 7*9, 9*7 or 9*9) which come out to form a character that is why it is called Dot Matrix Printer.

Advantages

- Inexpensive
- Widely Used
- Other language characters can be printed

Disadvantages

- Slow Speed
- Poor Quality

Daisy Wheel

Head is lying on a wheel and pins corresponding to characters are like petals of Daisy (flower name) that is why it is called Daisy Wheel Printer. These printers are generally used for word-processing in offices which require a few letters to be sent here and there with very nice quality.

Advantages

- More reliable than DMP
- Better quality
- The fonts of character can be easily changed

Disadvantages

- Slower than DMP
- Noisy
- More expensive than DMP

Line Printers

Line printers are the printers which print one line at a time.

These are of further two types

- Drum Printer
- Chain Printer

Drum Printer

This printer is like a drum in shape so it is called drum printer. The surface of drum is divided into number of tracks. Total tracks are equal to size of paper i.e. for a paper width of 132 characters, drum will have 132 tracks. A character set is embossed on track. The different character sets available in the market are 48 character set, 64 and 96 characters set. One rotation of drum prints one line. Drum printers are fast in speed and can print 300 to 2000 lines per minute.

Advantages

- Very high speed

Disadvantages

- Very expensive
- Characters fonts cannot be changed

Chain Printer

In this printer, chain of character sets are used so it is called Chain Printer. A standard character set may have 48, 64, or 96 characters.

Advantages

- Character fonts can easily be changed.
- Different languages can be used with the same printer.

Disadvantages

- Noisy

Non-impact Printers

Non-impact printers print the characters without using ribbon. These printers print a complete page at a time so they are also called as Page Printers.

These printers are of two types

- Laser Printers
- Inkjet Printers

Characteristics of Non-impact Printers

- Faster than impact printers.
- They are not noisy.
- High quality.
- Support many fonts and different character size.

Laser Printers

These are non-impact page printers. They use laser lights to produce the dots needed to form the characters to be printed on a page.

Advantages

- Very high speed
- Very high quality output
- Give good graphics quality
- Support many fonts and different character size

Disadvantages

- Expensive.
- Cannot be used to produce multiple copies of a document in a single printing.

Inkjet Printers

Inkjet printers are non-impact character printers based on a relatively new technology. They print characters by spraying small drops of ink onto paper. Inkjet printers produce high quality output with presentable features.

They make less noise because no hammering is done and these have many styles of printing modes available. Colour printing is also possible. Some models of Inkjet printers can produce multiple copies of printing also.

Advantages

- High quality printing
- More reliable

Disadvantages

- Expensive as cost per page is high
- Slow as compared to laser printer

9.Explain the benefits of multimedia in detail.

1. **Deeper understanding**

   According to research, a benefit of multimedia learning is that it takes advantage of the brain's ability to make connections between verbal and visual

representations of content, leading to a deeper understanding, which in turn supports the transfer of learning to other situations. All of this is important in today's 21st century classrooms, as we are preparing students for a future where higher-level thinking, problem solving and collaborative skills will be required.

2. Improved problem solving

A large percentage of the human brain dedicates itself to visual processing. Thus, using images, video and animations alongside a text stimulates the brain. Student attention and retention increase. Under these circumstances, in a multimedia learning environment, students can identify and solve problems more easily compared to the scenario where teaching is made possible only by textbooks.

3. Increased positive emotions

According to psychologist Barbara Fredrickson, experiencing positive emotions makes people see more possibilities in their lives. Using multimedia during instructions impacts student's mood during the learning process. With a positive attitude they learn better and tend to be more proactive.

4. Access to a vast variety of information

With computers, tablets, smartphones and the internet, students are today better equipped than ever to search and find the information they need. A study revealed that 95% of students who have access to internet, use it to search for online information. Sharing the information and participating in class discussions is done in a more confident way when access to information is as easy as today.

5. World exploration

There is no surprise here. With the help of multimedia children can explore and learn about places they would never been to. In a geography class, students can explore different cities of the world, the tallest mountains and the most dangerous jungles. In a science class, space and planets exploration is now possible. In a biology class, the dissection of rare animals and different habitats exploration are like a walk in a park for students benefiting of a multimedia learning environment.

10. Explain the challenges or issues of multimedia in detail.

Supporting multimedia applications over a computer network renders the application *distributed*. This will involve many special computing techniques -- discussed later.

Multimedia systems may have to render a variety of media at the same instant -- a distinction from normal applications. There is a temporal relationship between many forms of media (*e.g.* Video and Audio. There 2 are forms of problems here

- Sequencing within the media -- *playing frames in correct order/time frame in video*
- *Synchronisation* -- inter-media scheduling (*e.g.* Video and Audio). Lip synchronisation is clearly important for humans to watch playback of video and audio and even animation and audio. Ever tried watching an out of (lip) sync film for a long time?

The key issues multimedia systems need to deal with here are:

- How to represent and store temporal information.
- How to strictly maintain the temporal relationships on play back/retrieval
- What process are involved in the above.

Data has to represented *digitally* so many initial source of data needs to be *digitise* -- translated from analog source to digital representation. The will involve scanning (graphics, still images), sampling (audio/video) although digital cameras now exist for direct scene to digital capture of images and video.

The data is *large* several Mb easily for audio and video -- therefore storage, transfer (bandwidth) and processing overheads are high. Data compression techniques very common.

11.Write short note on vectorization.

The term *vectorization* is not the precise term *vector* is in mathematics, but rather just the information to store in order to redraw the picture.
Sometimes this is a few points; sometimes it is a formula.
Most drawing packages use this type of storage.
In any case, it is enough information to reconstruct the figure, but not to edit it (since individual parts of the picture are not available to be changed.)
However, the object can often be *resized* by changing coefficients in the storage formulas.
Vectorization will reduce the size of a 300 dpi (dots per inch) picture to 1/200 of its original (uncompressed) size, but with some loss in quality.
Lotus DIF and PIC formats and Microsoft SYLK use vector formats.

SECTION – C(10 – MARKS)

1. Explain in details about the Bresenham'S Line-Drawing Algorithm

The basic Bresenham algorithm

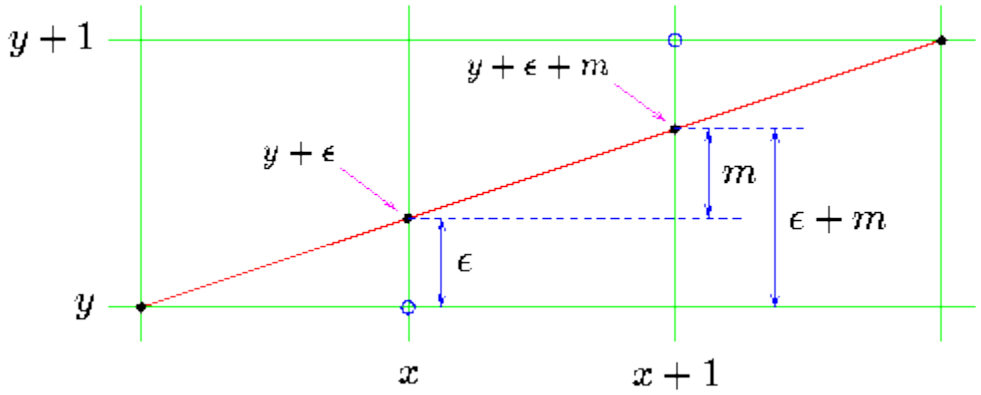
Consider drawing a line on a raster grid where we restrict the allowable slopes of the line to the range $0 \leq m \leq 1$.

If we further restrict the line-drawing routine so that it always increments *x* as it plots, it becomes clear that, having plotted a point at *(x,y)*, the routine has a severely limited range of options as to where it may put the *next* point on the line:

- It may plot the point *(x+1,y)*, or:
- It may plot the point *(x+1,y+1)*.

So, working in the *first positive octant* of the plane, line drawing becomes a matter of deciding between two possibilities at each step.

We can draw a diagram of the situation which the plotting program finds itself in having plotted *(x,y)*.



In plotting *(x,y)* the line drawing routine will, in general, be making a compromise between what it would like to draw and what the resolution of the screen actually allows it to draw. Usually the plotted point *(x,y)* will be in error, the actual, mathematical point on the line will not be addressable on the pixel grid. So we associate an error, ϵ, with each *y* ordinate, the real value of *y* should be $y + \epsilon$. This error will range from -0.5 to just under +0.5.

In moving from *x* to *x+1* we increase the value of the true (mathematical) y-ordinate by an amount equal to the slope of the line, *m*. We will choose to plot *(x+1,y)* if the difference between this new value and *y* is less than 0.5.

$$y + \epsilon + m < y + 0.5$$

Otherwise we will plot *(x+1,y+1)*. It should be clear that by so doing we minimize the total error between the mathematical line segment and what actually gets drawn on the display.

The error resulting from this new point can now be written back into ϵ, this will allow us to repeat the whole process for the next point along the line, at *x+2*.

The new value of error can adopt one of two possible values, depending on what new point is plotted. If *(x+1,y)* is chosen, the new value of error is given by:

$$\epsilon_{new} \leftarrow (y + \epsilon + m) - y$$

Otherwise it is: $\epsilon_{new} \leftarrow (y + \epsilon + m) - (y + 1)$

This gives an algorithm for a DDA which avoids rounding operations, instead using the error variable ϵ to control plotting:

$\epsilon \leftarrow 0, \quad y \leftarrow y_1$
For $x \leftarrow x_1$ **to** x_2 **do**
    Plot point at (x, y).
    If ($\epsilon + m < 0.5$)
        $\epsilon \leftarrow \epsilon + m$
    Else
        $y \leftarrow y + 1, \quad \epsilon \leftarrow \epsilon + m$ - 1
    EndIf
EndFor

This still employs floating point values. Consider, however, what happens if we multiply across both sides of the plotting test by Δx and then by 2:

$$\epsilon + m < 0.5$$

$$\epsilon + \Delta y/\Delta x < 0.5$$

$$2\epsilon\Delta x + 2\Delta y < \Delta x$$

All quantities in this inequality are now integral.

Substitute ϵ' for $\epsilon\Delta x$. The test becomes:

$$2(\epsilon' + \Delta y) < \Delta x$$

This gives an *integer-only* test for deciding which point to plot.

The update rules for the error on each step may also be cast into ϵ' form. Consider the floating-point versions of the update rules:

$$\epsilon \leftarrow \epsilon + m$$

$$\epsilon \leftarrow \epsilon + m - 1$$

Multiplying through by Δx yields:

$$\epsilon\Delta x \leftarrow \epsilon\Delta x + \Delta y$$

$$\epsilon\Delta x \leftarrow \epsilon\Delta x + \Delta y - \Delta x$$

which is in ϵ' form.

$$\epsilon' \leftarrow \epsilon' + \Delta y$$

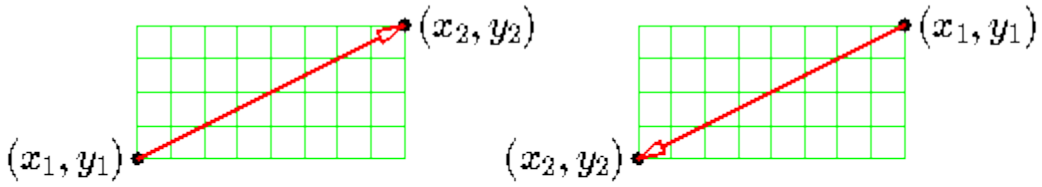
$$\epsilon' \leftarrow \epsilon' + \Delta y - \Delta x$$

Using this new ``error" value, ϵ', with the new test and update equations gives Bresenham's integer-only line drawing algorithm:

$\epsilon' \leftarrow 0, \quad y \leftarrow y_1$
For $x \leftarrow x_1$ **to** x_2 **do**
    Plot point at (x, y).
    If ($2(\epsilon' + \Delta y) < \Delta x$)
        $\epsilon' \leftarrow \epsilon' + \Delta y$
    Else
        $y \leftarrow y + 1, \quad \epsilon' \leftarrow \epsilon' + \Delta y - \Delta x$
    EndIf
EndFor

- Integer only - hence efficient (fast).
- Multiplication by 2 can be implemented by left-shift.
- This version limited to slopes in the first octant, $0 \leq m \leq 1$.

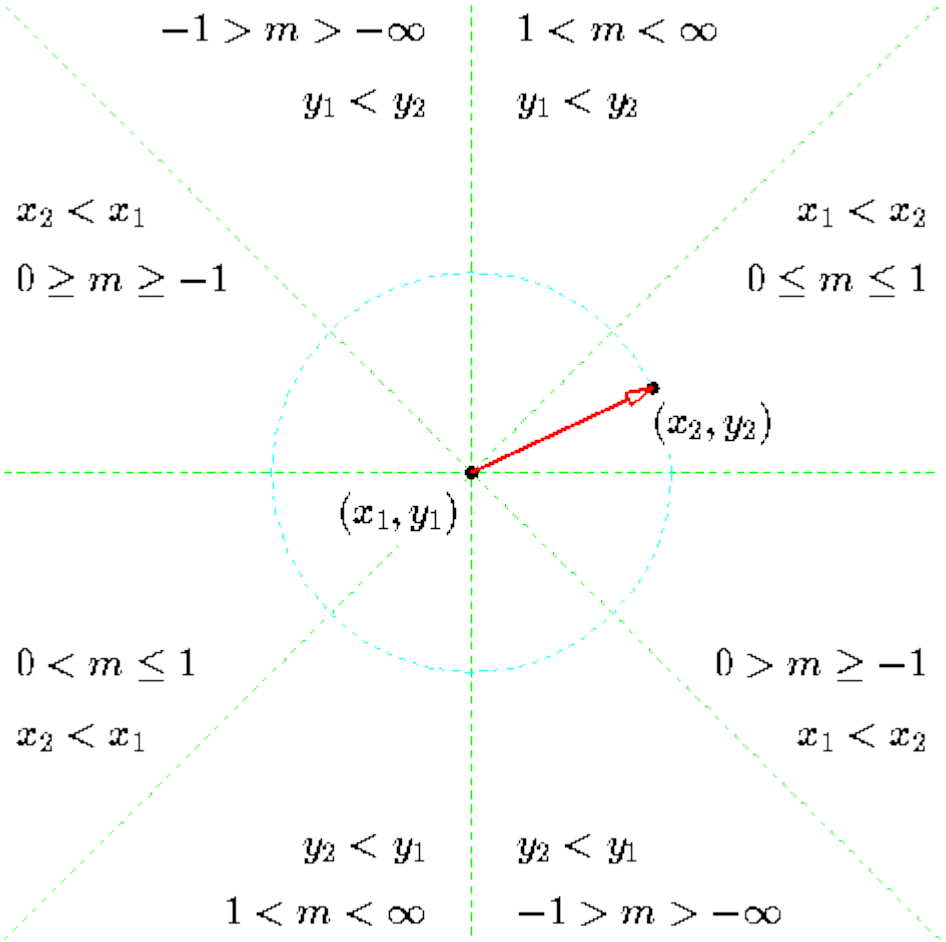
In fact, if we have two line segments with the same endpoints, and the same slope, this routine may draw one of them successfully but fails to draw the other one.



Line successfully drawn

Line fails to plot

Of course, this is not surprising really, when we consider that the function works by **incrementing** *x*. It does emphasise, however, that the routine is plotting *vectors*, direction is significant. Considering all the vectors from *(x1,y1)* to *(x2,y2)* we find that there are eight regions, (the ``octants") and the basic Bresenham algorithm works in only one of them.



A full implementation of the Bresenham algorithm must, of course, be able to handle all combinations of slope and endpoint order.

Some of the regions in the plane, those for which *x2* is smaller than *x1* can be handled by exchanging the endpoints of the line segment.

It is also clear that we will need a piece of code to handle large slopes by stepping over *y* instead of *x* values.

However, careful consideration of the diagram will reveal that there is one case which cannot be reduced to a version of the algorithm we have already looked at. If we want to draw a line having a small *negative* slope, we will have to consider a modification of the basic Bresenham algorithm to do this. (The same point applies to lines of *large* negative slope as well, but the code for small negative slopes may be adapted to this case by stepping over *y* instead of *x*).

Introduction

The Bresenham Algorithm for drawing lines on the discrete plane, such as computer monitor is one of the fundamental algorithms in computer graphics. This algorithm provides the means for the fast and efficient way to represent continuous abstract lines onto discrete plane of computer display. This process is called rasterization. Assume y = mx + b represents the real variable equation of a line which is to be plotted using a grid of pixels where the two points (Ax, Ay) and (Bx, By) have integer coordinates and represent two known points on the line. The algorithm basically approximates real valued line by calculating what pixels to illuminate and to provide "illusion" of line. Since the pixels are sufficiently small, the approximation is good enough to "trick" the human eyes and to get illusion of a real line. The basic idea is shown on Figure 1 and Figure 2. Figure 1 shows the real line drawn over the pixel grid. The Figure 2 shows how the same line is approximated by "illuminating" particular pixels.

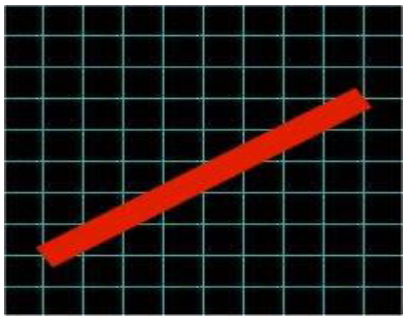


Figure 1.

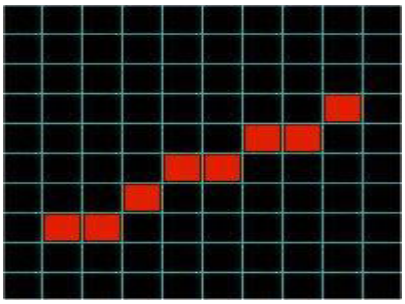


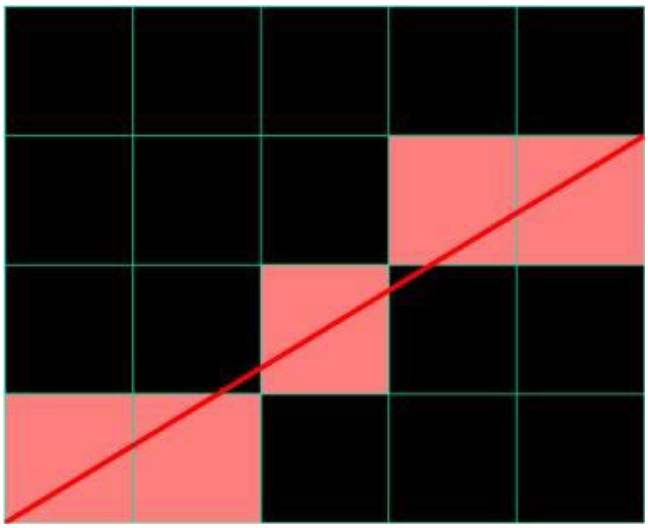
Figure 2.

2. **How to Derivation of Bresenham Line Drawing Algorithm**

Given two endpoints (Ax, Ay) and (Bx, By), we can chose the start point (x(k), y(k)). The choice is purely arbitrary, it can be either of (Ax,Ay) and (Bx,By) points. From this start point or pixel, we have eight possible choices for the next pixel in the line, since each pixel is surrounded by 8 other pixels (except border pixels). We need to isolate these eight choices into only two choices. If we restrict the slope m for now to 0 <= m <=1 and assume Ax < Bx, we know that we can simply step in x one pixel at a time to the right and determine what y value to choose next. Given (x(k), y(k)), the next ideal

pixel (the closest to the real line) will be (x(k)+1, y) where y = m*(x(k)+1) + b. But we must choose between (x(k)+1, y(k)) or (x(k)+1, y(k)+1). These pixels represent the one just to the right and the one to the right and one up pixel, respectively.

The following DERIVATION demo shows basic idea of Bresenham Algorithm; i.e. it shows simplified steps of "illumination" of proper pixels according to the given line. Below is complete derivation which incorporates all optimization and speed improvements of the algorithm code.



To find the best "next pixel", first we must find the distances to the two available choices from the ideal location (of the real line).

Distance between pixel-to-right and ideal pixel is: d1 = y - y(k) and the distance between pixel-to-right-and-up and ideal pixel is: d2 = (y(k)+1) - y.

So we can simply choose subsequent pixels based on the following:
if (d1<=d2) then choose pixel-to-right: (x(k)+1, y(k))
if (d1>d2) then choose pixel-to-right-and-up: (x(k)+1, y(k)+1)

In order to develop a fast way of doing this, we will not be comparing these values in such a

manner; instead we will create a decision variable that can be used to quickly determine which point to use.

Instead of comparing the two values to each other, we can simply evaluate d1-d2 and test the sign to determine which to choose. If d1 > d2 then d1-d2 will be strictly positive, and if d1-d2 is strictly positive, we will choose pixel-to-right-and-up. If d1-d2 is negative or zero, we will choose pixel-to-right. In addition to this optimization, Bresenham Algorithm suggests to optimize more. If we evaluate d1-d2 as follows:

d1-d2 = y - y(k) - ((y(k)+1) - y) = y - y(k) - (y(k)+1) + y and now substitute using y = m*(x(k)+1) + b, we get

d1-d2 = m*(x(k)+1) + b - y(k) - (y(k)+1) + m*(x(k)+1) + b = 2*m*(x(k)+1) - 2*y(k) + 2*b - 1

The last equation can be reduced by the slope m and substituting as follows:

m = dY/dX where dY = abs(By - Ay) and dX = abs(Bx - Ax), so now we have

d1-d2 = 2*(dY/dX)*(x(k)+1) - 2*y(k) + 2*b - 1 or if we expand the first term (multiply), then:

d1-d2 = 2*(dY/dX)*x(k) + 2*(dY/dX) - 2*y(k) + 2*b - 1

This last equation can be simplified by creating a new decision variable P(k) = dX * (d1-d2). This will remove the divisions (all integer operations for faster and efficient computing) and will still keep the same sign for the decision because dX variable is always positive (dX = abs(Bx - Ax) - absolute value).

If we now evaluate a new decision variable P(k), we get:

P(k) = dX * (2*(dY/dX)*x(k) + 2*(dY/dX) - 2*y(k) + 2*b - 1) or further:

P(k) = 2*dY*x(k) + 2*dY - 2*dX*y(k) + 2*dX*b - dX

If we now rearrange the terms in the last equation, we get:

P(k) = 2*dY*x(k) - 2*dX*y(k) + 2*dY + 2*dX*b - dX or

P(k) = 2*dY*x(k) - 2*dX*y(k) + c where c is always constant value (it depends only on the input endpoints) and is equal to 2*dY + dX*(2*b - 1)

Using described approach, decision variable can be computed very efficiently, but it still requires evaluation of P(k) for each point (pixel) along a line. Since line entity is linear in its nature, P(k) change will be linear as well, therefore we can evaluate subsequent P(k) values

incrementally by finding a constant change in P(k) for each subsequent pixel. By evaluating an incremental change of the decision function P = dP = P(k+1) - P(k) we can evaluate by substitution dP as follows:

P(k+1) - P(k) = 2*dY*x(k+1) - 2*dX*y(k+1) + c - 2*dY*x(k) + 2*dX*y(k) - c

= 2*dY*x(k+1) - 2*dY*x(k) - 2*dX*y(k+1) + 2*dX*y(k)

= 2*dY*(x(k+1) - x(k)) - 2*dX*(y(k+1) - y(k))

Since we are processing pixel one by one in the x direction, the change in the x direction is (x(k+1) - x(k)) = 1, so if we substitute this into our dP derivation, we get:

dP = 2*dY - 2*dX*(y(k+1) - y(k))

For the y direction, there are two possibilities; the term (y(k+1) - y(k)) can be only 0 or 1,

depending on if we choose pixel-to-right or pixel-to-right-and-up, so now our dP

derivation looks like:

dP = 2*dY - 2*dX*(0) = 2*dY if pixel-to-right is chosen

dP = 2*dY - 2*dX*(1) = 2*dY - 2*dX if pixel-to-right-and-up is chosen

The only remaining thing is to decide what is the initial value of P(0).

This can be decided by evaluating equation P(k) = 2*dY*x(k) - 2*dX*y(k) + 2*dY + dX*(2*b - 1),

so for zero, we get:

P(0) = 2*dY*x(0) - 2*dX*y(0) + 2*dY + dX*(2*b - 1)

From line equation at the starting pixel y(0) = m*x(0) + b

we get term for b intercept b = y - m*x(0).

Substituting b and slope m = dY/dX into equation

P(0) we get:

P(0) = 2*dY*x(0) - 2*dX*y(0) + 2*dY + dX*(2*(y(0) - (dY/dX)*x(0)) - 1)

= 2*dY*x(0) - 2*dX*y(0) + 2*dY + 2*dX*(y(0) - (dY/dX)*x(0)) - dX

= 2*dY*x(0) - 2*dX*y(0) + 2*dY + 2*dX*y(0) - 2*dY*x(0) - dX P(0) = 2*dY - dX

3. Discuss in detail about the **Line Attributes**

Basic attributes of a straight line segment are its type, its width, and its color. In some graphics packages, lines can also be displayed using selected pen or brush options

* Line Type
* Line Width
* Pen and Brush Options
* Line Color

Line type

Possible selection of line type attribute includes solid lines, dashed lines and dotted lines. To set line type attributes in a **PHIGS** application program, a user invokes the function

setLinetype (lt)

Where parameter lt is assigned a positive integer value of 1, 2, 3 or 4 to generate lines that are solid, dashed, dash dotted respectively. Other values for line type parameter it could be used to display variations in dot-dash patterns.

Line width

Implementation of line width option depends on the capabilities of the output device to set the line width attributes.

setLinewidthScaleFactor (lw)

Line width parameter lw is assigned a positive number to indicate the relative width of line to be displayed. A value of 1 specifies a standard width line. A user could set lw to a value of 0.5 to plot a line whose width is half that of the standard line. Values greater than 1 produce lines thicker than the standard.

Line Cap

We can adjust the shape of the **line** ends to give them a better appearance by adding line caps.

There are three types of line cap. They are

* Butt cap
* Round cap
* Projecting square cap

Butt cap obtained by adjusting the end positions of the component parallel lines so that the thick line is displayed with square ends that are perpendicular to the line path.
Round cap obtained by adding a filled semicircle to each butt cap. The circular arcs are centered on the line endpoints and have a diameter equal to the line thickness.
Projecting square cap extend the line and add butt caps that are positioned one-half of the line width beyond the specified endpoints.

* Mitter Join

* Round Join
* Bevel Join

A miter join accomplished by extending the outer boundaries of each of the two lines until they meet.

A round join is produced by capping the connection between the two segments with a circular boundary whose diameter is equal to the width.
A bevel join is generated by displaying the line segment with but caps and filling in tri angular gap where the segments meet.

Pen and Brush Options

With some packages, lines can be displayed with pen or brush selections. Options in this category include shape, size, and pattern. Some possible pen or brush shapes are given in Figure

Line color

A poly line routine displays a line in the current color by setting this color value in the frame buffer at pixel locations along the line path using the set pixel procedure.We set the line color value in PHIGS with the function

setPolylineColourIndex (lc)

Nonnegative integer values, corresponding to allowed color choices, are assigned to the line color parameter lc
Example: Various line attribute commands in an applications program is given by the following sequence of

statements
setLinetype(2);
setLinewidthScaleFactor(2);
setPolylineColourIndex (5);
polyline(n1, wc points1);
setPolylineColorIndex(6);
poly line (n2, wc points2);

This program segment would display two figures, drawn with double-wide dashed lines. The first is displayed in a color corresponding to code 5, and the second in color

4. Explain briefly about the Curve attributes

Parameters for curve attribute are same as those for line segments. Curves displayed with varying colors, widths, dot – dash patterns and available pen or brush

options

Color and Grayscale Levels

Various color and intensity-level options can be made available to a user, depending on the capabilities and design objectives of a particular system

In a color raster system, the number of color choices available depends on the amount of storage provided per pixel in the frame buffer

Color-information can be stored in the frame buffer in two ways:

* We can store color codes directly in the frame buffer
* We can put the color codes in a separate table and use pixel values as an index into this table

With the direct storage scheme, whenever a particular color code is specified in an application program, the corresponding binary value is placed in the frame buffer for each-component pixel in the output primitives to be displayed in that color.

A minimum number of colors can be provided in this scheme with 3 bits of storage per pixel, as shown in Table

3 bits - 8 choice of color

6 bits – 64 choice of color

8 bits – 256 choice of color

A user can set color-table entries in a PHIGS applications program with the function

setColourRepresentation (ws, ci, colorptr)

Parameter **ws** identifies the workstation output device; parameter ci specifies the color index, which is the color-table position number (**0** to **255**) and parameter colorptr points to a trio of RGB color values (**r, g, b**) each specified in the range from **0** to 1

Grayscale

With monitors that have no color capability, color functions can be used in an application program to set the shades of gray, or grayscale, for displayed primitives. Numeric values over the range from 0 to 1 can be used to specify grayscale levels, which are then converted to appropriate binary codes for storage in the raster.

Intensity = 0.5[min(r, g, b) + max(r, g, b)]

Area fill Attributes

Options for filling a defined region include a choice between a solid color or a pattern fill and choices for particular colors and patterns

Fill Styles

Areas are displayed with three basic fill styles: hollow with a color border, filled with

a solid color, or filled with a specified pattern or design. A basic fill style is selected in a PHIGS program with the function

setInteriorStyle (fs)

Values for the fill-style parameter fs include hollow, solid, and pattern. Another value for fill style is hatch, which is used to fill an area with selected hatching patterns-parallel lines or crossed lines. The color for a solid interior or for a hollow area outline is chosen with where fill color parameter fc is set to the desired color code

setInteriorColourIndex (fc)

Pattern Fill

We select fill patterns with setInteriorStyleIndex (pi) where pattern index parameter pi specifies a table position

For example, the following set of statements would fill the area defined in the fillArea command with the second pattern type stored in the pattern table:

```
SetInteriorStyle( pattern)
SetInteriorStyleIndex(2);
Fill area (n, points)
```

5. Describe in detail about the Character Attributes

The appearance of displayed character is controlled by attributes such as font, size, color and orientation. Attributes can be set both for entire character strings (text) and for individual characters defined as marker symbols

Text Attributes

The choice of font or type face is set of characters with a particular design style as courier, Helvetica, times roman, and various symbol groups.

The characters in a selected font also be displayed with styles. (solid, dotted, double) in **bold face** in **italics**,

A particular font and associated stvle is selected in a PHIGS program by setting an integer code for the text font parameter tf in the function

setTextFont (tf)

Control of text color (or intensity) is managed from an application program with

setTextColourIndex (tc)

Where text color parameter tc specifies an allowable color code.

Text size can be adjusted without changing the width to height ratio of characters with

setCharacterHeight (ch)

Parameter ch is assigned a real value greater than 0 to set the coordinate height of

capital letters
The width only of text can be set with function.

setCharacterExpansionFactor (cw)

Where the character width parameter cw is set to a positive real value that scales the body width of character

Spacing between characters is controlled separately with

setCharacterSpacing (cs) Where the character-spacing parameter cs can he assigned any real value

The orientation for a displayed character string is set according to the direction of the character up vector

setCharacterUpVector (upvect)

Parameter upvect in this function is assigned two values that specify the x and y vector components. For example, with upvect = (1, 1), the direction of the up vector is 45o and text would be displayed as shown in Figure.

To arrange character strings vertically or horizontally

setTextPath (tp)

can be assigned the value: right, left, up, or down

Another handy attribute for character strings is alignment. This attribute specifies how text is to be positioned with respect to the $tart coordinates. Alignment attributes are set with

setTextAlignment (h,v)

where parameters h and v control horizontal and vertical alignment. Horizontal alignment is set by assigning h a value of left, center, or right. Vertical alignment is set by assigning v a value of top, cap, half, base or bottom.
A precision specification for text display is given with

setTextPrecision (tpr) tpr is assigned one of values string, char or stroke.

6. Explain in detail about the Marker Attributes

A marker symbol is a single character that can he displayed in different colors and in different sizes. Marker attributes are implemented by procedures that load the chosen character into the raster at the defined positions with the specified color and size. We select a particular character to be the marker symbol with

setMarkerType (mt)

where marker type parameter mt is set to an integer code. Typical codes for marker type are the integers 1 through 5, specifying, respectively, a dot (.) a vertical cross (+), an asterisk (*), a circle (o), and a diagonal cross (X).

We set the marker size with

setMarkerSizeScaleFactor (ms)

with parameter marker size ms assigned a positive number. This scaling parameter is applied to the nominal size for the particular marker symbol chosen. Values greater than 1 produce character enlargement; values less than 1 reduce the marker size.

Marker color is specified with

setPolymarkerColourIndex (mc)

A selected color code parameter mc is stored in the current attribute list and used to display subsequently specified marker primitives

7. Discuss about the Bundled Attributes

The procedures considered so far each function reference a single attribute that specifies exactly how a primitive is to be displayed these specifications are called individual attributes.

A particular set of attributes values for a primitive on each output device is chosen by specifying appropriate table index. Attributes specified in this manner are called bundled attributes. The choice between a bundled or an unbundled specification is made by setting a switch called the aspect source flag for each of these attributes

setIndividualASF(attributeptr, flagptr)

where parameter attributer ptr points to a list of attributes and parameter flagptr points to the corresponding list of aspect source flags. Each aspect source flag can be assigned a value of individual or bundled.

Bundled line Attributes

Entries in the bundle table for line attributes on a specified workstation are set with the function

setPolylineRepresentation (ws, li, lt, lw, lc)

Parameter ws is the workstation identifier and line index parameter li defines the bundle table position. Parameter lt, lw, tc are then bundled and assigned values to set the line type, line width, and line color specifications for designated table index.

Example

setPolylineRepresentation (1, 3, 2, 0.5, 1)

setPolylineRepresentation (4, 3, 1, 1, 7)

A poly line that is assigned a table index value of 3 would be displayed using dashed lines at half thickness in a blue color on work station 1; while on workstation 4, this same index generates solid, standard-sized white lines

Bundle area fill Attributes

Table entries for bundled area-fill attributes are set with

setInteriorRepresentation (ws, fi, fs, pi, fc)

Which defines the attributes list corresponding to fill index fi on workstation ws. Parameter fs, pi and fc are assigned values for the fill style pattern index and fill color.

Bundled Text Attributes

setTextRepresentation (ws, ti, tf, tp, te, ts, tc)

Bundles values for text font, precision expansion factor size an color in a table position for work station ws that is specified by value assigned to text index parameter ti.

Bundled marker Attributes

setPolymarker Representation (ws, mi, mt, ms, mc)

That defines marker type marker scale factor marker color for index mi on workstation ws.

Inquiry functions

Current settings for attributes and other parameters as workstations types and status in the system lists can be retrieved with inquiry functions.

inquirePolylineIndex (last li)

and

inquireInteriorcColourIndex (last fc)

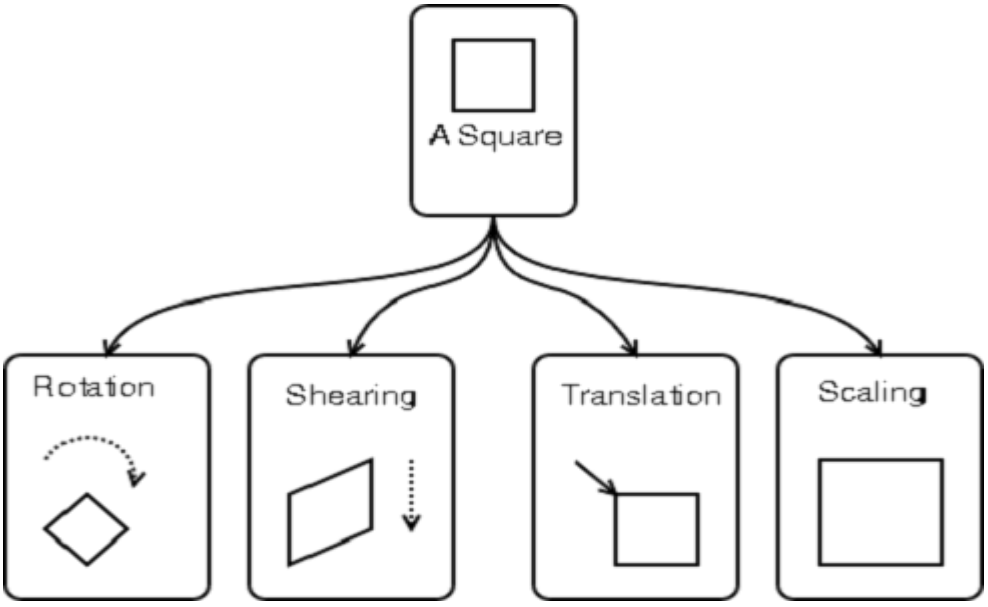
Copy the current values for line index and fill color into parameter last li and last fc.

8. What is meant by Basic Transformations. Explain it.

1.Translation

2.Rotation

3.Scaling



hem.

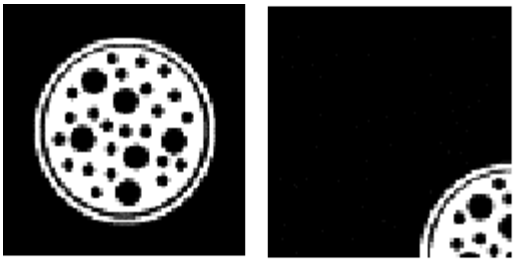
An example of the basic 2D transformation applied for a square. These operations are very common in computer graphics. Any linear operation can be written in matrix form and using homgeneous coordinates. We will consider the following basic transformations in a 3D cartesian coordinate system.

1. Translation

Suppose that the task is to translate a point with coordinates (X,Y,Z) to a new location by using displacements (X o ,Y o ,Z o).

With this notation, matrix T for translation is:

$$T = \begin{bmatrix} 1 & 0 & 0 & X_o \\ 0 & 1 & 0 & Y_o \\ 0 & 0 & 1 & Z_o \\ 0 & 0 & 0 & 1 \end{bmatrix}$$



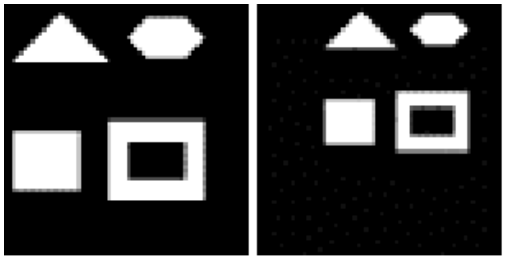
Example of translation

2. Scaling

The scale operator performs a geometric transformation which can be used to shrink or zoom the size of an image (or part of an image).

Scaling by factors Sx , Sy , and Sz along the X, Y, and Z axes is given by the transformation matrix

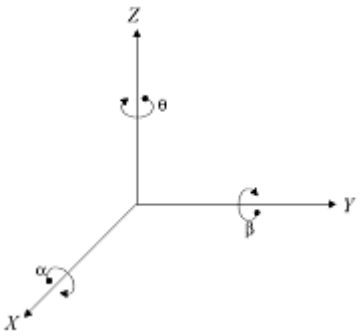
$$S = \begin{bmatrix} S_x & 0 & 0 & 0 \\ 0 & S_y & 0 & 0 \\ 0 & 0 & S_z & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$



Example of scaling

3.Rotation

The transformations used for 3-D rotation are inherently more complex. The simplest form of these transformations is for rotation of a point about the coordinate axes.



Rotation of a point about the Z coordinate axis by an angle θ is achieved by using the transformation

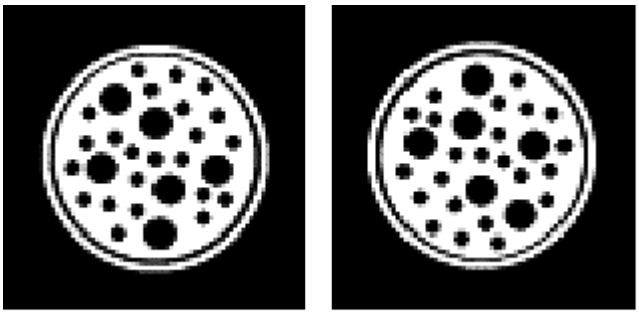
$$R_{\theta} = \begin{bmatrix} \cos\theta & \sin\theta & 0 & 0 \\ -\sin\theta & \cos\theta & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Rotation of a point about the X coordinate axis by an angle α a is performed by using the transformation:

$$R_{\alpha} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos\alpha & \sin\alpha & 0 \\ 0 & -\sin\alpha & \cos\alpha & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Finally, rotation of a point about the Y axis by an angel B is achieved by using the transformation:

$$R_{\beta} = \begin{bmatrix} \cos\beta & 0 & -\sin\beta & 0 \\ 0 & 1 & 0 & 0 \\ \sin\beta & 0 & \cos\beta & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$



Example of rotation in 2D.

Homogeneous Coordinates in 2 Dimensions

Scaling and rotations are both handled using matrix multiplication, which can be combined as we will see shortly. The translations cause a difficulty, however, since they use addition instead of multiplication.

We want to be able to treat all 3 transformations (translation, scaling, rotation) in the same way - as multiplications.

The solution is to give each point a third coordinate (X, Y, W), which will allow translations to be handled as a multiplication also.

(Note that we are not really moving into the third dimension yet. The third coordinate is being added to the mathematics solely in order to combine the addition and multiplication of 2-D coordinates.)

Two triples (X,Y,W) and (X',Y',W') represent the **same point** if they are multiples of each other e.g. (1,2,3) and (2,4,6).

At least one of the three coordinates must be nonzero.

If W is 0 then the point is at infinity. This situation will rarely occur in practice in computer graphics.

If W is nonzero we can divide the triple by W to get the cartesian coordinates of X and Y which will be identical for triples representing the same point (X/W, Y/W, 1). This step can be considered as mapping the point from 3-D space onto the plane W=1.

Conversely, if the 2-D cartesian coordinates of a point are known as (X, Y), then the homogenous coordinates can be given as (X, Y, 1)

Translation of 2D Homogenous Coordinates

point (X,Y) is to be translated by amount Dx and Dy to location (X',Y')

X' = Dx + X
Y' = Dy + Y

or P' = T * P where

$$P' = \begin{vmatrix} X' \\ Y' \\ 1 \end{vmatrix}$$

$$T = \begin{vmatrix} 1 & 0 & Dx \\ 0 & 1 & Dy \\ 0 & 0 & 1 \end{vmatrix} = T(Dx,Dy)$$

$$P = \begin{vmatrix} X \\ Y \\ 1 \end{vmatrix}$$

Hey Look! Translation is now a multiplication instead of an addition!

Scaling of 2D Homogenous Coordinates

P' = S * P where

$$P' = \begin{vmatrix} X' \\ Y' \\ 1 \end{vmatrix}$$

$$S = \begin{vmatrix} Sx & 0 & 0 \\ 0 & Sy & 0 \\ 0 & 0 & 1 \end{vmatrix} = S(Sx,Sy)$$

```
    -       -

    _  _
P  = |  X  |
    |  Y  |
    |  1  |
     -   -
```

Rotation of 2D Homogenous Coordinates

P' = R * P where

```
    _  _
P' = |  X' |
    |  Y' |
    |  1  |
     -   -

    _
R  = |  cos(theta) -sin(theta) 0 | = R(theta)
    |  sin(theta)  cos(theta) 0 |
    |       0           0     1 |
     -                        -

    _  _
P  = |  X  |
    |  Y  |
    |  1  |
     -   -
```

Composition of 2D Transformations

There are many situations in which the final transformation of a point is a combination of several (often many) individual transformations. For example, the position of the finger of a robot might be a function of the rotation of the robots hand, arm, and torso, as well as the position of the robot on the railroad train and the position of the train in the world, and the rotation of the planet around the sun, and . . .

Applying each transformation individually to all points in a model would take a lot of time. Instead of applying several transformations matrices to each point we want to combine the transformations to produce 1 matrix which can be applied to each point.

In the simplest case we want to apply the same type of transformation (translation, rotation, scaling) more than once.

Translation is additive as expected
Scaling is multiplicative as expected
Rotation is additive as expected

9. Explain important roles of multimedia in detail.

Multimedia in Education:

Multimedia combines several media in a one obviously it has more sources of information. So it is extensively used in the field of education and training.

Even in conventional method we use audio visual for imparting education, where charts, models etc. were used. Now a days the classroom needs audio and visual media.

The multimedia integrates all of them in one system. For the use of multimedia as an education aid the PC contains a high quality display.

The multimedia provides a friendly interactive method of learning.

Multimedia in Training

There are many intelligent tutoring systems available to train the students in many areas starting from the mathematics of a primary to a difficult surgical process for a medical student.

As there enough audio clips added to these tutorials and an action can be seen from all perspective and repeatedly so obviously as far as practical skills is concerned it gives a lot of far that.

These tutorials contain enough number of videos sequences for thorough clarification.

Science and Technology:

Multimedia had a wide application in the field of science and technology. The multimedia system is capable of transferring audio, and clips in addition to the regular text. It is even capable of sending message and formatted multimedia documents.

At the same time the multimedia also helps in live which are a live interaction through audio messages.

At the same time the multimedia is enough useful services based on images.

Similarly it is useful for surgeons as they can use images created from imaging scans of human body to practice complicated procedures such as brain removal and reconstructive surgery. The plans can be made in a better way to reduce the costs and complication

Multimedia in Business:

The business application of multimedia includes, product demos, instant messaging. One the excellent applications is voice and live conferencing.

A multimedia can make a audience come live. It is widely used in programs. Such a program can be used by a mechanic and peoples.

There are a number of easy to use authoring programs and tools that can even let workers to create their own program. T

There are a number of applications available that slow to run more smoothly and effectively.

Multimedia in Games :

One of the most exciting applications of multimedia is games.

Now a days the live internet pay to play gaming with multiple players has become popular.

10. Explain Multimedia Platforms in detail.

IBM and PCs

PCs are the most common computer attached multimedia platforms. A conservative estimate in 1992 shows 2.1 million CD-ROMs are attached to PCs. Of these 2.1 million, only 800,000 CD-ROMs have the multimedia capabilities (386 and above). This represent 38 percent of installed CD-ROMs used for multimedia. This low number of CD-Rom's used for multimedia is expected to increase rapidly since all new PCs are at least 386 or above.

The 1992 figure of 38 percent is distributed between household and business with the majority of CD-ROMs towards business. Because of this unequal distribution, the primary market for developers lie in the business sector. Titles that might be suitable for this market may therefore include the following:

- Accounting and Finance Applications
- Employee Training Programs
- Business Organization and Strategic Planning
- Business Presentation Tools

The MPC market is expected to grow rapidly in the near future. It is estimated that shipments of multimedia ready PC will reach 3 million units in 1993 and continue to grow close to 5 million in 1996 as shown in chart on below (source: The New York Times, Dataquest).

The connecting rate for between CD-ROMs and MPC has been estimated to 2.5 percent. The household market is expected to absorb a greater amount of the installed CD-ROM distribution and therefore create a market for edutainment, infotainment, reference, and game titles.

Macintosh

The Macintosh computers are more suitable for multimedia delivery and therefore have a larger number of multimedia titles available to its format. About 68 percent of all multimedia titles available represent Macintosh format and the rest 32 percent represent PC format as shown in the picture (Dataquest -93, p.18).

The number of attached CD-ROMs in 1992 is 600,000 which of 400,000 has multimedia capabilities (all systems except Plus and SE). This represent 67 percent of Macintosh attached CD-ROMs compared to only 38 percent of MPC attached CD-ROMs. In addition, the connecting rate between Macintosh computers and CD-ROMs is estimated to 6 percent compared to 2.5 percent for MPCs as shown below (Source; Apple's Mkt research report, p 13).

Computer Attached Multimedia CD Drives Summary

Computer attached multimedia CD drives (MMCD drives) are referred to Macintosh and MPC machines that are capable of delivering multimedia titles. That is, in 1992, 800,000+400,000=1,200,000 units as explained in the previous section. It is estimated that only 1/3 of 96 million U.S. households are computer literate and the about half of these household use their computers in business. Because of the lack of computer knowledge, the Consumer Appliance Players businesses are targeting the rest (2/3) of the U.S. household market.

Consumer Appliance Players

Consumer appliance players are referred to all multimedia players that are not attached to computers. This market is larger and is expected to grow more rapidly than the MMCD market because of the lower cost and the limited computer knowledge that is required. The installed base of consumer appliance players is expected to 28,600,000 units in 1997 as shown below. Some common players that should be considered include Nintendo, Sega, 3DO, CD-I, CDTV, Data Discman, Photo CD, and VIS.

11. Explain in detail about jpeg files

The JPEG standard refers to both the technique for compressing an image into a stream of bytes and then decompressing it back close to its original form, and the file format holding that stream.

The JPEG image file format has become popular for offering an amazingly effective compression method for color images. It helps images to be compressed to about five percent of their original size, which allows for minimized traffic consumption for websites using JPEG images. The complex compression algorithm allows the customers to create smaller graphics by losing some of the quality of the image. Although this is

known to be a lossy compression, meaning that some image details are lost while the image is being compressed, any quality changes are usually invisible to the human eye.

The resulting quality of a JPEG image after decompression is proportional to its size, so, the bigger you choose it to be, the more preserved its original properties will remain.

The JPEG supports several image file formats. The most commonly employed of them are JPEG/Exif, used by most photographic image capture devices, such as digital cameras, and most image editing programs, and JPEG/JFIF. Both formats are known for allowing photographic images to be stored and quickly transmitted over the Internet and are most commonly referred to as simply JPEG.

The images stored in a JPEG format could have one of the following file extensions: .JPG, .JPEG, .JFIF, .JIF .or .JPE.