IT6501-GRAPHICS AND MULTIMEDIA
UNIT-1
OUTPUT PRIMITIVES

1. **Define clipping.**
   Any procedure that identifies those portions of a picture that are either inside or outside of a specified region of space is referred to as a clipping algorithm or clipping. The region against which an object is to be clipped is called as the clip window.
2. **What is the significance of the terms, "window" and "viewport" in graphics.**
   A window is a world coordinate area selected for display. The window defines what is to be viewed. It is an area on a display device to which the window is mapped. It defines where it is to be displayed.
3. **What is vertical retrace of the electron beam?**
   Vertical retrace: At the end of each frame the electron beam returns to the top left corner of the screen to the beginning the next frame.
4. **What is mean by basic transformation in 2D?**
   Changes in orientation, size and shape are accomplished with geometric transformations that alter the coordinate description of objects. The basic geometric transformations are translation, rotation and scaling.

   Translation : translation is applied to an object by repositioning it along a straight line path from one coordinate location to another.
   x1=x+Tx y1=y+Ty (Tx,Ty) – translation vector or shift vector
   Rotation: a two dimensional rotation is applied to an object by repositioning it along a circular path in the xy plane.
   P1=R.P
   R= $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ θ- rotation angle
   Scaling:a scaling transformation alters the size of an object .x1=x.Sx and y1=y.Sy.

5. **Distinguish between differential scaling and uniform scaling.**
   The value of sx and sy for the object is different then it is differential scaling sx != sy The value of sx and sy for the object is same then it is uniform scaling such as sx=sy.
6. **Define shearing.**
   A transformation that distorts the shape of an object such that the transformed shape appears as if the object were composed of internal layers that had been caused to slide over each other is called a shear.
7. **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.
8. **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.
9. **What is aliasing?**
   Displayed primitives generated by the raster algorithms have a jagged, stair step appearance because the sampling process digitizes coordinate points on an object to discrete integer pixel positions. This distortion of information due to low frequency sampling is called aliasing.

10. **What is antialiasing?**
    Appearance of the displayed raster lines can be improved by applying antialiasing methods.Nyquist sampling frequency: to avoid losing information, the sampling frequency to at least twice that of the highest frequency occurring in the object. Fs=2*fmax.
11. **What are line caps?**
    The shape of the line ends are adjusted to give a better appearance by adding line caps.
    i. Butt cap: obtained by adjusting the end positions of the component parallel lines so that the thick line is displayed with square ends that is perpendicular to the line path.
    ii. Round cap: obtained by adding a filled semicircle to each butt cap.
    iii. Projecting square cap: extend the line and add butt caps that are positioned one-half of the line width beyond the specified endpoints.
12. **What is resolution?**
    The maximum number of points that can be displayed without an overlap on a CRT is called as resolution.
13. **What are steps involved for rotating the object from any pivot point?**
    Translate the object so that the pivot-point position is moved to the coordinate origin. Rotate the object about the coordinate origin. Translate the object so that the pivot point is returned to its original position.
14. **What is advantage of Liang-Barsky algorithm?**
    The Liang-Barsky algorithm is more efficient than the Cohen-Sutherland algorithm, since intersection calculations are reduced. Each update of parameters u1 and u2 requires only one division and window intersections of the line are computed only once, when the final values of u1 and u2 have been computed.
15. **What is output primitive?**
    Basic geometric structures that describe a scene are referred to as Output Primitives. Points and straight lines segments are the simplest geometric components of pictures. Additional output primitives that can be used to construct a picture include circles and other conic sections, quadric surfaces, spline curves and surfaces, polygon color areas and character strings.
16. **What is DDA?**
    The Digital Differential Analyzer is a scan-conversion line algorithm based on calculating either difference in y-coordinate (dy) or difference in x-coordinate. We sample the line at unit intervals in one coordinate and determine corresponding integer values nearest the line path for the other coordinate.
17. **Define Reflection.**
    A Reflection is a transformation that produces a mirror image of an object. The mirror image for a 2D reflection is generated relative to an axis of reflection by rotating the object 180 degree about the reflection axis.
18. **What is attribute parameter?**
    Any parameter that affects the way a primitive is to be displayed is referred to as an attribute parameter.
19. **List the different types of text clipping methods available**.
    The different types of text clipping methods are
    i. All –or-none string clipping.
    ii. All-or-none character clipping.
    iii. Clip-components of individual characters.
20. **What is the rule of clipping?**
    For the viewing transformation, we are needed to display only those picture parts that are within the window area. Everything outside the window is discarded. Clipping algorithms are applied in world co-ordinates, so that only the contents of the window interior are mapped to device co-ordinates.

PART-B

1. Describe the Brsenham's Line drawing algorithm for lines.

ALGORITHM-STEPS

- Start
- Read the two end points of the line and assign the left end point to x_0 ,y_0
- Load x_0 ,y_0 into the frame buffer (i.e) plot the first point
- Compute dx,dy,2dy and 2dy-2dx and determine the decision parameter P_0 as 2dy-dx
- At each x_k , along the line starting at k = 0, perform the following test
- If $P_k < 0$, the next point to plot is (x_{k+1} , y_k) and $P_{k+1} = P_k+2dy$
- Otherwise the next point to plot is (x_k, y_{k+1}) and $P_{k+1} = P_k+2dy- 2dx$
- Repeat step 4 dx times
- Stop

2. Write down the steps involved in midpoint circle algorithm with an example.

ALGORITHM-STEPS

- Start
- Input the radius r and the center (x_c,y_c) and obtain the first point on the circumference of a circle centered on the origin as (x_0,y_0) = (0,r)
- Calculate the initial value of the decision parameter as $P_0 = 5/4 – r$
- At each x_k position, starting at k = 0, perform the following test
- If $P_k < 0$, the next point along the circle centered on (0,0) is (x_{k+1},y_k) and $P_{k+1} = P_k +2x_{k+1}+1$
- Otherwise, the next point along the circle is (x_{k+1},y_{k-1}) and $P_{k+1} = P_k +2x_{k+1}+1- 2y_{k+1}$ where $2x_{k+1} = 2x_k + 2$ and $2y_{k+1} = 2y_k - 2$
- Determine symmetry points in the remaining seven octants
- Move each calculated pixel position (x,y) onto the circular path centered on (x_c,y_c) and plot the coordinate value $x = x+x_c$, $y = y+ y_c$
- Repeat steps 3 to 5 until x >= y
- Stop

3. Compute the points on the line between(2,10) and (4,0) using Bresenham's line drawing procedure.

- Read the two end points as (2,10) and (4,0)
- Assign the left end point to (2,10) and proceed the bresenham's line algorithm (refer question no1.)

4. Write and explain Cohen-Sutherland line clipping algorithm.

ALGORITHM –STEPS

Basic concept of Cohen-Sutherland
Region codes
Bit 1 – left
Bit 2 – right
Bit 3 – below
Bit 4 – above

- If the point is in clipping rectangle then the region code is 0000
- A value of 1 in any position indicates the point is in that relative position
- Assignment of Binary region codes

- Bit 1 is set to 1 if $x < xw_{min}$
- Bit 2 is set to 1 if $x > xw_{max}$
- Bit 3 is set to 1 if $y < yw_{min}$
- Bit 4 is set to 1 if $y > yw_{max}$

Calculation of intersection points with the clip window

- Accept the lines whose both endpoints are having the region code 0000
- Reject the lines whose endpoints have a 1 in the same bit position in the region code
- Lines that cannot be identified as completely inside or outside a clip window are checked for intersection with window boundaries
- Intersection with clipping boundary can be calculated using the slope intercept form of the line equation.
- The intersection point with the vertical boundary is $y = y_1 + m (x – x_1)$
- The intersection point with the horizontal boundary is $x = x_1 + (y – y_1) / m$

5. Discuss about any two popular antialiasing techniques.

(i) SUPERSAMPLING OR POSTFILTERING

It is the process by which aliasing effects in graphics are reduced by increasing the frequency of the sampling grid and then averaging the results down. This process means calculating a virtual image at a higher spatial resolution than the frame store resolution and then averaging down to the final resolution. It is called postfiltering as the filtering is carried out after sampling.The drawback is that there is a technical and economic limit for increasing the resolution of the virtual image.Since the frequency of images can extend to infinity, it just reduces aliasing by raising the Nyquist limit - shift the effect of the frequency spectrum.

Supersampling is basically a three stage process.

- A continuous image I(x,y) is sampled at n times the final resolution. The image is calculated at n times the frame resolution. This is a virtual image.
- The virtual image is then lowpass filtered
- The filtered image is then resampled at the final frame resolution.

ALGORITHM FOR SUPERSAMPLING

- To generate the original image, we need to consider a region in the virtual image. The extent of that region determines the regions involved in the lowpass operation. This process is calledconvolution.
- After we obtain the virtual image which is at a higher resolution, the pixels of the final image are located over superpixels in the virtual image. To calculate the value of the final image at (Si,Sj), we place the filter over the superimage and compute the sum of the filter weights and the surrounding pixels. An adjacent pixel of the final image is calculated by moving the filter S superpixels to the right. Thus the step size is same as the scale factor between the real and the virtual image.
- Filters combine samples to compute a pixel's color. The weighted filter shown on the slide combines nine samples taken from inside a pixel's boundary. Each sample is multiplied by its corresponding weight and the products are summed to produce a weighted average, which is used as the pixel color. In this filter, the center sample has the most influence. The other type of filter is an unweighted filter. In an unweighted filter, each sample has equal influence in determining the pixel's color. In other words, an unweighted filter computes an unweighted average.
- The spatial extent of the filter determines the cutoff frequency. The wider the filter, the lower is the cutoff frequency and the more blurred is the image.

(ii) AREA SAMPLING

determine the percentage of area coverage for a screen pixel, then set the pixel intensity proportional to this percentage.

- Consider a line as having thickness
- Consider pixels as little squares
- Unweighted area sampling -Fill pixels according to the proportion of their square covered by the line
- Weighed area sampling - weight the contribution according to where in the square the primitive falls

UNWEIGHTED AREA SAMPLING

primitive cannot affect intensity of pixel if it does not intersect the pixel

- equal areas cause equal intensity, regardless of distance from pixel center to area
- Un-weighted sampling colors two pixels identically when the primitive cuts the same area through the two pixels
- intuitively, pixel cut through the center should be more heavily weighted than one cut along corner

WEIGHTED AREA SAMPLING

weight the subpixel contributions according to position, giving higher weights to the central subpixels.

- weighting function, W(x,y) specifies the contribution of primitive passing through the point (x, y) from pixel center

6. Use Lang-Barsky line clipping algorithm to clip the line P_1(-15,-30) P_2(30,60) against the window having diagonally opposite corners as (0,0) and (15,15).

• Consider:

x = x0 + u*dx

y = y0 + u*dy where dx = xend-x0 and dy =yend-y0

• Want values:

xwmin <= x0 + u*dx <= xwmax

ywmin <= y0 + u*dx <= ywmax

• Can rewrite these conditions as: u*p_k <= q_k

where k=1,2,3,4 and

p_1 = -dx, p_2 = dx, p_3 = -dy, p_4 = dy

q_1 = x0 - xwmin, q_2 = xwmax-x0, q_3 = y0 - ywmin, q_4 = ywmax - y0

- Note if p_k = 0 for any k line must be parallel to one of the boundaries and problem is easy.
- Note if p_k < 0 line proceeds from inside to outside given boundary following u until u*p_k =q_k. If p_k >0 line proceeds from outside to inside
- For k such that p_k < 0 we compute r_k =q_k/p_k. Let u1 = max of these r_k and 0.
- For k such that p_k > 0 we compute r_k = q_k/p_k again. Let u2 = min of these r_k and 1.
- If u_1 > u_2 then the line is outside the clipping window. Otherwise, u1 and u2 can be used to get intersection

7. A clipping window PQRS has left corner at (3,4) and upper right corner at (10,9). Find the section of the clipped line AB(2,11),(9,2) using Cohen Sutherland line clipping algorithm.

- If the point is in clipping rectangle then the region code is 0000
- A value of 1 in any position indicates the point is in that relative position
- Assignment of Binary region codes

- Bit 1 is set to 1 if $x < xw_{min}$
- Bit 2 is set to 1 if $x > xw_{max}$
- Bit 3 is set to 1 if $y < yw_{min}$
- Bit 4 is set to 1 if $y > yw_{max}$

Calculation of intersection points with the clip window

- Accept the lines whose both endpoints are having the region code 0000
- Reject the lines whose endpoints have a 1 in the same bit position in the region code
- Lines that cannot be identified as completely inside or outside a clip window are checked for intersection with window boundaries
- Intersection with clipping boundary can be calculated using the slope intercept form of the line equation.
- The intersection point with the vertical boundary is $y = y_1 + m (x – x_1)$
- The intersection point with the horizontal boundary is $x = x_1 + (y – y_1) / m$

8. Discuss the methods of two dimensional clipping.

Clipping is a procedure that identifies those portions of a picture that are either inside or outside of a specified region of space. It can be applied to primitive types such as point, line, area and curve.

Cohen-Sutherland line clipping

- Accept the lines whose both endpoints are having the region code 0000
- Reject the lines whose endpoints have a 1 in the same bit position in the region code
- Lines that cannot be identified as completely inside or outside a clip window are checked for intersection with window boundaries
- Intersection with clipping boundary can be calculated using the slope intercept form of the line equation.

Liang-Barsky line clipping

To compute the final line segment:

1. A line parallel to a clipping window edge has $p_k = 0$ for that boundary.
2. If for that k, $q_k < 0$, the line is completely outside and can be eliminated.
3. When $p_k < 0$ the line proceeds outside to inside the clip window and when $p_k > 0$, the line proceeds inside to outside.
4. For nonzero p_k, $u = \frac{q_k}{p_k}$ gives the intersection point.
5. For each line, calculate u_1 and u_2. For u_1, look at boundaries for which $p_k < 0$ (i.e. outside to inside). Take u_1 to be the largest among $\left\{0, \frac{q_k}{p_k}\right\}$. For u_2, look at boundaries for which $p_k > 0$ (i.e. inside to outside). Take u_2 to be the minimum of $\left\{1, \frac{q_k}{p_k}\right\}$. If $u_1 > u_2$, the line is outside and therefore rejected.

Nicholl-Lee-Nicholl line clipping

The area around the clipping window is divided into a number of different areas, depending on the position of the initial point of the line to be clipped. This initial point should be in three predetermined areas; thus the line may have to be translated and/or rotated to bring it into the desired region. The line segment may then be re-translated and/or re-rotated to bring it to the original position. After that, straight line segments are drawn from the line end point, passing through the corners of the clipping window. These areas are then designated as L, LT, LB, or TR, depending on the location of the initial point. Then the other end point of the line is checked against these areas. If a line starts in the L area and finishes in the LT area then the

algorithm concludes that the line should be clipped at xw (max). Thus the number of clipping points is reduced to one, compared to other algorithms that may require two or more clipping

Sutherland Hodgeman Polygon Clipping

It is performed by processing polygon vertices against each clip rectangle boundary

1. First vertex is outside , Second is inside
2. add second vertex & intersection point of polygon edge with window boundary to o/p vertex list
3. If both vertices are inside, add the second vertex to o/p vertex list
4. If the first vertex is inside ,second is outside save the edge intersection point with window boundary to o/p vertex list
5. If both vertices are outside, add nothing to o/p vertex list

9. Scale a square ABCD A(0,0) B(5,0) C(5,5)D(0,5) two units in X direction and three units in Y direction.

We can represent the given square in matrix form using homogenous coordinates of vertices as

$$\begin{matrix} A- \\ B- \\ C- \\ D- \end{matrix} \begin{matrix} x1 & y1 & 1 \\ x2 & y2 & 1 \\ x3 & y3 & 1 \\ x4 & y4 & 1 \end{matrix} = \begin{matrix} 0 & 0 & 1 \\ 5 & 0 & 1 \\ 5 & 5 & 1 \\ 0 & 5 & 1 \end{matrix}$$

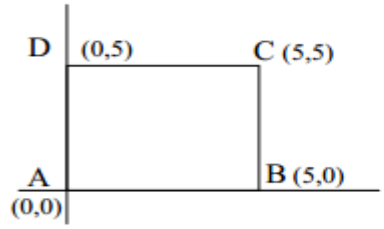
Translation factors are tx =2 and ty =3

Transformation matrix are translation $tv = \begin{matrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ tx & ty & 1 \end{matrix} = \begin{matrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 2 & 3 & 1 \end{matrix}$

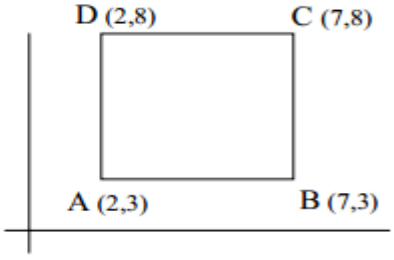
New object point coordinates are [A',B',C',D']=[A,B,C,D].tv

$$\begin{matrix} A'- \\ B'- \\ C'- \\ D'- \end{matrix} \begin{matrix} x1' & y1' & 1 \\ x2' & y2' & 1 \\ x3' & y3' & 1 \\ x4' & y4' & 1 \end{matrix} = \begin{matrix} 0 & 0 & 1 \\ 5 & 0 & 1 \\ 5 & 5 & 1 \\ 0 & 5 & 1 \end{matrix} \cdot \begin{matrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 2 & 3 & 1 \end{matrix} = \begin{matrix} \mathbf{2} & \mathbf{3} & \mathbf{1} \\ \mathbf{7} & \mathbf{3} & \mathbf{1} \\ \mathbf{7} & \mathbf{8} & \mathbf{1} \\ \mathbf{2} & \mathbf{8} & \mathbf{1} \end{matrix}$$

Thus A'(x1',y1')=(2,3)
B'(x2',y2')=(7,3)
C'(x3',y3')=(7,8)
D'(x4',y4')=(2,8)



a) Square before Translation



b) Square after Translation

UNIT-2
THREE-DIMENSIONAL CONCEPTS

1. Define spline?

spline is a flexible strip used to produce a smooth curve through a designated set of points. Several small weights are distributed along the length of the strip to hold it in position on the drafting table as the curve is drawn.

2. **What do you mean by color model?**
   A color model is a method for explaining the properties or behavior of color within some particular context. Example: XYZ model, RGB model

3. **Define parallel and perspective projections.**
   In a parallel projection, coordinate positions are transformed to the view plane along parallel lines. Perspective projection object positions are transformed to the view plane along lines that converge to a point called the projection reference point.
4. **What is morphing?**
   Transformation of object shapes from one form to another is called morphing.
5. **Define Octree.**
   Hierarchical tree structures called octrees are used to represent solid objects in some graphics system. The tree structure is organized so that each node corresponds to a region of 3D space. This representation for solids takes advantage of spatial coherence to reduce storage requirements for 3D objects.
6. **What is blobby object?**
   Some objects do not maintain a fixed shape, but change their surface characteristics in certain motions or when in proximity to other objects. Examples in this class of objects include molecular structures, water droplets and other liquid effects, melting objects and muscle shapes in the human body. These objects can be described as exhibiting "blobbiness" and are often simply referred to as blobby objects, since their shapes show a certain degree of fluidity.
7. **What is HSV model?**
   The HSV(Hue,Saturation,Value) model is a color model which uses color descriptions that have a more intuitive appeal to a user. To give a color specification, a user selects a spectral color and the amounts of white and black that are to be added to obtain different shades, tint, and tones.
8. **Which spline is mostly used? Why?**
   The B-spline is mostly used spline. It has the following disadvantages.
   i. The degree of a B-spline polynomial can be set independently of the number of control points and,
   ii. B-splines allow local control over the shape of a spline curve or surface.
9. **What are the steps in animation sequence?**
   i. Story board layout
   ii. Object definition
   iii. Key-frame specifications
   iv. Generation of in-between frames
10. **What is the use of fractal geometry methods?**
    Natural objects can be realistically described with fractal- geometry methods, where procedures rather than equations are used to model objects.
11. **Explain about Bezier curves.**
    This is a spline approximation method. A beizer curve section can be fitted to any number of control points. The number of control points to be approximated and their relative position determine the degree of the Beizer polynomial. As with the interpolation splines , a beizer curve can be specified with boundary conditions, with a characterization matrix , or with blending functions.
12. **Define viewing.**
    Viewing in 3D have more parameters to select when specifying how a 3D scene is to be mapped to a display device. The scene description must be processed through the viewing coordinate transformation and projection routines that transform the 3D viewing coordinate into 2D device coordinates.
13. **Explain about axonometric projection and isometric projection.**

Orthogonal projections that display more than one face of an object are axonometric projection. Isometric projection is obtained by aligning the projection plane so that it intersects each coordinate axis in which the object is defined at the same distance from the origin.

14. State the uses of chromaticity diagram.

Comparing color gamuts for different sets of primaries
Identifying complementary colors
Determining dominant wavelength and purity of a given color.

15. What is animation?

Computer animation generally refers to any time sequence of visual changes in a scene. In addition to changing object positions with translations or rotations, a computer generated animation could display time variations in object size, color, transparency or surface texture. Animations often transition from one object shape to another.

16. Explain about frame-by-frame animation.

Frame-by-frame animation, each frame of the scene is separately generated and stored. Later the frames can be recorded on film or they can be consecutively displayed in "real time playback" mode.

17. List any four real time animation techniques.

The different types of animation are:
Raster animation
Raster operations: generate real-time animation in limited applications using raster operations.

i. Parameterized systems: allow object motion characteristics to be specified as part of the object definitions. The adjustable parameter control such as object characteristics as degrees of freedom, motion limitations and allowable shape changes.
ii. Scripting systems: allow object specifications and animation sequences to be defined with a user-input script.

18. Define keyframes.

A key frame is a detailed drawing of the scene at a certain time in the animation sequence. Within each key frame, each object is positioned according to the time for that frame. Some key frames are chosen at extreme positions in action; others are spaced so that the time interval between key frames is not too great. More key frames are specified for intricate motions than for simple, slowly varying motions.

19. What do you mean by complementary colors and primary colors?

If the two color sources combine to produce white light, they are referred to as complementary colors. Examples of complementary color pairs are red and cyan, green and magenta, and blue and yellow.The two or three colors used to produce other colors in a color model are referred to as primary colors.

20. State the difference between CMY and HSV color models.

CMY Model	**HSV Model**
A color model defined with the primary colors cyan, magenta and yellow (CMY) is useful for describing color output to hard-copy devices.	The HSV model uses color descriptors that have a more natural appeal to the user. Color parameters in this model are hue (H), saturation (S) and value(V).
Hard-copy devices such as plotters produce a color picture by coating a paper with color pigments.	To give color specification, a user selects a spectral color and the amounts of black and white that are to be added to obtain different shades, tints and tones

PART-B

1. Discuss in detail the three dimensional transformation with suitable examples.

Translation

$P^I = T \cdot P$

$x^I = x + t_x$

$y^I = y + t_y$

$z^I = z + t_z$

Inverse translation

- obtained by negating translation distances

Rotation-definition-equations-diagram-matrix representation

Rotation

To perform rotation we need,

An axis

Rotation angle

+ve rotation angles produce counter clockwise rotation

-ve rotation angles produce clockwise rotation

Coordinate axis rotation Z-axis, Y-axis and X-axis

Z axis rotation

$x^I = x\cos\Theta - y\sin\Theta$

$y^I = x\sin\Theta + y\cos\Theta$

$z^I = z$

$P^I = R_z(\Theta).P$

Scaling:

alters the size of the object

coordinate values of the vertex is multiplied by scaling factors S_x&S_y

$x^I = x \cdot S_x$

$y^I = y \cdot S_y$

Reflection

produces mirror image

obtained by rotating the object 180 degrees about the reflection axis.

Shear

distorts the shape of an object.

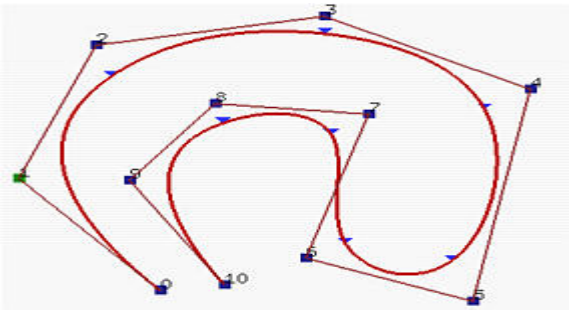
can be with respect to both axis

2. Briefly explain how curves are generated using B-spline function and properties of B-spline curves.

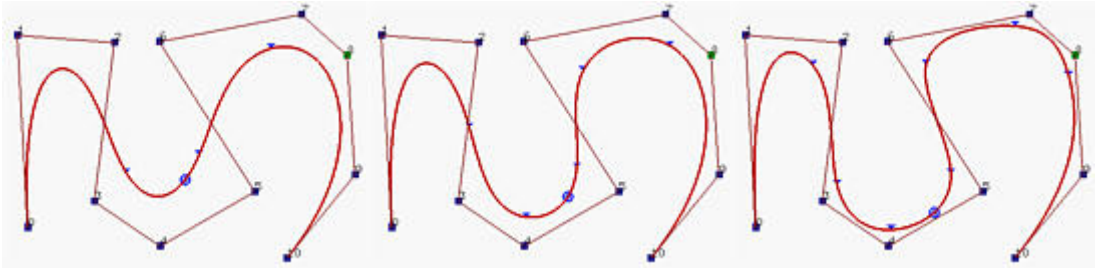
B-spline curves share many important properties with Bézier curves, because the former is a generalization of the later. Moreover, B-spline curves have more desired properties than Bézier curves. The list below shows some of the most important properties of B-spline curves.In the following we shall assume a B-spline curve **C**(u) of degree p is defined by n + 1 control points and a knot vector $U = \{ u_0, u_1, ..., u_m \}$ with the first p+1 and last p+1 knots "clamped" (i.e., $u_0 = u_1 = ... = u_p$ and $u_{m-p} = u_{m-p+1} = ... = u_m$).

- **B-spline curve C(u) is a piecewise curve with each component a curve of degree p.** As mentioned in previous page, **C**(u) can be viewed as the union of curve segments defined on each knot span. In the figure below, where n = 10, m = 14 and p = 3, the first four knots and last four knots are clamped and the 7 internal knots are uniformly spaced. There are eight knot spans, each of which corresponds to a curve segment. In the left figure below, these knot points

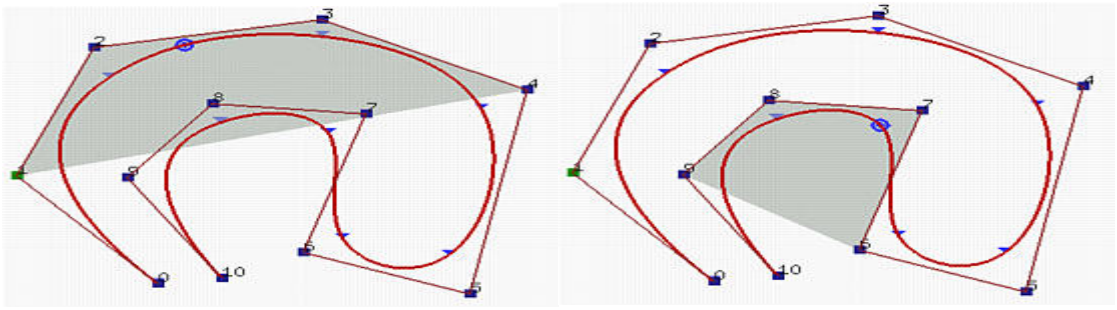
are shown as triangles.This nice property allows us to design complex shapes with lower degree polynomials. For example, the right figure below shows a Bézier curve with the same set of control points. It still cannot follow the control polyline nicely even though its degree is 10!



In general, the lower the degree, the closer a B-spline curve follows its control polyline. The following figures all use the same control polyline and knots are clamped and uniformly spaced. The first figure has degree 7, the middle one has degree 5 and the right figure has degree 3. Therefore, as the degree decreases, the generated B-spline curve moves closer to its control polyline.



- **Equality m = n + p + 1 must be satisfied.**
  Since each control point needs a basis function and the number of basis functions satisfies m = n + p + 1.
- **Clamped B-spline curve C(u) passes through the two end control points P_0 and P_n.** Note that basis function $N_{0,p}(u)$ is the coefficient of control point $\mathbf{P}_0$ and is non-zero on $[u_0,u_{p+1})$. Since $u_0 = u_1 = ... = u_p = 0$ for a clamped B-spline curve, $N_{0,0}(u)$, $N_{1,0}(u)$, ..., $N_{p-1,0}(u)$ are zero and only $N_{p,0}(u)$ is non-zero (recall from the triangular computation scheme). Consequently, if u = 0, then $N_{0,p}(0)$ is 1 and $\mathbf{C}(0) = \mathbf{P}_0$. A similar discussion can show $\mathbf{C}(1) = \mathbf{P}_n$



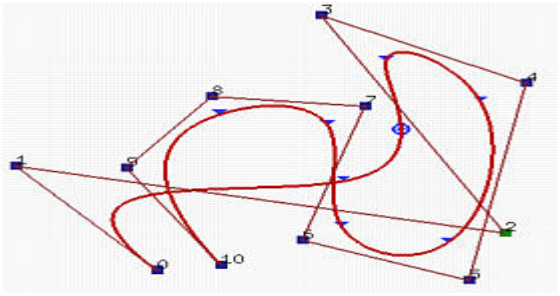
The above two B-spline curves have 11 control points (i.e., n = 10), degree 3 (i.e., p=3) and 15 knots (m = 14) with first four and last four knots clamped. Therefore, the number of knot spans is equal to the number curve segments. The knot vector is

u_0	u_1	u_2	u_3	u_4	u_5	u_6	u_7	u_8	u_9	u_{10}	u_{11}	u_{12}	u_{13}	u_{14}
0	0	0	0	0.12	0.25	0.37	0.5	0.62	0.75	0.87	1	1	1	1

The left figure has u in knot span $[u_4, u_5) = [0.12,0.25)$ and the corresponding point (i.e. $\mathbf{C}(u)$) in the second curve segment. Therefore, there are p+1 = 4 basis functions non-zero on this knot span (i.e.,$N_{4,3}(u)$, $N_{3,3}(u)$, $N_{2,3}(u)$ and $N_{1,3}(u)$) and the corresponding control points are $\mathbf{P}_4$, $\mathbf{P}_3$, $\mathbf{P}_2$ and $\mathbf{P}_1$. The shaded area is the convex hull defined by these four points. It is clear that $\mathbf{C}(u)$ lies in this convex hull.The B-spline curve in the right figure is defined the same way. However, u is in $[u_9, u_{10}) = [0.75,0.87)$ and the non-zero basis functions are $N_{9,3}(u)$, $N_{8,3}(u)$, $N_{7,3}(u)$ and $N_{6,3}(u)$. The corresponding control points are $\mathbf{P}_9$, $\mathbf{P}_8$, $\mathbf{P}_7$ and $\mathbf{P}_6$.

Consequently, as u moves from 0 to 1 and crosses a knot, a basis functions becomes zero and a new non-zero basis function becomes effective. As a result, one control point whose coefficient becomes zero will leave the the definition of the current convex hull and is replaced with a new control point whose coefficient becomes non-zero.

- **Local Modification Scheme: changing the position of control point $\mathbf{P}_i$ only affects the curve $\mathbf{C}(u)$ on interval $[u_i, u_{i+p+1})$.**
This follows from another important property of B-spline basis functions. Recall that $N_{i,p}(u)$ is non-zero on interval $[u_i, u_{i+p+1})$. If u is not in this interval, $N_{i,p}(u)\mathbf{P}_i$ has no effect in computing $\mathbf{C}(u)$ since $N_{i,p}(u)$ is zero. On the other hand, if u is in the indicated interval, $N_{i,p}(u)$ is non-zero. If $\mathbf{P}_i$ changes its position, $N_{i,p}(u)\mathbf{P}_i$ is changed and consequently $\mathbf{C}(u)$ is changed.



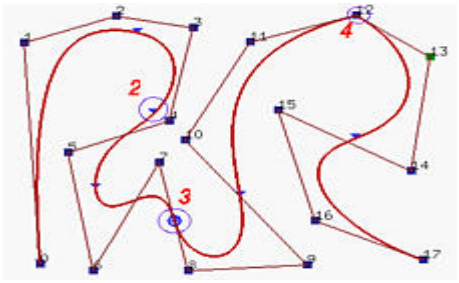
The above B-spline curves are defined with the same parameters as in the previous convex hull example. We intent to move control point $\mathbf{P}_2$. The coefficient of this control point is $N_{2,3}(u)$ and the interval on which this coefficient is non-zero is $[u_2, u_{2+3+1}) = [u_2, u_6) = [0,0.37)$. Since $u_2 = u_3 = 0$, only three segments that correspond to $[u_3, u_4)$ (the domain of the first curve segment), $[u_4, u_5)$ (the domain of the second curve segment) and $[u_5, u_6)$ (the domain of the third curve segment) will be affected. The right figure shows the result of moving $\mathbf{P}_2$ to the lower right corner. As you can see, only the first, second and third curve segments change their shapes and all remaining curve segments stay in their original place without any change.

This local modification scheme is very important to curve design, because we can modify a

u_0 to u_4	u_5	u_6 and u_7	u_8	u_9 to u_{11}	u_{12}	u_{13} to u_{16}	u_{17}	u_{18} to u_{22}
0	0.125	0.25	0.375	0.5	0.625	0.75	0.875	1

curve locally without changing the shape in a global way. This will be elaborated on the moeing control point page. Moreover, if fine-tuning curve shape is required, one can insert more knots (and therefore more control points) so that the affected area could be restricted to a very narrow region. We shall talk about knot insertion later.

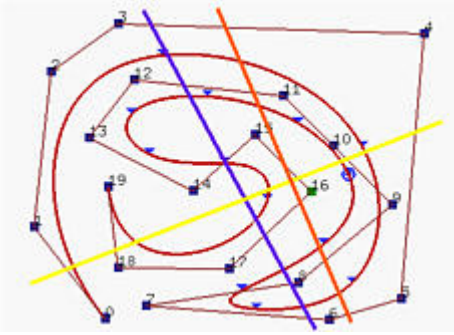
- **C(u) is C^{p-k} continuous at a knot of multiplicity k**
  If u is not a knot, **C**(u) is in the middle of a curve segment of degree p and is therefore infinitely differentiable. If u is a knot in the non-zero domain of $N_{i,p}(u)$, since the latter is only C^{p-k} continuous, so does **C**(u).



The above B-spline curve has 18 control points (i.e., n = 17), degree 4, and the following clamped knot vector

Thus, u_6 is a double knot, u_9 is a triple knot and u_{13} is a quadruple knot. Consequently, **C**(u) is of C^4 continuous at any point that is not a knot, C^3 continuous at all simple knots, C^2 continuous at u_6,C^1 continuous at u_9, C^0 continuous at u_{13}.All points on the curve that correspond to knots are marked with little triangles. Those corresponding to multiple knots are further marked with circles and their multiplicities. It is very difficult to visualize the difference between C^4, C^3 and even C^2 continuity. For the C^1 case, the corresponding point lies on a leg, while the C^0 case forces the curve to pass through a control point. We shall return to this issue later when discussing modifying knots.

- **Variation Diminishing Property**:
  The variation diminishing property also holds f or B-spline curves. If the curve is in a plane (resp., space), this means no straight line (resp., plane) intersects a B-spline curve more times than it intersects the curve's control polyline.



In the above figure, the blue line intersects both the control polyline and the B-spline curve 6 times, while the yellow line also intersects the control polyline and the B-spline curve 5 times. However, the orange line intersects the control polyline 6 times and the curve 4 times.

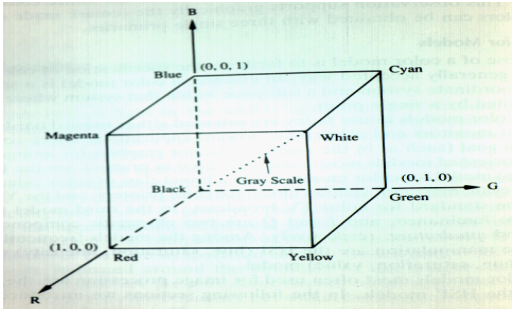
- **Bézier Curves Are Special Cases of B-spline Curves.**
  If n = p (i.e., the degree of a B-spline curve is equal to n, the number of control points minus 1), and there are 2 (p + 1) = 2 (n + 1) knots with p + 1 of them clamped at each end, this B-spline curve reduces to a Bézier curve.
- **AffineInvariance**
  The affine invariance property also holds for B-spline curves. If an affine transformation is applied to a B-spline curve, the result can be constructed from the affine images of its control points. This is a nice property. When we want to apply a geometric or even affine transformation to a B-spline curve, this property states that we can apply the transformation to control points, which is quite easy, and once the transformed control points are obtained the transformed B-spline curve is the one defined by these new points. Therefore, we do not have to transform the curve.

3. Describe the HSV and RGB color models.

RGB color model

- Colors are displayed based on the theory of vision (eyes perceive colors through the stimulation of three visual pigments in the cones of the retina)
- It is an additive model
- Uses Red, Green and Blue as primary colors
- Represented by an unit cube defined on the R, G and B axes
- The origin represents black and the vertex with coordinates(1,1,1) represents white
- Any color C_λ can be represented as RGB components as

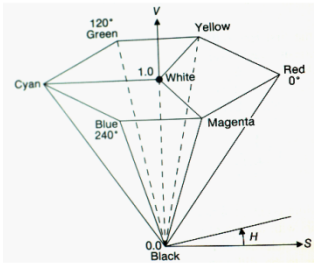
  $C_\lambda = R\mathbf{R} + G\mathbf{G} + B\mathbf{B}$



HSV color model

Color parameters used are Hue, saturation and value

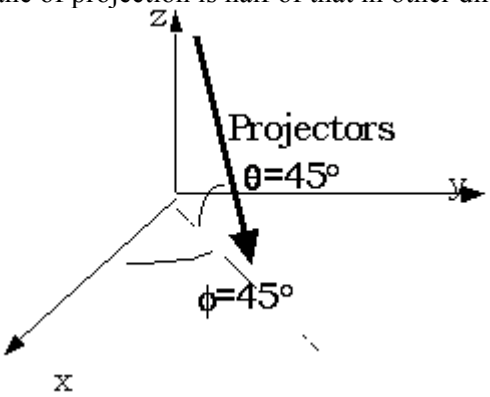
- Color is described by adding either black or white to the pure hue
- Adding black decreases V while S remains constant
- Adding white decreases S while V remains constant
- Hue is represented as an angle about vertical axis ranging from 0 degree to 360 degrees
- S varies from 0 to 1 and V varies from 0 to 1



4. Derive the oblique projection matrix and apply it to find the transformation for cavalier projection with Θ=45° and cabinet projection with Θ=30°

Oblique projection results when parallel projectors from centre of projection at infinity intersect the plane of projection at an oblique angle. Two oblique projections are well known: Cavalier and Cabinet.

- Cavalier Projection: It results when the angle of projection is 45º. In this projection all the three foreshortening factors are equal and the image appears too thick.
- Cabinet Projection: It is an oblique projection with foreshortening factor for edges perpendicular to the plane of projection is half of that in other directions.



- First, find the direction vector of the projector **V**. From the above figure, for a unit vector along the projector direction, its x, y, z components can be written as $x_V = \cos q \cos f$ $y_V = \cos q \sin f$ $z_V = -\sin q$
- Hence the direction vector **V** of the projector is (cosqcosf, cosqsinf, -sinq).
- Consider one arbitrary point P(x,y,z). It has been projected onto the XY plane at P'(x',y',0).

  The vector has the same direction as **V** and $\overline{\mathbf{PP'}} = k\mathbf{V}$. For point P' we can write the following:

  $x' = x + k \cos q \cos f$ $y' = y + k \cos q \sin f$ $0 = z - k \sin q$

  Hence k = z/sinq and $x' = x + \frac{\cos\theta\cos\phi}{\sin\theta} z$ $y' = y + \frac{\cos\theta\sin\phi}{\sin\theta} z$

  Recalling that $q=f=45$, the projection transformation matrix is then

$$\begin{bmatrix} 1 & 0 & \frac{\cos\theta\cos\phi}{\sin\theta} & 0 \\ 0 & 1 & \frac{\cos\theta\sin\phi}{\sin\theta} & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0.71 & 0 \\ 0 & 1 & 0.71 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

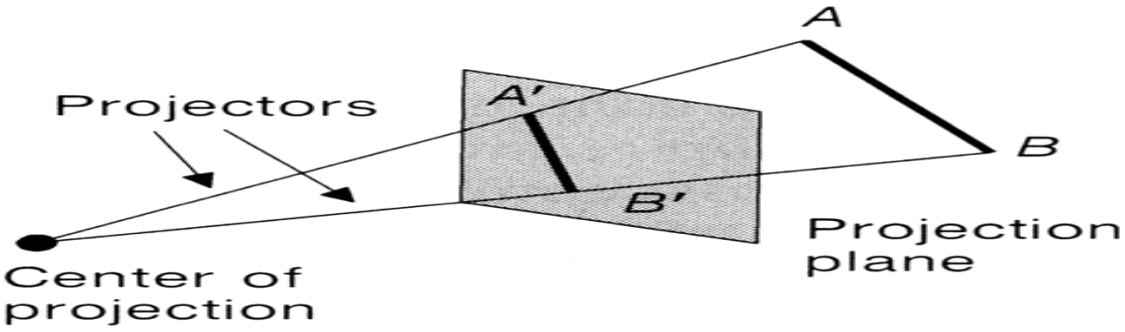
5. Explain different types of projection in detail and also explain the perspective projection for projecting 3D objects on a 2D surface.

Transform 3D objects on to a 2D plane using **projections(two types)**

- **parallel projections**
- **perspective projections**

In **parallel projection**, coordinate positions are transformed to the view plane along parallel lines.
In **perspective projection**, object position are transformed to the view plane along lines that converge to a point called **projection reference point (center of projection)**

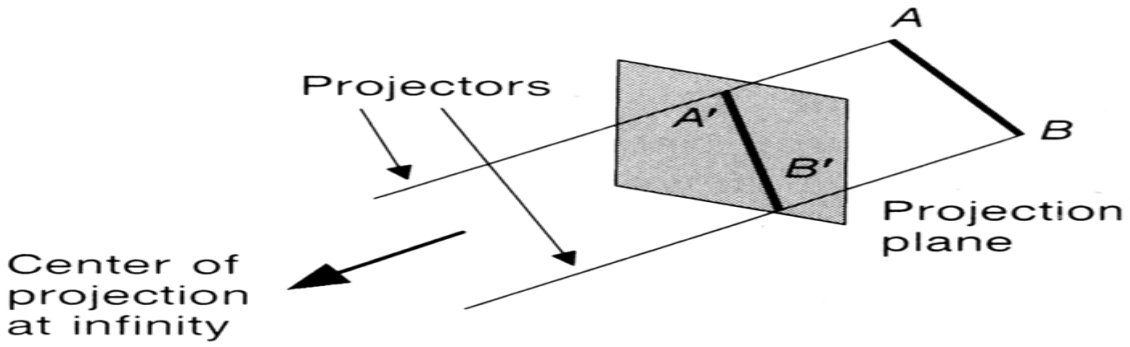
Perspective Projection



Characteristics:

- Center of Projection (CP) is a finite distance from object
- Projectors are rays (i.e., non-parallel)
- Vanishing points
- Objects appear smaller as distance from CP (eye of observer) increases
- Difficult to determine exact size and shape of object
- Most realistic, difficult to execute
- When a 3D object is projected onto view plane using perspective transformation equations, any set of parallel lines in the object that are not parallel to the projection plane, converge at a vanishing point.
- There are an infinite number of vanishing points, depending on how many set of parallel lines there are in the scene.
- If a set of lines are parallel to one of the three principle axes, the vanishing point is called anprincipal vanishing point.
- There are at most 3 such points, corresponding to the number of axes cut by the projection plane.

Parallel Projection



- We can define a parallel projection with a projection vector that defines the direction for the projection lines.

- **Orthographic** : when the projection is perpendicular to the view plane. In short,
  - direction of projection = normal to the projection plane.
  - the projection is perpendicular to the view plane.
- **Oblique** : when the projection is not perpendicular to the view plane. In short,
  - direction of projection ≠ normal to the projection plane.
  - Not perpendicular.

6. Derive the 3D transformation matrix rotation about an arbitrary axis and arbitrary plane.

Rotation of a point in 3 dimensional space by theta about an arbitrary axes defined by a line between two points $P_1 = (x_1,y_1,z_1)$ and $P_2 = (x_2,y_2,z_2)$ can be achieved by the following steps

(**1**) translate space so that the rotation axis passes through the origin
(**2**) rotate space about the x axis so that the rotation axis lies in the xz plane
(**3**) rotate space about the y axis so that the rotation axis lies along the z axis
(**4**) perform the desired rotation by theta about the z axis
(**5**) apply the inverse of step (**3**)
(**6**) apply the inverse of step (**2**)
(**7**) apply the inverse of step (**1**)

- If the rotation axis is already aligned with the z axis then steps **2**, **3**, **5**, and **6** need not be performed.
- In all that follows a right hand coordinate system is assumed and rotations are positive when looking down the rotation axis towards the origin.
- Symbols representing matrices will be shown in bold text.
- The inverse of the rotation matrices below are particularly straightforward since the determinant is unity in each case.
- All rotation angles are considered positive if anticlockwise looking down the rotation axis towards the origin.

Step 1

Translate space so that the rotation axis passes through the origin. This is accomplished by translating space by $-\mathbf{P}_1$ $(-x_1,-y_1,-z_1)$. The translation matrix **T** and the inverse $\mathbf{T}^{-1}$ (required for step 7) are given below

$$\mathbf{T} = \begin{pmatrix} 1 & 0 & 0 & -x_1 \\ 0 & 1 & 0 & -y_1 \\ 0 & 0 & 1 & -z_1 \\ 0 & 0 & 0 & 1 \end{pmatrix} \qquad \mathbf{T}^{-1} = \begin{pmatrix} 1 & 0 & 0 & x_1 \\ 0 & 1 & 0 & y_1 \\ 0 & 0 & 1 & z_1 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Step 2

Rotate space about the x axis so that the rotation axis lies in the xz plane. Let U = (a,b,c) be the unit vector along the rotation axis. and define d = sqrt($b^2 + c^2$) as the length of the projection onto the yz plane. If d = 0 then the rotation axis is along the x axis and no additional rotation is necessary. Otherwise rotate the rotation axis so that is lies in the xz plane. The rotation angle to achieve this is the angle between the projection of rotation axis in the yz plane and the z axis. This can be calculated from the dot product of the z component of the unit vector U and its yz projection. The sine of the angle is determine by considering the cross product.

$$\cos(t) = \frac{(0,0,c) \text{ dot } (0,b,c)}{c\ d} = c/d \qquad \sin(t) = \frac{\| (0,0,c) \text{ cross } (0,b,c) \|}{c\ d} = b/d$$

The rotation matrix $\mathbf{R}_x$ and the inverse $\mathbf{R}_x^{-1}$ (required for step 6) are given below

$$\mathbf{R}_x = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & c/d & -b/d & 0 \\ 0 & b/d & c/d & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \qquad \mathbf{R}_x^{-1} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & c/d & b/d & 0 \\ 0 & -b/d & c/d & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Step 3

Rotate space about the y axis so that the rotation axis lies along the positive z axis. Using the appropriate dot and cross product relationships as before the cosine of the angle is d, the sine of the angle is a. The rotation matrix about the y axis $\mathbf{R}_y$ and the inverse $\mathbf{R}_y^{-1}$ (required for step 5) are given below.

$$\mathbf{R}_y = \begin{pmatrix} d & 0 & -a & 0 \\ 0 & 1 & 0 & 0 \\ a & 0 & d & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \qquad \mathbf{R}_y^{-1} = \begin{pmatrix} d & 0 & a & 0 \\ 0 & 1 & 0 & 0 \\ -a & 0 & d & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Step 4

Rotation about the z axis by t (theta) is $\mathbf{R}_z$ and is simply

$$\mathbf{R}_z = \begin{pmatrix} \cos(t) & -\sin(t) & 0 & 0 \\ \sin(t) & \cos(t) & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

The complete transformation to rotate a point (x,y,z) about the rotation axis to a new point (x`,y`,z`) is as follows, the forward transforms followed by the reverse transforms.

$$\begin{pmatrix} x' \\ y' \\ z' \\ 1 \end{pmatrix} = \mathbf{T}^{-1}\,\mathbf{R}_x^{-1}\,\mathbf{R}_y^{-1}\,\mathbf{R}_z\,\mathbf{R}_y\,\mathbf{R}_x\,\mathbf{T} \begin{pmatrix} x \\ y \\ z \\ 1 \end{pmatrix}$$

7. How will you construct deterministic self similar fractals? Explain.

To geometrically construct a deterministic (non-random) self-similar fractal, we start with a given geometric shape, called the initiator. Subparts of the initiator are then replaced with a pattern, called the generator.

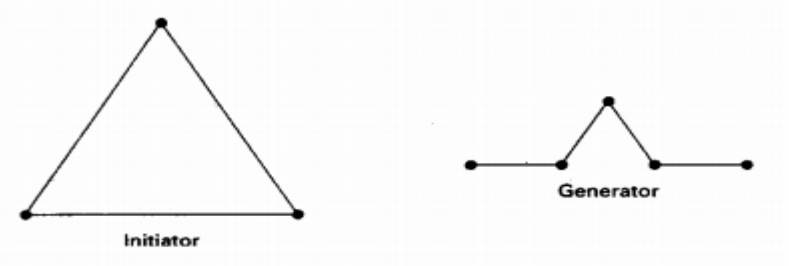


Figure 8-4
Initiator and generator for the Koch curve.

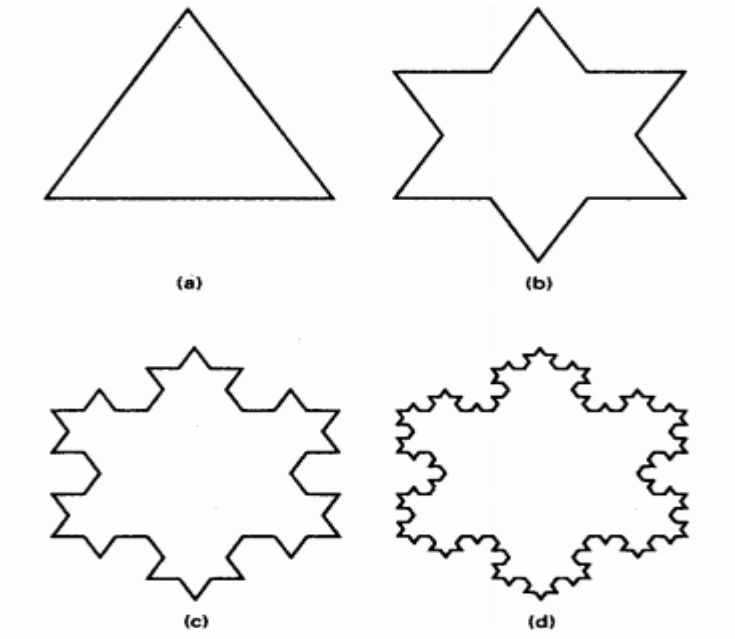


Figure 8-5
First three iterations in the generation of the Koch curve.

an example, if we use the initiator and generator shown in Fig.8-4, we can construct the snowflake pattern or Koch shown in Fig.8-5.

Each straight-line segment in the initiator is replaced with four equal-length line segments at each step. The scaling factor is l/3, so the fractal dimension is D = ln 4/ln 3 ≈ 1.2619. Also, the length of each line segment in the initiator increases by a factor of 4/3 at each step, so that the length of the fractal curve tends to infinity as more detail is added to the curve (Fig.8-6). Examples of other self-similar, fractal-curve constructions are shown in Fig.8-7. These examples illustrate the more jagged appearance of objects with higher fractal dimensions.

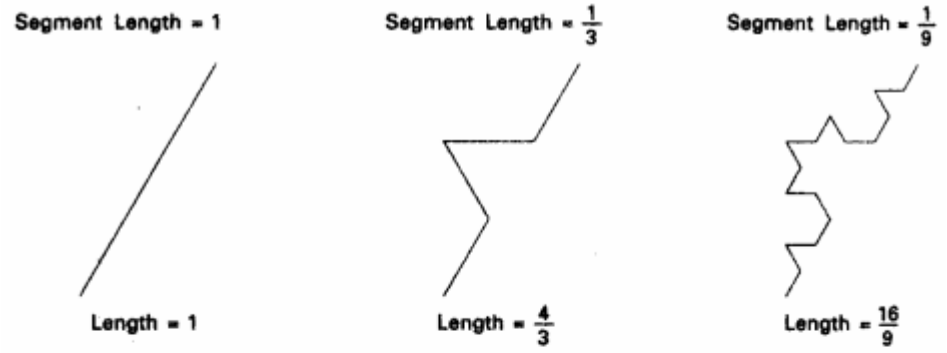


Figure 8-6

Length of each side of the Koch curve increases by a factor of 4/3 at each step, while the line-segment lengths are reduced by a factor of 1/3.

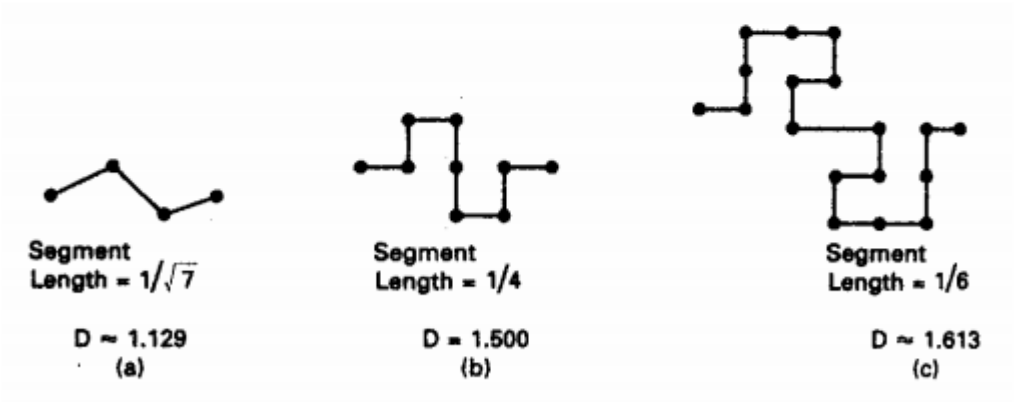


Figure 8-7

Self-similar curve constructions and associated fractal dimensions.

Figure 8-9 shows an example of a self-similar construction using multiple scaling factors. The fractal dimension of this object is determined from Eq.8-4. As an example of self-similar - 7 - fractal construction for a surface, we scale the regular tetrahedron shown in Fig.8-10 by a factor of 1/2, then place the scaled object on each of the original four surfaces of the tetrahedron. Each face of the original tetrahedron is converted to 6 sma1ler faces and the original face area is increased by a factor of 3/2. The fractal dimension of this surface is D = ln6 / ln2 ≈ 2.58496 which indicates a fairly fragmented surface.

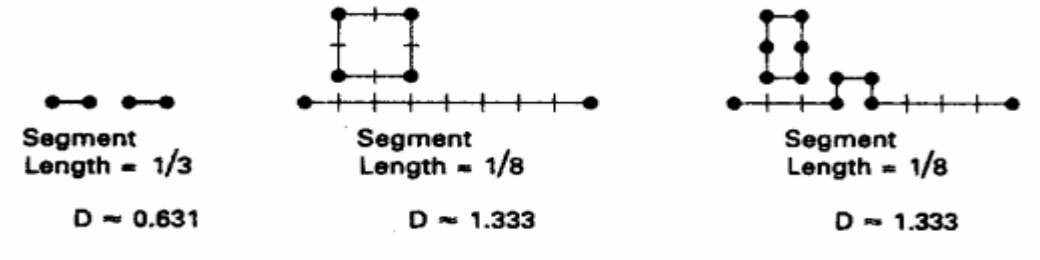


Figure 8-8
Generators with multiple, disjoint parts.

Figure 8-9
A snowflake-filling Peano curve

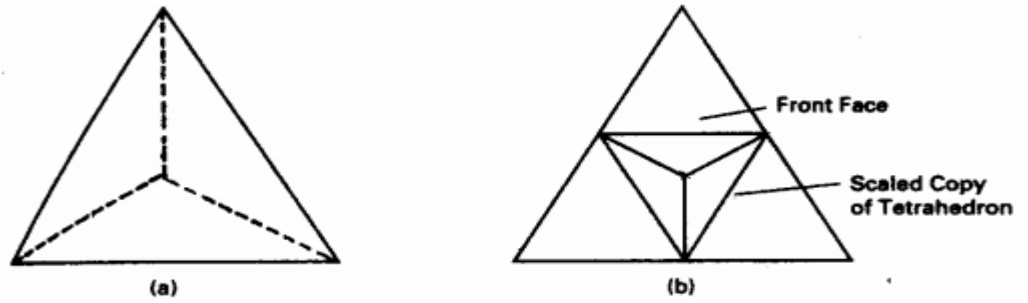


Figure 8-10
Scaling the tetrahedron in (a) by a factor of l/2 and positioning the scaled version on one face of the original tetrahedron produces the fractal surface (b).

Another way to create self-similar fractal objects is to punch holes in a given initiator, instead of adding more surface area. Fig.8-11 shows some examples of fractal objects created in this way

8. Discuss briefly about the characteristics of Cubic Bezier curves.

Several important properties of Bezier curves are summarized here. Many of these can be understood by examining the Bernstein blending functions used to define Bezier curves.

- The k-th derivative at the start (end) of a Bezier curve depends only on the first (last) (k+1) control points. Two obvious special cases:
  - k=0: The Bezier curve starts at the first control point and stops at the last control point. (In general, it will not pass through any other control point.)
  - k=1: The vector tangent to the Bezier curve at the start (stop) is parallel to the line connecting the first two (last two) control points.
- A Bezier curve will always be completely contained inside of the Convex Hull of the control points. For planar curves, imagine that each control point is a nail pounded into a board. The

shape a rubber band would take on when snapped around the control points is the convex hull. For Bezier curves whose control points do not all lie in a common plane, imagine the control points are tiny balls in space, and image the shape a balloon will take on if it collapses over the balls. This shape is the convex hull in that case. In any event, a Bezier curve will always lie entirely inside its planar or volumetric convex hull.

- Closely related to the previous is the fact that adjusting the position of a control point changes the shape of the curve in a "predictable manner". Intuitively, the curve "follows" the control point. In the image below, see how a curve defined in terms of four control points (the magenta curve) changes when one of its control points is moved to the right, yielding the modified (cyan) curve.
- There is no local control of this shape modification. Every point on the curve (with the exception of the first and last) move whenever any interior control point is moved. This property can also be observed in the image shown in the previous item.
- Also related to property #2 is the fact that Bezier curves exhibit a variation diminishing property. Informally this means that the Bezier curve will not "wiggle" any more than the control polygon does. In other words, the curve will not wiggle unless the designer specifically introduces wiggling in the control polygon. More formally, the variation diminishing property can be stated as follows: any straight line will intersect legs of the control polygon at least as many times as it crosses the Bezier curve itself. See the example below which illustrates the property with a degree 12 Bezier curve:
- The effect of control point P_i on the curve is at its maximum at parameter value $t = i/n$. Among other things, this somewhat ameleriorates problems related to the fact that there is no local control.
- Bezier curves exhibit a symmetry property: The same Bezier curve shape is obtained if the control points are specified in the opposite order. The only difference will be the parametric direction of the curve. The direction of increasing parameter reverses when the control points are specified in the reverse order.
- Bezier curves are invariant under affine transformations, but they are not invariant under projective transformations.
- Bezier curves are also invariant under affine parameter transformations. That is, while the curve is usually defined on the parametric interval [0,1], an affine transformation mapping [0,1] to the interval [a,b], $a \neq b$, yields the same curve.

9. **Write about CIE color model and its advantages. Make a detailed comparison of all color models.**

CIE (Commission International de l'Eclairage - International ColorCommision) organisation produced two models for defining color:

- 1931: Measured on 10 subjects on samples subtending 2 degrees of the field of view
- 1964: Measured on larger number of subjects subtending 10 degrees of field of view
- The CIE 1931 model is the most commonly used
- It defines three primary “colors” X, Y and Z that can be used to describe all visible colors, as well as a standard white, called C. The range of colors that can be described by combinations of other colors is called a color gamut. ! Since it is impossible to find three colors with a gamut containing all visible colors, the CIE’s three primary colors are imaginary. They cannot be seen, but they can be used to define other visible colors

To define a color in CIE model, provide weights for the X, Y and Z primaries, just as you would for an RGB display (e.g. color = xX + yY + zZ).

• X, Y and Z form a three dimensional color volume. We can ignore the dimension of luminance by normalizing with total light intensity, x+y+z = 1. This gives chromaticity values: x' = x/(x+y+z) y' = y/(x+y+z) z' = 1 - x' - y'
• Plotting x' and y' gives the CIE chromaticity diagram.
• Colorgamuts are found by taking the convex hull of the primary colors. • Complements are found by inscribing a line from the color through C to the edge of the diagram.
• Hue of a color: found by inscribing a line from C (white) through the color to the edge of the diagram. The hue is the wavelength of the color at the intersection of the edge and the line. • Saturation of a color: found by taking the ratio of the distance of the color from C on the above line and the length of the whole line.
• Complementary colors : can be mixed to produce white light (a non-spectral color) . White can be produced by constant spectral distribution as well as by only two complementary colors, e.g., greenish-blue, D, and reddish-orange.No gamut described by a linear combination of n physical (real) primaries (yielding a convex hull) can simulate the eye's responses to all visible colors
• Subject shown color and asked to create metameric match from colored monochromatic primaries, R, G and B . Most colors can be matched, some can't because of way response curves overlap .
• Would need "negative amounts" of some primary to match all visible color samples, not physically possible, but can be simulated by adding that color to sample to be matched. To simplify, CIE primaries X, Y, and Z used to get all positive color matching functions

UNIT-3
MULTIMEDIA SYSTEMS DESIGN

1. What are the basic objects of multimedia systems?

TEXT -Text is the basic element of multimedia.
GRAPHIC -Graphics make the multimedia application attractive.
AUDIO -A multimedia application may require the use of speech, music and sound effects.
VIDEO -Video provides a powerful impact in a multimedia program.
ANIMATION -Animation is a process of making a static image look like it is moving.

2. What are Multimedia Data Interface Standards? Give example.

Multimedia Data Interface standard is a compact audio/video interface for transferring uncompressed video data and compressed or uncompressed digital audio data from an device ("the source device") to a compatible digital audio device, computer monitor, video projector, or digital television. Eg: Waveform Audio file format-WAVE, Rich Text Format-RTF, Multimedia Movie Format.

3. List the methods of defining objects for multimedia systems.

The objects for a multimedia system are defined independently or combinations of the following elements

i. Text
ii. Graphics / Images
iii. Animations
iv. Audio and video,
v. Full motion and live video

4. What is RDIB?

RDIB- stands for RIFF Device Independent Bitmap.
RIFF- Resourse Interchange file Format is a Standard file Format.
RDIB allows more complex set of bitmaps that can be handled by DIB

5. Write the four different categories of image processing.

Image Recognition, Image Enhancement, Image Synthesis, Image Reconstruction are the four different categories of image processing

6. Write down the features of Apple's quick time standard for compression.

The QuickTime standard, developed by Apple Computer, is designed to support multimedia applications. Apple 's QuickTime is viewed as a multimedia interface that is evolving to become a standard part of the Apple as well as MS-Windows based systems

7. What are asymmetric applications? Give an example.

Asymmetric application require frequent use of the decompression process, but it is performed only once.

Eg,

i. Education and training
ii. Travel guide
iii. Point of Sale
iv. Games and Entertainment

8. Give two examples each, for lossless and lossy compression standards.

Lossy compression: JPEG and MP3

Lossless Compression: GIF and ZIP

9. What is a hypertext?

Hypertext is an application of indexing text to provide a rapid search of specific text strings in one or more documents. Hypertext is an integral part of hypermedia documents. In multimedia applications, a hypermedia documents is the basic complex object of which text is a sub-object. Other sub-objects in the basic object include images, sound, and full-motion video.

10. What are the multimedia elements?

The elements of multimedia are Text,vedio,audio,graphics, image animation etc.

11. Explain about Abstract images?

Abstract Images are not really images. They exist as real world objects or representations. They are computer generated images based on some arithmetic calculations. The examples are Fractals – Fractals are the result of computer generated algorithms it shows different patterns that can be created Kaleidoscope – Shows different patterns due to relative positions of glass beads when it is rotated

12. State the mathematical used for generating Abstract Images?

Discrete Functions – It results in still images that remain constant on a temporal scale

Continuous Functions – It is used to show animated images and operations such as image fading or dissolving into another image

13. What are the benefits of Multimedia Databases?

i. Significant reduction of time and space
ii. Increased productivity
iii. Simultaneous document access
iv. Multidimensional information flow
v. Reduction of time and money
vi. Facilitation of rapid and correct responses
vii. Documents are manageable

14. Define dual buffered VGA mixing/scaling.

In double buffer scheme there are two buffers. One called decompression buffer used to store the original images and the other called display buffer used to store the resized buffer.Mention the key issues of database organization?Data Independence, Common distributed database architecture, Distributed database servers, Multimedia object management.

15. Explain about Massive Data Volumes?

In this storage technology only 20% of all strategic information is automated. More than 80% resides on paper or performed interactively in meetings, discussions and presentations.

16. Explain Microfiche and Microfilm?

Microfiche and Microfilm is used as a medium for storage of paper documents. Both have high level of mechanical failure and physical deterioration. Microfiche and Microfilm leaves a lot of

noise on documents. Microfiche is a 4x6 sheet of film that holds hundreds of document pages. Microfilm is a continuous film strip that holds several thousands of document pages.

17. Give the two Mass Storage technologies?

The Mass storage technologies are used for storage of multimedia documents. They are

i. Optical disk storage systems
ii. High speed magnetic storage

18. What is a BLOB?

BLOB means Binary Large Object. Relational Database has adopted a data type commonly known as BLOB. It is used for objects such as images or other binary datatypes. Image Compression is the process of reducing the size of the image by removing redundant information in a lossless or lossy manner to conserve storage space and transmission time.

19. What is High-Definition Television(HDTV)?

A new digital broadcast standard aimed at changing the shape and doubling thequality of television pictures. HDTV will provide 1125 lines instead of 525 lines, have the widescreen 16-to-9 shape, and come with surround sound of CD quality in five channels.

20. Write about ATM network standard.

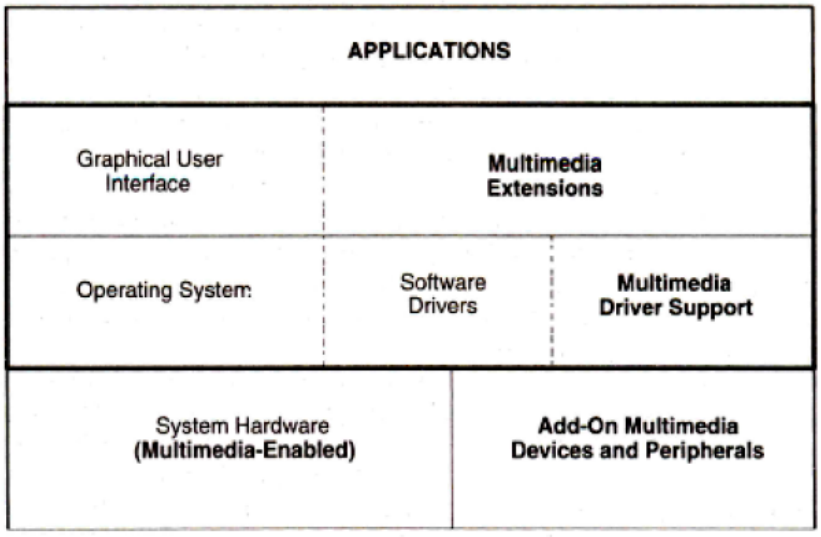
ATM stands for Asynchronous Transfer Mode. It is a method of multiplexing andrelaying 53 byte cells out of which 48 byte is user information and 5 bytes of header information, containing either text data packets or compressed images, real time audio or video information.

PART-B

1. Draw the schematic diagram of multimedia systems architecture and write about the functions of various components?

Multimedia Systems Architecture

Multimedia encompasses a large variety of technologies and integration of multiple architectures interacting in real time. All of these multimedia capabilities must integrate with the standard user interfaces such as Microsoft Windows. The following figure describes the architecture of a multimedia workstation environment.



The right side shows the new architectural entities required for supporting multimedia applications.

For each special devices such as scanners, video cameras, VCRs and sound equipment-, a software device driver is need to provide the interface from an application to the device. The GUI require control extensions to support applications such as full motion video .

High Resolution Graphics Display

The various graphics standards such as MCA, GGA and XGA have demonstrated the increasing demands for higher resolutions for GUls.

Combined graphics and imaging applications require functionality at three levels. They are provided by three classes of single-monitor architecture.

(i) VGA mixing: In VGA mixing, the image acquisition memory serves as the display source memory, thereby fixing its position and size on screen:

(ii) VGA mixing with scaling: Use of scalar ICs allows sizing and positioning of images in pre-defined windows.

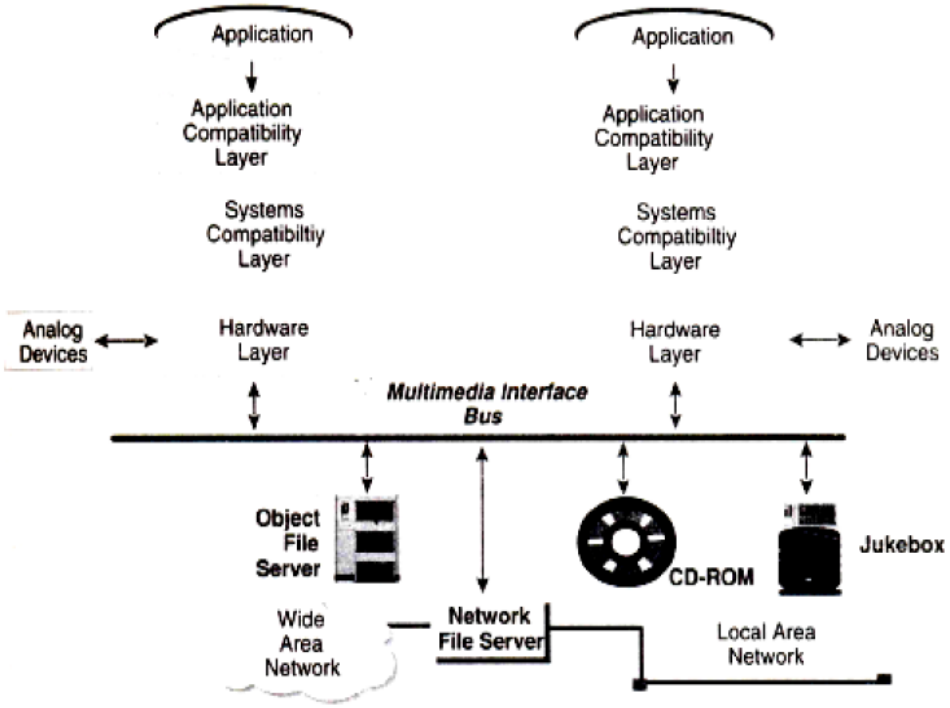
Resizing the window causes the things to be retrieved again.

(iii) Dual-buffered VGA/Mixing/Scaling: Double buffer schemes maintain the original images in a decompression buffer and the resized image in a display buffer.

The IMA Architectural Framework

The Interactive Multimedia Association has a task group to define the architectural framework for multimedia to provide interoperability. The task group has C0ncentrated on the desktops and the servers. Desktop focus is to define the interchange formats. This format allows multimedia objects to be displayed on any work station.

The architectural approach taken by IMA is based on defining interfaces to a multimedia interface bus. This bus would be the interface between systems and multimedia sources. It provides streaming I/O service"s, including filters and translators **Figure 3.4** describes the generalized architectural ap.roach



Network Architecture for Multimedia Systems:

Multimedia systems need special networks. Because large volumes of images and video messages are being transmitted.
Asynchronous Transfer Mode technology (A TM) simplifies transfers across LANs and W ANs.
Task based Multi level networking
Higher classes of service require more expensive components in the' workstations as well as in the servers supporting the workstation applications.
Rather than impose this cost on all work stations, an alternate approach is to adjust the class of service to the specific requirement for the user. This approach is to adjust the class of services according to the type of data being handled at a time also. We call this approach task-based multilevel networking.

High speed server to server Links
Duplication: It is the process of duplicating an object that the user can manipulate. There is no requirement for the duplicated object to remain synchronized with the source (or master) object.
Replication: Replication is defined as the process of maintaining two or more copies of the same object in a network that periodically re-synchronize to provide the user faster and more reliable access to the data Replication is a complex process.
Networking Standards**:** The two well-known networking standards are Ethernet and token ring.
ATM and FDDI are the two technologies which we are going to discuss in detail.
ATM: ATM is a acronym for Asynchronous Transfer Mode. It's topology was originally designed for broadband applications in public networks.
ATM is a method of multiplexing and relaying (cell-switching) 53 byte cells. (48 bytes of user information and 5 bits of header information).
Cell Switching: It is a form of fast packet switching based on the use of cells.
Cells: Short, fixed length packets are called cells.
ATM provides high capacity, low-latency switching fabric for data. It is independent of protocol and distances. ATM effectively manage a mix of data types, including text data, voice, images and full motion video. ATM was proposed as a means of transmitting multimedia applications over asynchronous networks.
FDDI: FDDI is an acronym of Fiber Distributed Data Interface. This FDDI network is an excellent candidate to act as the hub in a network configuration, or as a backbone that interconnects different types of LANs.
FDDI presents a potential for standardization for high speed networks.
The ANSI standard for FDDI allows large-distance networking. It can be used as high-performance backbone networks to complement and extend current LANs.

2. Explain the evolving technologies in multimedia systems?

Evolving Technologies For Multimedia Systems
Multimedia applications use a number of technologies generated for both commercial business application as well as the video game industry.
Let us review some of these technologies in this section.
Hypermedia documents
Hypermedia documents are documents which have text, embedded or linked multimedia objects such as image, audio, hologram, or full-motion video.
Hypertext
Hypertext systems allow authors to link information together, create information paths through a large volume of related text in documents.
It also allows to annotate existing text, and append notes.

It allows fast and easy searching and reading of selected excerpts.

Hypermedia

It is an extension of hypertext.

In that, we can include texts, any kind of information that can be stored in electronic storage, such as audio, animated video, graphics or full-motion video.

Hypermedia documents used for electronic mail and work flow applications provide a rich functionality for exchanging a variety of information types. The hypermedia document is a definition of a document and a set of pointers to help locate the various elements of the document on the network.

Hyper Speech

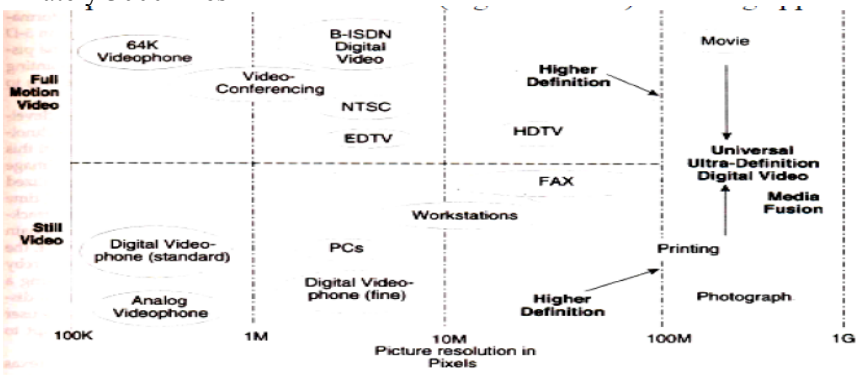
Multimedia stimulated the development of general-purpose speech interfaces. Speech synthesis and speech recognition are fundamental requirement for hyperspeech systems. Speech recognition is nothing but converting the analog speech into a computer action and into ASCII text. Speech-recognition systems cannot segment a stream of sounds without breaks into meaningful units. The user must speak in a stilted fashion. He should make sure to interpose silence between each word.

HDTV AND UDTV

HDTV is an acronym of High-Definition Television.

The broadcasting standards such as NTSC, PAL, SECAM, NHK have an idea of bringing the world together on a single high-definition Television broadcasting standard.

The japanese broadcasting services developed a 1125-line, along MUSE system. A competing standard in the U.S. changed direction from analog to digital technology:A 1125-line digital HDTV has been developed and is being commercialized. NHK of Japan is trying to leapfrog the digital technology to develop ultra definition television (digital UDTV) featuring approximately 3000 lines



3D **Technologies And Holography**

Three-dimensional technologies are concerned with two areas: pointing devices and displays. 3-D pointing devices are essential to manipulate object in a 3-D display system. 3-D displays are achieved using holography techniques.

The techniques developed for holography have been adapted for direct computer use.

Fuzzy Logic

Fuzzy logic is logic which is used for low-level process controllers.

Use of fuzzy logic in multimedia chips is the key to the emerging graphical interfaces of the future. It is expected to become an integral part of multimedia hardware. Fuzzy logic has mathematical principles. Hence, the application of multimedia can benefit those principles.

Digital Signal Processing

Digital Signal Processing are used in applications such as digital servos in hard disk drives, and fax/modems. DSP technology is used in Digital wireless communications, such as personal communication networks (pens), wireless local area networks and digital cordless phones.

DSP Architectures and Applications
A typical DSP operating system architecture would contain the following subsystems:
Memory Management: DSP architectures provide dynamic allocation of arrays from multiple segments, including RAM, SRAM and DRAM.
Hardware-Interrupt handling: A DSP operating system must be designed to minimize hardware-interrupt latency to ensure fast response to real time events for applications, such as servo systems.
Multitasking: DSPs need real-time kernels that provide pre-emptive multitasking and user-defined and dynamic task prioritization
INTERTASK SYNCHRONIZATION AND COMMUNICATION
Mechanisms for intertask communication include message queues, semaphores, shared memory, and quick response event flags. Multiple timer services: The ability for the developer to set system clock interrupt managed timers to control and synchronize tasks is needed for most real-time applications.
Device-Independent I/O: DSP operating system should supports
(i) Asynchronous data stream
(ii) Synchronous message passing.
Use of DSP' s has evolved from traditional general purpose digital signal processors to application-specific and customizable DSPs. DSPs were conceived as math engines with a system architecture that was like that of a mini-computer with an array processor.

3. Define and discuss the term 'Multimedia Databases'. Explain the issues in multimedia storage and retrieval.
Multimedia Databases
Images, sounds and movies can be stored, retrieved and played by many databases. In future, multimedia databases will bcome a main source of interaction between users and multimedia elements.
Multimedia storage and retrieval Multimedia storage is characterized by a number of considerations. They are:
(i) massive storage volumes
(ii) large object sizes
(iii) multiple related objects
(iv) temporal requirements for retrieval
Massive Data Volumes
A single multimedia document may be a combination of different media Hence indexing of documents, fi lms and tapes is more complex. Locating massive data volumes requires searching through massive storage files.
Locating and indexing systems can be understood only by a few key staff personnel. Hence it requires a major organizational eff0l1 to ensure that they are returned in proper sequence to their original storage location.
storage technologies
There are two major mass storage technologies used currently for storage of multimedia documents.
(i) Optical disk storage systems. (ii) High-speed magnetic storage.
Advantages of Optical disk storage systems:
(i) Managing a few optical disk platters in a juke box is much simpler than man;lging a large magnetic disk farm. (ii) Optical disk storage is excellent storage system for off line archival of old and infrequently referenced documents for significant periods of time
Multimedia object storage
Multimedia object storage in an optical medium serves its original purpose, only if it can be located fast and automatically. A key issue here is random keyed Access t6 various components of hypermedia database record. Optical media providcs very dense storage. Speed of retrieval is another consideration.
Retrieval speed is a direct result of the storage latency, size of the data relative to display resolution, transmission media and speed, and decompression efficiency. Indexing is important for fast retrieval of information. Indexing can be at multiple levels.

Multimedia document retrieval

The simplest form of identifying a multimedia document is by storage platter identification and its relative position on the platter (file number). These objects can then be grouped using a database in folders (replicating the concept of paper storage in file folders) or within complex objects representing hypermedia documents.

The capability to access objects using identifiers stored in a database requires capability in the database to perform the required multimedia object directory functions. Another important application for sound and full motion video is the ability to clip parts of it and combine them with another set.

Indexing of sound and full-motion video is the subject of intense debate and a number of approaches have been used.

Database Management Systems for Multimedia Systems

Since most multimedia applications are based primarily on communications technologies, such as electronic mail, the database system must be fully distributed. A number of database storge choices are available.

The choices available are:

* Extending the existing relational database management systems, (RDBMSs) to support the various objects for multimedia as binary objects.
* Extending RDBMSs beyond basis binary objects to the concepts of inheritance and classes. RDBMSs supporting these . features provide extensions for object-programming front ends and/or C++ support.
* Converting to a full fledged object oriented database that supports the standard SQL language.
* Converting the database and the application to an objectoriented database and using an object-oriented language, or an object-enabled SQL for development.

Multimedia applications combine numerical and textual data, graphics from GUI front-ends, CAD/CAM systems and GIS applications, still video, audio and full-motion video with recorded audio and annotated voice components. Relational databases, the dominent database paradigm, have lacked the ability to support multimedia databases. Key limitations of relational database systems for implementing multimedia applications stem from two areas: the relational data model and the relatIonal computational model.

RDBMSs have been designed to manage only tabular alphanumeric forms of data (along with some additional data types stored in binary form such as dates).

RDBMS EXTENSIONS FOR MULTIMEDIA

Binary Large Object (BLOB) is a data type which has been adapted by most of the leading relational databases. BLOBs are used for objects such as images or other binary data types.

The relational database is extended to access these BLOBs to present the user 'with a complete' data set.

Extended relational databases provide a gradual migration path to a more object-oriented environment.

Relational database tables include location information for the BLOBs which may be stored outside the database on separate image or video servers. Relational databases have the strength of rigorous set management for maintaining the integrity of the database

Object-Oriented Databases for Multimedia

In object databases, data remains in RMS or flat files. Object databases can provide the fastest route to multimedia support. Object programming embodies the principles of reusable code and modularity. This will ease future maintenance of these databases.

Object database capabilities such as message passing, extensibility, and the support of hierarchical structures, are important for multimedia systems.

We can develop the application fastest class definitions. ODBMSs are extensible. They allow incremental changes to the database applications.

Extensibility: Extensibility .means that the set of operations, structures and constraints that are available to operations are not fixed, and developers can define new operations, which can then be added as needed to their application.

Object-oriented software technology has three important concepts. They are:

Encapsulation: It is the ability to deal with software entities as units that interact in pre-defined and controllable manner, and where the control routines are integral with entity.
Association: It is the ability to define a software entity in terms of its di fferences from another entity.
Classification: It is the ability to represent with a single software entity a number of data items that all have the same behavior and the same state attributes.
Object orientation helps to organize the software in a more, modular and re-usable manner.
Encapsulation allows for the development of open systems where one part of the application does not need to know the functioning of other part. It also provides autonomy; **Autonomy** means we can interface to a variety of external programs can be built in one class of objects and the storage of the data in another class of objects.
Database Organization for Multimedia Applications
Data organization for multimedia systems has some key issues. They are:
(l) Data independence (2) Common distributed database architecture
(3) Distributed database servers· (4) Multimedia object management.

Data Independence

Flexible access by a number of databases requires that the data be independent from the application so that future applications can access the data without constraints related to a previous application.
Key features of data independent designs are:

1.Storage design in independent of specific applications.

2.Explicit data definitions are independent of application program.

3.Users need not know data formats or physical storage structures.

4.Integrity assurance in independent of application programs.

5.Recovery in independent of application programs.

Distributed Data servers Distributed database servers are a dedicated resource on a network accessible to a number of applications. The database server is built for growth and enhancement, and the network provides the opportunity for the growth of applications and distributed access to the data.
Multimedia Object Management
The object management system must be capable of indexing, grouping and storing multimedia objects in distributed hierarchical optional storage systems, and accessing these objects on or keyed basis.
The design of the object management system should be capable indexing objects in such a manner that there is no need to maintain multiple storage copies.
Multimedia transactions are very complex transactions. We define a multimedia transaction as the sequence of events that starts when a user makes a request to display, edit, or print a hyper media document. The transaction is complete when the user releases the hypermedia document and stores back the edited versions or discards the copy in memory (including virtual memory) or local storage .

4. Discuss any four multimedia applications in detail.

Multimedia Applications

The first widely used application of multimedia is document image management. It is primarily intended for scanning documents and retaining their images.
Another application is image processing. It is also known as Image recognition. It is intended for recognizing objects by analyzing their raster images. Applications that present a view of generic multimedia applications are:

1. Document Imaging

The fundamental concepts of storage, compression and decompression, and display technologies used for multimedia systems were developed for document image management. Organizations such as insurance agencies law offices,country and state governments, and the federal government manage large volumes of documents.

Document image technology is adopted by Department of Defence for applications ranging from military personnel records to maintenance manuals and high-speed printing systems. Almost all document image system use workflows that are customized for the purpose for which they are being used. The workflow defines the sequence for scanning images, performing data *entry* based on the contents of the lmages, indexing them and storing them on optical media.
Document Image Hardware requirements:

Realtime image decompression and display place an important role on image processing hardware.
Image decompression and display hardware supports 4 to 8 planes. 4 planes provide 16 colors and 8 planes provide 256 colors. The image planes are also called bit planes, because, they are addressed by a bit in a bytes. Images must be processed at the rate of tens to hundreds of pixels per nano-second. For high-resolution images, processing of the order of 10 pixels/ ns is enough for monochrome still images.
Gray scale images consist of pixels that have shades of gray ranging from 16 to 256. Color images feature color hues instead of shades of gray. Most high-resolution monitors support 16 to 256 colors display capability. The number of colors that can be depicted depends on the number of bits used to define the palette.

2.Image processing and Image Recognition

Image processing involves image recognition, Image enhancement,image synthesis, and image reconstruction.
An image processing system may actually alter the contents of the image itself. Image processing systems employ the compression and decompression techniques, a wide range of algorithm for object recognition, comparing images of objects with pre-defined objects, extrapolating finer details to view edges more clearly, gray-scale balancing and gray-scale and color adjustments.
Let us briefly review the various aspects of inlage processing and recognition.
Image enhancement**:** Most image display systems feature some level of image adjustment.
Increasing the sensitivity and contrast makes the picture darker by making bonderline pixels black or increasing the gray-scale level of pixels.
Capabilities built in the compression boards might include the following
* **Image calibration**: The overall image density is calibrated, and the image pixels are adjusted to a predefined level. * **Real time alignment**: The image is aligned in real-time for skewing caused by improper feeding of paper. * **Gray-Scale normalization**: The overall gray level of an image or picture is evaluated to determine if it is skewed in one direction and if it needs cOlTection. * **RGB hue intensity adjustment**: Too much color makes picture garish and fuzzy. Automatic hue intensity adjustment brings the hue intensity within pre-defined ranges. * **Color Separation**: A picture with very little color contrast can be dull and may not bring out the details. The hardware used can detect and adjust the range of color separation. * **Frame averaging**: The intensity level of the frame is averaged to overcome the effects of very dark or very light areas by adjusting the middle tones.

3. Image Animation

Computers-created or scanned images can be displayed sequentially at controlled display speeds to provide image animation that simulates real processes.
The basic concept of displaying successive images at short intervals to give the perception of motion is being used successfully in designing moving parts such as automobile engines.

4. Optical Character Recognition

Data entry is the most expensive component of data processing, because it requires extensive clerical staff work to enter data.
Automating data entry, both typed and handwritten, is a significant application that can provide high returns. Optical Character Recognition (OCR) technology is used for data entry by scanning typed or printed words in a form.
Initially, people used dedicated OCR scanners. Now, OCR Technology is available in software. OCR technology, used as a means of data entry, may be used for capturing entire paragraphs of text. The capturing text is almost a\ways entered as a field in a database or in an editable document

5.Handwriting recognition

Research for Handwriting recognition was performed for *CADI* CAM systems for command recognition. Pen-based systems are designed to allow the user to write· commands on an electronic tablet.

Handwriting recognition engines use complex algorithms designed to capture data in real time as it is being input or from an image displayed in a window, depending on the application. Two factors are important for handwriting recognition. They are the strokes or shapes being entered, and the velocity of input or the vectoring that is taking place. The strokes are parsed and processed by a shape recognizer that tries to determine the geometry and topology of the strokes. It attempts to compared it to existing shapes, such as predefined characters. The stroke is compare with the prototype character set until a match is found or all pre-defined prototypes have been checked without a match.Multimedia system will use handwriting recognition as another means of user input.

5. How multimedia databases are different from ordinary databases?

Database	**Conventional Database**
A **Multimedia database** (**MMDB**) is a collection of related multimedia data.	A **relational database management system** (**RDBMS**) is a database management system (DBMS) that is based on the relational model
A Multimedia Database (MMDB) hosts one or more multimedia data types[3] (i.e. text, images, graphic objects, audio, video, animation sequences.	Each database is a collection of tables, which are called relations, hence the name "relational database
Multimedia data consists of a variety of media formats or file representations including TIFF,BMP, PPT, IVUE, FPX, JPEG, MPEG, AVI, MID, WAV, DOC, GIF, EPS, PN G, etc.	relational model contains the following components: • Collection of objects or relations • Set of operations to act on the relations • Data integrity for accuracy and consistency
• Multimedia database consume a lot of processing time, as well as bandwidth.	Extremely fast retrieval times for multi-user, transactional environment. • Ease the use compared to other database systems
Examples of multimedia database application areas: • Digital Libraries • News-on-Demand • Video-on-Demand • Music database • Geographic Information Systems (GIS) • Telemedicine	examples of relational database system • process control • internet service management • spacecraft control system • network management system

6. Write short notes on multimedia data interface standards.

Multimedia Data Interface Standards

File Formats for Multimedia Systems:

(i) Device-independent Bitrnap (DIB): This file format contains bit map, color, and color paJlette information.

(ii) RIFF device Independent Bitrnap (RDIB): Resource Interchange File Frmat **(RIFF)** is the standard file format defined for Microsoft Windows and OS/2. It allows a more complex set of bit maps than can be handled by DIB.

(iii) **Musical Instrument Digital interface (MIDI):** This is the interface standard for file transfer between a computer and a musical instrument such as a digital piano. It is also, used for full-motion video and voice-mail messaging systems. It has the advantage of ready availability of MIDI device controller boards for personal computers.

RIFF Musical Instrument Digital Interface

A MIDI format within a RIFF envelope provides a more complex interface.

Palette File Format (PAL) An interface that allows defining a palette of 1 to 256 colours in a representation as RGB values.

Rich Text Format (RTF) This file format allows embedding graphics and other file formats within a document. This format is used by products such as Lotus Notus. This format is also the basis for the use of OLE.

Waveform Audio File Format (WAVE) A digital file representation of digital audio.

Windows Metafile Format (WMF) This is a vector graphic format used by Microsoft Windows as an interchange format.

Multimedia Movie Format (MMM) This is a format used for digital video animation.

Apple's Movie Format This format was defined as the standard for file exchange by Quick Time enabled systems.

Digital Video Command Set (DVCS) This is the set of digital video commands simulating VCR controls.

Digital Video Media Control Interface Microsoft's high level control interface for VCR controls, including play, rewind, record and so on.

Vendor - Independent Messaging (VIM) Developed by a consortium of Vendors providing a standardized format for cross-product messages.

Apple's Audio Interchange File Format Apple's standard file format for compressed audio and voice data.

SDTS GIS Standard The Spatial Data Transfer Standard (SDTS) is designed to provide a common storage format for geographic and cartographic data.

Video Processing Standards

INTELS DVI

DVI is an achronym of Digital Video Interface.

DVI standard is to provide a processor independent specification for a video interface. That video interface should accomodate most compression algorithms for fast multimedia displays. An example of custom-designed chip which supports DVI is Intel's i750 B. This chip is designed for enhancing low-end, software based PC video.

Advantages of the DVI Chip

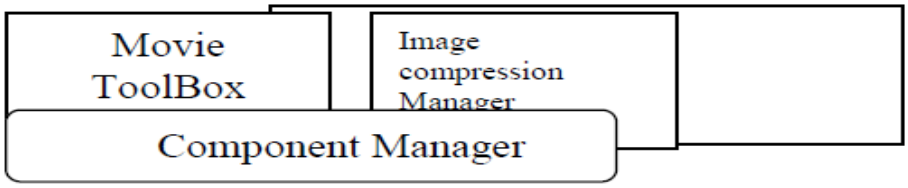
(i) It can operate software video processing real time. (ii) It can share the processing with the host CPU. (iii) It can handle additional vector-quantization-type algorithms in conjunction with host processing. DVI silicon chip relies on a programmable video processor. It gives potential to DVI chips to run a range of compression algorithms.

APPLE QUICK TIME

Quick Time standard is developed by Apple Computer. It is designed to Support multimedia applications. It is integrated with the operating system. Quick time refers to both the extensions to the Mac Operating system and to the compression/decompression functionality Of the environment. Quick Time is designed to be the graphics standard for timebased graphic data types.

Quick Time's definition has been extended to include (i) System Software, (ii) File Formats, (Hi) Compression! decompression algorithms, (iv) Human Interface Standards.

Figure Shows the components in the Quick Time Architecture.



Quick Time adjust automatically to the hardware being used by the user. MPEG is another competing standard which is comparitively higher-end, hardware-assisted standard. It can produce better resolutions at faster rates.

7. Discuss the task based networking and their standards required to transfer multimedia data.

Task based Multi level networking

Higher classes of service require more expensive components in the' workstations as well as in the servers supporting the workstation applications.

Rather than impose this cost on all work stations, an alternate approach is to adjust the class of service to the specific requirement for the user. This approach is to adjust the class of services according to the type of data being handled at a time also.

We call this approach task-based multilevel networking.

High speed server to server Links

Duplication: It is the process of duplicating an object that the user can manipulate. There is no requirement for the duplicated object to remain synchronized with the source (or master) object.

Replication: Replication is defined as the process of maintaining two or more copies of the same object in a network that periodically re-synchronize to provide the user faster and more reliable access to the data Replication is a complex process.

Networking Standards: The two well-known networking standards are Ethernet and token ring.

ATM and FDDI are the two technologies which we are going to discuss in detail.

ATM: ATM is a acronym for Asynchronous Transfer Mode. It's topology was originally designed for broadband applications in public networks.

ATM is a method of multiplexing and relaying (cell-switching) 53 byte cells. (48 bytes of user information and 5 bits of header information).

Cell Switching: It is a form of fast packet switching based on the use of cells.

Cells: Short, fixed length packets are called cells.

ATM provides high capacity, low-latency switching fabric for data. It is independent of protocol and distances. ATM effectively manage a mix of data types, including text data, voice, images and full motion video. ATM was proposed as a means of transmitting multimedia applications over asynchronous networks.

FDDI: FDDI is an acronym of Fiber Distributed Data Interface. This FDDI network is an excellent candidate to act as the hub in a network configuration, or as a backbone that interconnects different types of LANs.

FDDI presents a potential for standardization for high speed networks.

The ANSI standard for FDDI allows large-distance networking. It can be used as high-performance backbone networks to complement and extend current LANs.

8. What is a Universal Multimedia application and what are its characteristics?

A Universal Multimedia Application

It is an application that works on universal data type. This means that the application manipulates datatypes that can be combined in a document, displayed 'on a screen, or printed, with no special manipulations that the user needs to perform. The application is truly distributed in nature.

An important consideration for such a universal application is the methodology for dissemination of the information on a network.

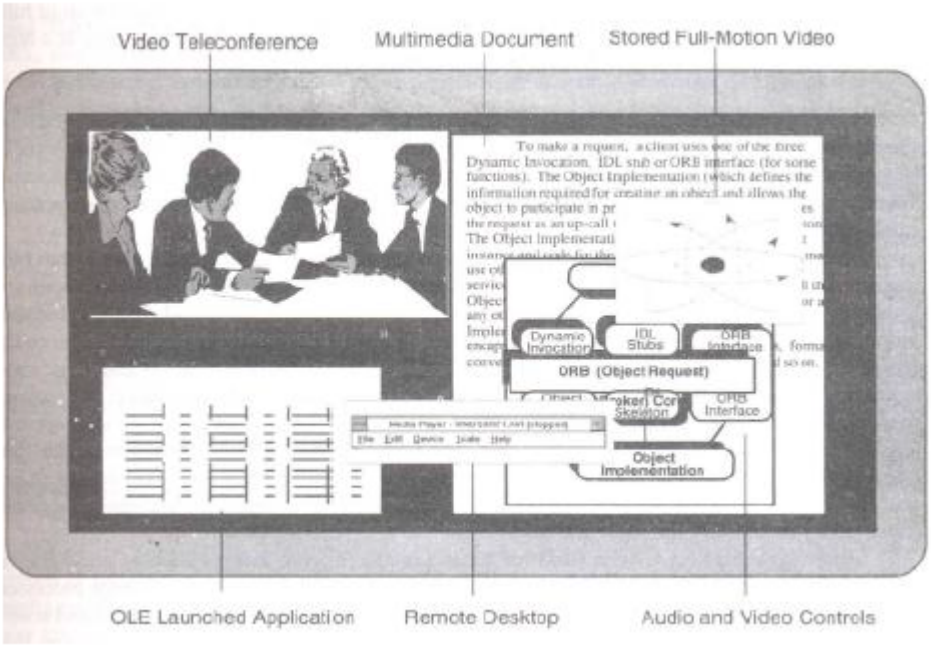


Figure describes the user screen for a universal multimedia application. **In** this screen, mix of windows for displaying still video and document images, a video conference window with a live session in progress, a remote live desk top, and a couple of other windows for applications such as electronic mail and desk top publishing.

To maintain all of these windows requires a substantial amount of CPU power. Digital Signal Processing assistance is needed to manage the multiple simultaneous decompressions for JPEG, MPEG and windows applications.

Full-Motion Video Messages

In addition to textual messages, electronic mail capability allows embedding of voice messages and video messages. Video messages may consist of video snapshots or live video with full-motion picture and sound.

Two technological concepts at play in the implementation of full motion video messages:

i) The storage and transmitted of a very large volume of data at a high rate,

(ii) Decompression of that data to present a continuous play back

Audio and Video Indexing.

Indexing is an important and complex subject for multimedia design. Marking a position is called Indexing. Audio and video indexing are used in full-motion video in a manner similar to any video sequence, i.e.,. just as it would in a home movie, taped performance and so on.

The needs of the application must be a strong consideration for the type of indexing provideq with the system.

Key points for indexing of stored video clips:

* Indexing is useful only if the video is stored, indexing information is lost.
* When sound and video are decompressed and managed separately, synchronization is very important.
* Depending on the application, indexing information must be maintained separately for sound and video components of a video clip.

UNIT-4
MULTIMEDIA FILE HANDLING

1. What is a histogram for an image?

Histograms are used to depict image statistics in easily interpreted visual formats. It is useful during image capturing .It is used to improve the visual appearance of the image. It describes the frequency of the intensity values that occurs in the image.

2. What is lossless compression? Give example.

In lossless compression every single bit of data that was originally in the file remains after the file is uncompressed. All of the information is completely restored. This is generally the technique of choice for text or spreadsheet files, where losing words or financial data could pose a problem. The Graphics Interchange File (GIF) is an image format used on the Web that provides lossless compression.

3. State the role compression in multimedia.

i. It reduces the resource usage like disk space .
ii. It reduces the transmission capacity.
iii. It reduces the file size of various formats.
iv. Compression eliminate redundancies in the pattern of data .

4. List the components of full motion video models.

i. Video capture board
ii. Video channel multiplexer
iii. Video compression and decompression
iv. Audi compression
v. Analog-to-digital converter

5. Define quantization.

Quantization is a process that attempts to determine what information can be safely discarded without a significant loss in visual fidelity. It uses DCT(Discrete Cosine Transform) coefficients and provides many-to-one mapping. Quantization process is fundamentally lossy due to many-to-one mapping.

6. What are the four factors governing the ADC process?

The factors governing the ADC process are,

i. Sampling rate
ii. Resolution
iii. Linearity
iv. Conversion speed

7. Define entropy encoding.

Entropy is defined as a measure of randomness, disorder or chaos, as well as a measure of a systems ability to undergo spontaneous change. The entropy encoder compress quantized DCT coefficients more compactly based on their spatial characteristics. Arithmetic coding is a type of entropy encoding.

8. List any two methods used to reduce rotational latency while retrieving huge multimedia objects.

i. Zero latency read/write
ii. Interleave factor

9. What do you know about AVI standard?

AVI means Audio Video Interleave, is a multimedia container format. Files can contain both audio and video data in a file container that allows synchronous audio-with-video playback. The AVI file type is primarily associated with 'Audio Video Interleave File'. Recent files might be compressed with one or another codecs (like DivX and XviD).

10. What are the different file formats standards for data?

i. Rich Text Format(RTF)
ii. Tagged Image File format(TIFF)
iii. Resource Image File Format(RIFF)
iv. Musical Instrument Digital Interface(MIDI)

v. Joint Photographic Experts Group(JPEG)
vi. Audio Video Interleaved (AVI) file format
vii. TWAIN

11. What are the considerations in multimedia storage?

i. Massive storage volumes
ii. large object sizes
iii. multiple related objects
iv. temporal requirements for retrieval.

12. Explain about Rewriteable Optical Disk technology?

Rewriteable optical media technology allows erasing old data and rewriting new data over old data. It behaves like a magnetic hard disk where data can be written and erased repeatedly. Two types of Rewriteable technology are

i. Magneto-optical technology
ii. Phase change rewriteable optical disk

13. Explain about Magneto-optical technology?

Magneto-optical technology uses a combination of magnetic and laser technology to achieve read/write. The disk recorded layer is magnetically recordable. It uses a weak magnetic field to record data under high temperatures. It requires two passes to write data. In the first pass, the magneto optical head goes through an erase cycle. In the second pass it writes the data

.

14. Explain the Phase Change technology?

In phase change technology the recording layer changes the physical characteristics from crystalline to amorphous under the influence of heat from a laser beam. The benefits of phase change technology are

i. Require only one pass to write the data.
ii. No magnetic technology is needed.

15. What is a multifunction drive?

A multifunction drive is a single drive unit. It is capable of reading and writing a variety of disk media i.e., CD-ROMS, WORM drives and rewriteable disks. It provides permanence of read-only device and flexibility of a rewriteable device. It is used in product documentations.

16. What is RLL?

RLL (Run-Length Limited) is an encoding scheme. The benefit of RLL is that it packs 50% more bits than the MFM scheme, resulting in 26 sectors per track with a 6.4 Mbits/sec or 798 Kbytes/sec transfer rate.

17. Explain about Rewriteable Optical Disk technology?

Rewriteable optical media technology allows erasing old data and rewriting new data over old data. It behaves like a magnetic hard disk where data can be written and erased repeatedly. Two types of Rewriteable technology are

Magneto-optical technology Phase change rewriteable optical disk

18. Explain about Magneto-optical technology?

Magneto-optical technology uses a combination of magnetic and laser technology to achieve read/write. The disk recorded layer is magnetically recordable. It uses a weak magnetic field to record data under high temperatures. It requires two passes to write data. In the first pass, the magneto optical head goes through an erase cycle. In the second pass it writes the data.

19. What is a cache?

Cache is a area in memory for temporary storage of data objects. It is a private memory used for storing disk data temporarily. Cache memory is located on either a disk controller or system memory and when the disk I/O request takes place the host CPU obtains the block of data from the cache.

20. What happens when the disk cache is full and there is no space for newly requested data in the Cache?

The caching controller utilizes the least recently used algorithm and most recently used algorithm to discard the least recently used blocks of data and keep the most recently used blocks of data. Space is created for the new blocks by discarding the existing data on the cache that has not been accessed for long period of time.

21. What is cache hit and cache miss?

If the requested data is in the disk cache and no disk accesses are required then it is called cache hit. If the requested data is not in the disk cache then it is called cache miss.

PART-B

1. Describe the JPEG standard for image compression.

JOINT PHOTOGRAPHIC EXPERTS GROUP COMPRES5ION (JPEG)

ISO and CCITT working committee joint together and formed Joint Photographic Experts Group. It is focused exclusively on still image compression.

Another joint committee, known as the Motion Picture Experts Group (MPEG), is concerned with full motion video standards.

JPEG is a compression standard for still color images and grayscale images, otherwise known as continuous tone images.

JPEG has been released as an ISO standard in two parts

Part I specifies the modes of operation, the interchange formats, and the encoder/decoder specifies for these modes along with substantial implementation guide lines .

Part 2 describes compliance tests which determine whether the implementation of an encoder or decoder conforms to the standard specification of part I to ensure interoperability of systems compliant with JPEG standards

Requirements addressed by JPEG

The design should address image quality .

The compression standard should be applicable to practically any kind of continuous-tone digital source image .

It should be scalable from completefy lossless to lossy ranges to adapt it.

It should provide sequential encoding .

It should provide for progressive encoding .

It should also provide for hierarchical encoding .

The compression standard should provide the option of lossless encoding so that images can be guaranteed to provide full detail at the selected resolution when decompressed.

Definitions in the JPEG Standard

The JPEG Standards have three levels of definition as follows:

* Base line system
* Extended system
* Special lossless function.

The base line system must reasonably decompress color images, maintain a high compression ratio, and handle from 4 bits/pixel to 16 bits/pixel.

The extended system covers the various encoding aspects such as variable-length encoding, progressive encoding, and the hierarchical mode of encoding.

The special lossless function is also known as predictive lossless coding. It ensures that at the resolution at which the image is no loss of any detail that was there in the original source image.

Overview of JPEG Components JPEG Standard components are:

(i) Baseline Sequential Codec

(ii) OCT Progressive Mode
(Hi) Predictive Lossless Encoding
(iv) Hierarchical Mode.
These four components describe four four different levels of jPEG compression.
The baseline sequential code defines a rich compression scheme the other three modes describe enhancements to this baseline scheme for achieving different results.
Some of the terms used in JPEG methodologies are:

Discrete Cosine Transform (OCT)

OCT is closely related to Fourier transforms. Fourier transforms are used to represent a two dimensional sound signal.
DCT uses a similar concept to reduce the gray-scale level or color signal amplitudes to equations that require very few points to locate the amplitude in Y-axis X-axis is for locating frequency.

DCT Coefficients

The output amplitudes of the set of 64 orthogonal basis signals are called OCT Co-efficients.

Quantization This is a process that attempts to determine what information can be safely discarded without a significant loss in visual fidelity. It uses OCT co-efficient and provides many-to-one mapping. The quantization process is fundamentally lossy due to its many-to-one mapping.

De Quantization This process is the reverse of quantization. Note that since quantization used a many-to-one mapping, the information lost in that mapping cannot be fully recovered

Entropy Encoder / Decoder Entropy is defined as a measure of randomness, disorder, or chaos, as well as a measure of a system's ability to undergo spontaneous change. The entropy encoder compresses quantized DCT co-efficients more compactly based on their spatial characteristics. The baseline sequential. codec uses Huffman coding. Arithmetic coding is another type of entropy encoding

Huffman Coding Huffman coding requires that one or more sets of huff man code tables be specified by the application for encoding as well as decoding. The Huffman tables may be pre-defined and used within an application as defaults, or computed specifically for a given image.

Baseline Sequential codec

It consists of three steps: Formation of DCT co-efficients quantization, and entropy encoding. It is a rich compression scheme.

DCT Progressive Mode

The key steps of formation of DCT co-efficients and quantization are the same as for the baseline sequential codec. The key difference is that each image component is coded in multiple scans instead ofa single scan.

Predictive Lossless Encoding

It is to define a means of approaching lossless continuous-tone compression. A predictor combines sample areas and predicts neighboring areas on the basis of the sample areas. The predicted areas are checked against the fully loss less sample for each area.
The difference is encoded losslessly using huffman on arithmetic entropy encoding .

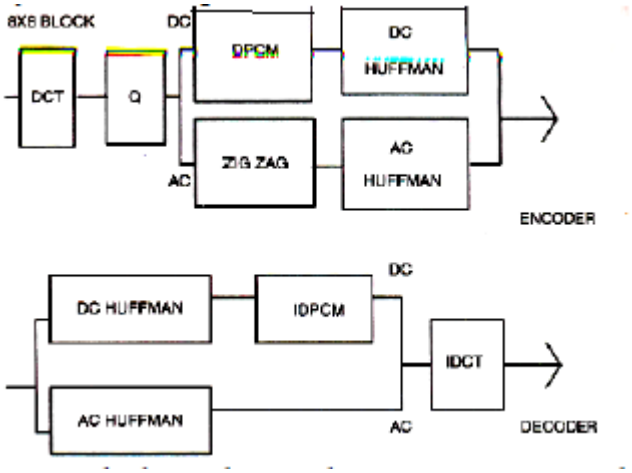
Hierarchical Mode

The hierarchical mode provides a means of carrying multiple resolutions. Each successive encoding of the image is reduced by a factor of two, in either the horizontal or vertical dimension.

JPEG Methodology

The JPEG compression scheme is lossy, and utilizes forward discrete cosine transform (or forward DCT mathematical function), a uniform quantizer, and entropy encoding. The DCT function removes data redundancy by transforming data from a spatial domain to a frequency domain; the quantizer quantizes DCT co-efficients with weighting functions to generate quantized DCT co-efficients optimized for the human eye; and the entropy encoder minimizes the entropy of quantized DCT co-efficients.
The JPEG method is a symmetric algorithm. Here, decompression is the exact reverse process of compression.
Figure below describes a typical DCT based encoder and decoder.

Symmetric Operation of DCT based Codec



Quantization

Quantization is a process of reducing the precision of an integer, thereby reducing the number of bits required to store the integer, thereby reducing the number of bits required to store the integer.

The baseline JPEG algorithm supports four color quantization tables and two huffman tables for both DC and AC DCT co-efficients. The quantized co-efficient is described by the following equation: Quantized Co-efficient (i, j) =) , ( ) , (j i Quantum j i DCT

ZigZag Sequence

Run-length encoding generates a code to represent the C0unt of zero-value OCT co-efficients. This process of run-length encoding gives an excellent compression of the block consisting mostly of zero values.

Further empirical work proved that the length of zero values in a run can be increased to give a further increase in compression by reordering the runs. JPEG came up with ordering the quantized OCT co-efficients in a ZigZag sequence

Entropy Encoding

Entropy is a term used in thermodynamics for the study of heat and work. Entropy, as used in data compression, is the measure of the information content of a message in number of bits. It is represented as

Entropy in number of bits = log2 (probability of Object)

2. Discuss at length about the techniques for creation, editing and manipulation of digital voice and audio in multimedia applications?

A video frame grabber is used to captue, manipulate and enhance video images.

A video frame grabber card consists of video channel multiplexer, Video ADC, Input look-up table with arithmetic logic unit, image frame buffer, compression-decompression circuitry, output color look-up table, video DAC and synchronizing circuitry.

Video Channel Multiplexer:

A video channel multiplexer has multiple inputs for different video inputs. The video channel multiplexer allows the video channel to be selected under program control and switches to the control circuitry appropriate for the selected channel in aTV with multi – system inputs.

Analog to Digital Converter: The ADC takes inputs from video multiplexer and converts the amplitude of a sampled analog signal to either an 8-bit digital value for monochrome or a 24 bit digital value for colour.

Input lookup table: The input lookup table along with the arithmetic logic unit (ALU) allows performing image processing functions on a pixel basis and an image frame basis. The pixel image-

processing functions ate histogram stretching or histogram shrinking for image brightness and contrast, and histogram sliding to brighten or darken the image. The frame-basis image-processing functions perform logical and arithmetic operations.

Image Frame Buffer Memory: The image frame buffer is organized as a l024 x 1024 x 24 storage buffer to store image for image processing and display.

Video Compression-Decompression: The video compression -decompression processor is used to compress and decompress still image data and video data.

Frame Buffer Output Lookup Table: The frame buffer data represents the pixel data and is used to index into the output look uptable. The output lookup table generates either an 8 bit pixel value for monochrome or a 24 bit pixel value for color.

SVGA Interface: This is an optional interface for the frame grabber. The frame grabber can be designed to include an SVGA frame buffer with its own output lookup table and digital-to-analog converter.

Analog Output Mixer: The output from the SVGA DAC and the output from image frame buffer DAC is mixed to generate overlay output signals. The primary components involved include the display image frame buffer and the display SVGA buffer. The display SVGA frame buffer is overlaid on the image frame buffer or live video, This allows SVGA to display live video.

Video and Still Image Processing

Video image processing is defined as the process of manipulating a bit map image so that the image can be enhanced, restored, distorted, or analyzed.

Let us discuss about some of the terms using in video and still image processing.

Pixel point to point processing: In pixel point-to-point processing, operations are carried out on individual pixels one at a time.

Histogram Sliding: It is used to change the overall visible effect of brightening or darkening of the image. Histogram sliding is implemented by modifying the input look-up table values and using the input lookup table in conjunction with arithmetic logic unit.

Histogram Stretching and Shrinking: It is to increase or decrease the contrast.

In histogram shrinking, the brighter pixels are made less bright and the darker pixels are made less dark.

Pixel Threshold: Setting pixel threshold levels set a limit on the bright or dark areas of a picture. Pixel threshold setting is also achieved through the input lookup table.

Inter- frame image processing

Inter- frame image processing is the same as point-to-point image processing, except that the image processor operates on two images at the same time. The equation of the image operations is as follows:

Pixel output (x, y) = (Image l(x, y)

Operator (Image 2(x, y)

Image Averaging: Image averaging minimizes or cancels the effects of random noise.

Image Subtraction: Image subtraction is used to determine the change from one frame to the next .for image comparisons for key frame detection or motion detection.

Logical Image Operation: Logical image processing operations are useful for comparing image frames and masking a block in an image frame.

Spatial Filter Processing The rate of change of shades of gray or colors is called spatial frequency. The process of generating images with either low-spatial frequency-components or high frequency components is called spatial filter processing.

Low Pass Filter: A low pass filter causes blurring of the image and appears to cause a reduction in noise.

High Pass Filter: The high-pass filter causes edges to be emphasized. The high-pass filter attenuates low-spatial frequency components, thereby enhancing edges and sharpening the image.

Laplacian Filter: This filter sharply attenuates low-spatial-frequency components without affecting and high-spatial frequency components, thereby enhancing edges sharply.

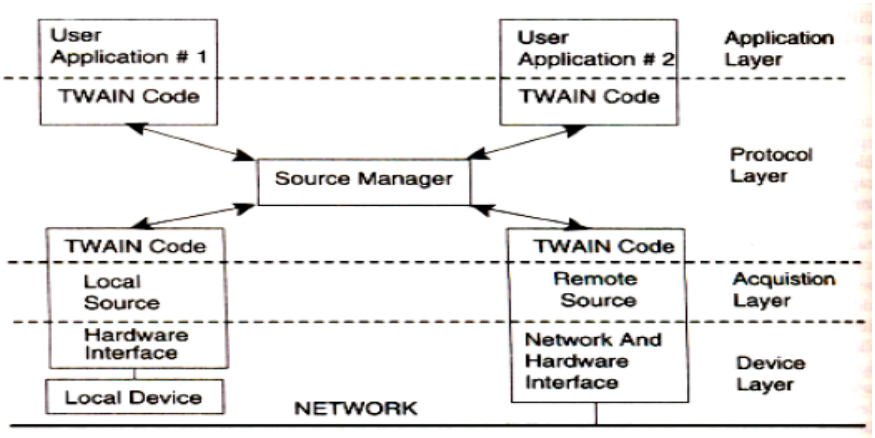
Frame Processing Frame processing operations are most commonly for geometric operations, image transformation, and image data compression and decompression Frame processing operations are very compute intensive many multiply and add operations, similar to spatial filter convolution operations.
Image scaling: Image scaling allows enlarging or shrinking the whole or part of an image.
Image rotation: Image rotation allows the image to be rotated about a center point. The operation can be used to rotate the image orthogonally to reorient the image if it was scanned incorrectly. The operation can also be used for animation. The rotation formula is:
pixel output-(x, *y)* = pixel input *(x,* cos Q + *y* sin Q, - *x* sin Q + Y cos Q)
where, Q is the orientation angle
x, yare the spatial co-ordinates of the original pixel.
Image translation: Image translation allows the image to be moved up and down or side to side. Again, this function can be used for animation.
The translation formula is:
Pixel output *(x, y)* =Pixel Input *(x + Tx, y + Ty)* where *Tx* and *Ty* are the horizontal and vertical coordinates. *x,* yare the spatial coordinates of the original pixel.
Image transformation: An image contains varying degrees of brightness or colors defined by the spatial frequency. The image can be transformed from spatial domain to the frequency domain by using frequency transform.

3. What is TWAIN? Explain the objectives and architecture of TWAIN.

TWAIN

To address the problem of custom interfaces, the TWAIN working group was formed to define an open industry standard interface for input devices. They designed a standard interface called a generic TW AIN . interface. It allows applications to interface scanners, digital still cameras, video cameras.

TWAIN ARCHITECHTURE:



The Twain architecture defines a set of application programming interfaces (APls) and a protocol to acquire data from input devices.
It is a layered architecture.
It has application layer, the protocol layer, the acquisition layer and device layer.
Application Layer: This layer sets up a logical connection with a device. The application layer interfaces with protocol layer.
Protocol Layer: This layer is responsible for communications between the application and acquisition layers.
The main part of the protocol layer is the source Manager.
Source manager manages all sessions between an application and the sources, and monitors data acquisition transactions. The protocol layer is a complex layer.

It provides the important aspects of device and application interfacing functions.

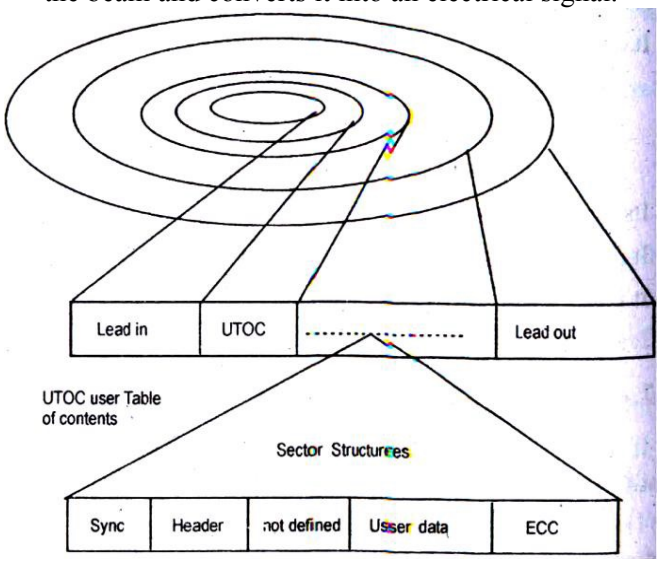
The Acquisition Layer: It contains the virtual device driver.
It interacts directly with the device driver. This layer is also known as source.
It performs the following functions:
1.Control of the device.
2.Acquisition of data from the device.
3.Transfer of data in agreed format.
4.Provision of user interface to control the device.

The Device Layer: The device layer receives software commands and controls the device hardware.
New Wave RIFF File Format:
This format contains two subchunks:
(i) Fmt **(ii)** Data.
It may contain optional subchunks:
(i) Fact
(ii) Cue points
(iii) Play list
(iv) Associated datalist.

Fact Chunk: It stores file-dependent information about the contents of the WAVE file. **Cue Points Chunk:** It identifies a series of positions in the waveform data stream. **Playlist Chunk:** It specifies a play order for series of cue points. **Associated Data Chunk:** It provides the ability to attach information, such as labels, to sections of the waveform data stream. **Inst Chunk:** The file format stores sampled sound synthesizer's samples.

4. Briefly explain WORM technology. How does a magneto optical technology differ from WORM technology?
WORM Optical Drives
It records data using a high power laser to create a permanent burnt-in record of data. The laser beam makes permanent impressions on the surface of the disk.
It creates pits. Information is written once. It cannot be written over and cannot be erased. i.e., Here data cannot be edited.
Recording of information: During recording, the input Signal is fed to a laser diode. The laser beam from the laser diode is modulated by the inpUt signal. It switches the laser beam on and off. if the beam is on, it strikes the three recording layers.
The beam is absorbed by the bismuth-tellurium layer. Heat is generated within the layer. This heat diffuses the atoms in the three recording layers. It forms four-element alloy layer. Now, the layer becomes recorded layers.
Reading Information from disk:
During disk read, a weaker, laser beam is focused on to the disk. It is reflectted back. The beam splitter mirror and lens arrangement sends the reflected beam to the photo detector. The photo sensor detects

the beam and converts it into an electrical signal.



WORM DRIVE Applications

On-line catalogs
Large-volume distribution
Transaction logging
Multimedia archival.

Write Once Read Many Optical Drives: (WORM)

WORM Optical drives provide very high volumes of storage for very low cost.
Some important characteristics of WORM optical disks are:
Optical drives tend to be slower than magnetic drives by a factor of three to four. .
WORM drives can write once only; typically 5-10% of disk capacity m left free to provide for changes to existing information.
They are useful for recording informations that would not change very much.
They are virtually indestructible in normal office use and have long shelf lives.
They an be used in optical disk libraries (Juke boxes). A Juke box may provide anywhere from 50-100 disk platters with two or more drives.
These characteristics make optical disks ideal candidates for on-line document images (which change very little once scanned and do not have an isochronous requirement) and archived data.

Rewritable Optical Disks:

Rewritable optical drives are produced by using the technologies like magneto-optical. It has the advantage ofrewritability over the WORM where rewritable is not possible. It can be used as primary or secondary media for storage of large objects, which are then archieved. (Placed where documents are preserved) on WORM disks.
If it is used as primary media, it should be accompanied by highspeed magnetic disk cache. This is to achieve acceptable video performance.

Optical Disk Libraries:

Optical disk libraries are nothing but juke boxes. Work disks and rewritables can be used in optical disk libraries to achieve very high volumes of near-lines storage. Optical disk libraries range from desk top juke boxes with one 5' 1/4" drive and I O-slot optical disk stack for upto lOG Bytes of stroage of large libraries using as many as four 12" drives with an 80-s10t optical disk stack for upto terabytes of storage.
The disadvantage of optical disk library is the time taken for a platter to be loaded into a drive and span to operating speed.

5. Differentiate TIFF file structure from RIFF file structure.

TIFF File Format

TIFF is an industry-standard file format designed to represent raster image data generated by scanners, frame grabbers, and paint/ photo retouching applications.

TIFF Version 6.0 .

It offers the following formats:

(i) Grayscale, palette color, RGB full-color images and black and white.

(ii) Run-length encoding, uncompressed images and modified Huffman data compression schemes.

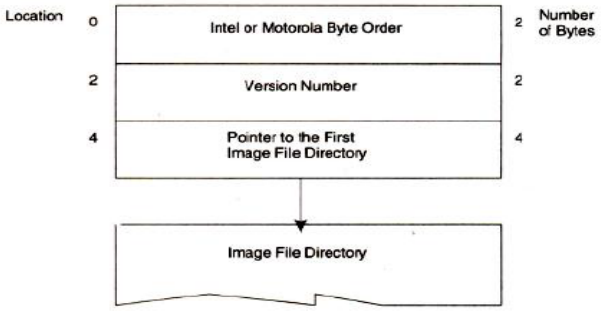
The additional formats are:

(i) Tiled images, compression schemes, images using CMYK, YCbCr color models.

TIFF Structure

TIFF files consists of a header. The header consists of byteordering flag, TIFF file format version number, and a pointer to a table. The pointer points image file directory. This directory contains table of entries of various tags and their information.

TIFF file format Header:



TIFF Tags

The first two bytes of each directory entry contain a field called the Tag ID.

Tag IDs arc grouped into several categories. They are Basic, Informational, Facsimile, Document storage and Retrieval.

TIFF Classes: (Version 5.0)

It has five classes

1. Class B for binary images
2. Class F for Fax
3. Class G for gray-scale images
4. Class P for palette color images
5. Class R for RGB full-color images.

Resource Interchange File Format (RIFF)

The **RIFF** file formats consist' of blocks of data called chunks. They are

RIFF Chunk - defines the content of the RIFF file.

List Chunk - allows to embed archival location copy right information and creating date.

Subchunk - allow additional information to a primary chunk

The first chunk in a RIFF file must be a RIFF chunk and it may contain one or more sub chunk

The first four bytes of the RIFF chunk data field are allocated for the form type field containing four characters to identify the format of the data stored in the file: AVI, WAV, RMI, PAL and so

File type	Form typl	File extension
Waveform Audio File	WAVE	.WAV
Audio Video Interleaved file	AVI	.AVI
MIDI File	RMID	.RMI
Device Independent Bitmap file	RDIB	.RDI
Pallette File	PAL	.PAL

The sub chunk contains a four-character ASCII string 10 to identify the type of data.
Four bytes of size contains the count of data values, and the data. The data structure of a chunk is same as all other chunks.
RIFF Chunk The first 4 characters of the RlFF chunk are reserved for the "RIFF" ASCII string. The next four bytes define the total data size.
The first four characters of the data field are reserved for form tyPe. The rest of the data field contains two subchunk:
(i) fmt ~ defines the recording characteristics of the waveform.
(ii) data ~ contains the data for the waveform.
LIST Chunk
RlFF chunk may contains one or more list chunks.
List chunks allow embedding additional file information such as archival location, copyright information, creating date, description of the content of the file.
RlFF MIDI FILE FORMAT
RlFF MIDI contains a RlFF chunk with the form type "RMID"and a subchunk called "data" for MIDI data.
The 4 bytes are for ID of the *RlFF* chunk. 4 bytes are for size 4 bytes are for form type
4 bytes are for ID of the subchunk data and 4 bytes are for the size of MIDI data.
RIFF DIBS (Device-Independent Bit Maps) .
DIB is a Microsoft windows standard format. It defines bit maps and color attributes for bit maps independent of devices. DIEs are normally embedded in .BMP files, .WMF meta data files, and .CLP files.

6. **Explain how scanners are used for image enhancements**.

IMAGE SCANNERS
In a document imaging system, documents are scanned using a scanner. \The document being scanned is placed on the scanner bed or fed into the sheet feeder of the scanner .The scanner acts as the camera eye and takes a photograph of the document, creating an image of the original. The pixel representation (image) is recreated by the display software to render the image of the original document on screen or to print a copy of it.
Types of Scanners
A and B size Scanners, large form factor scanners, flat bed scanners, Rotory drum scanners and hand held scanners are the examples of scanners.
Charge-Coupled Devices All scanners use charge-coupled devices as their photosensors. CCDs consists of cells arranged in a fixed array on a small square or rectangular solid state surface. Light source moves across a document. The intensity of the light reflected by the mirror charges those cells. The amount of charge is depending upon intensity of the reflected light, which depends on the pixel shade in the document.
Image Enhancement Techniques
HalfTones In a half-tone process, patterns of dots used to build .scanned or printed image create the illusion of continuous shades of gray or continuous shades of color. Hence only limited number of shades are created. This process is implemented in news paper printers.

But in black and white photograph or color photograph, almost infinite levels of tones are used.

Dithering

Dithering is a process in which group of pixels in different patterns are used to approximate halftone patterns by the scanners. It is used in scanning original black and white photographs.

Image enhancement techniques includes controls of brightness, deskew (Automatically corrects page alignment), contrast, sharpening, emphasis and cleaning up blacknoise dots by software.

Image Manipulation

It includes scaling, cropping and rotation.

Scaling: Scaling can be up or down, the scaling software is available to reduce or enlarge. This software uses algorithms.

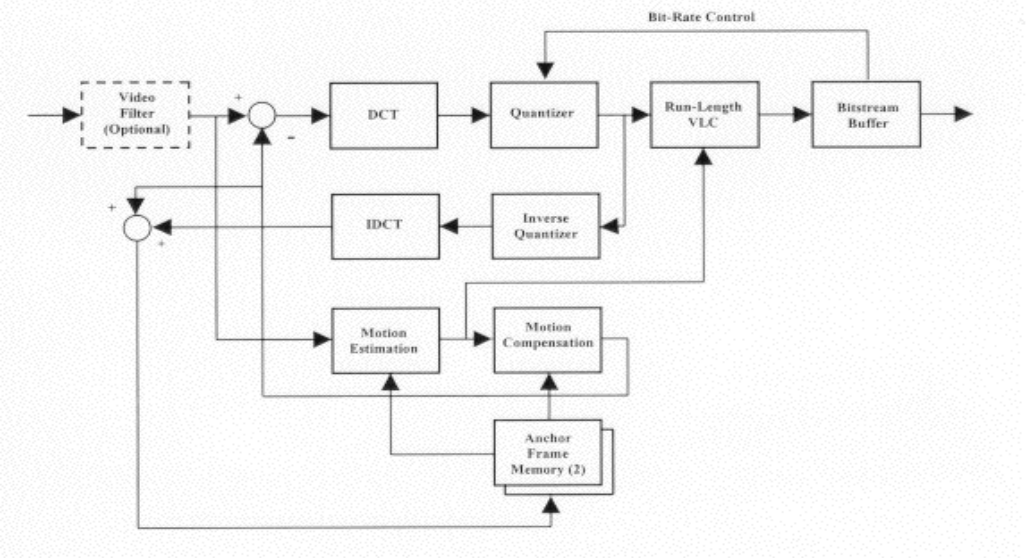
Cropping: To remove some parts of the image and to put the rest of the image as the subset of the old image.

Rotation: Image could be rotated at any degree for displaying it in different angles.

7. Explain the "P-frame" encoding process as described in the MPEG standard.

Inter-frame (P-frame) Coding

The previously discussed intra frame coding techniques were limited to processing the video signal on a spatial basis, relative only to information within the current video frame. Considerably more compression efficiency can be obtained however, if the inherent temporal, or time-based redundancies, are exploited as well. Anyone who has ever taken a reel of the old-style super-8 movie film and held it up to a light can certainly remember seeing that most consecutive frames within a sequence are very similar to the frames both before and after the frame of interest. Temporal processing to exploit this redundancy uses a technique known as block-based motion compensated prediction, using motion estimation. A block diagram of the basic encoder with extensions for non-intra frame coding techniques is given in Figure . Of course, this encoder can also support intra frame coding as a subset.

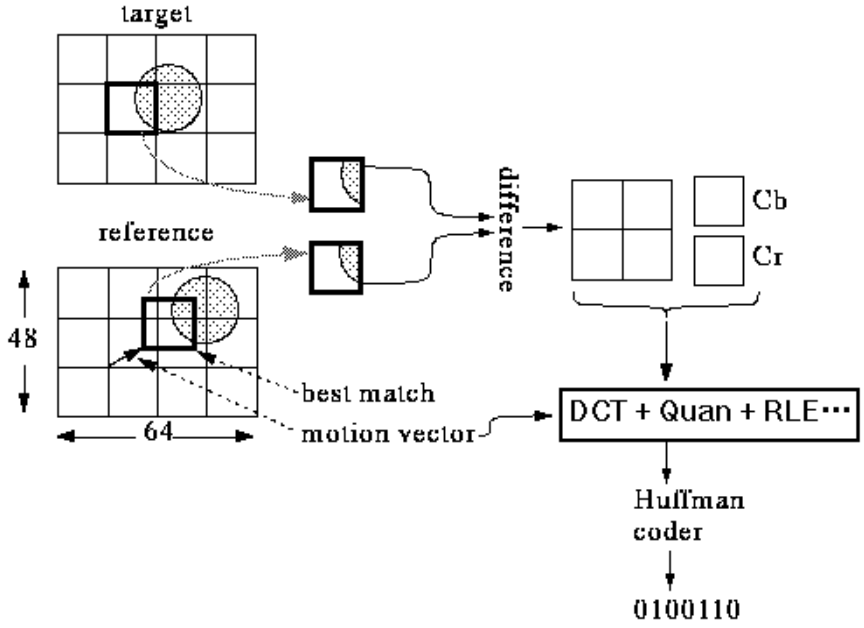


P-Frame Coding

Starting with an intra, or I frame, the encoder can forward predict a future frame. This is commonly referred to as a P frame, and it may also be predicted from other P frames, although only in a forward time manner. As an example, consider a group of pictures that lasts for 6 frames. In this case, the frame ordering is given as I,P,P,P,P,P,I,P,P,P,P

Each P frame in this sequence is predicted from the frame immediately preceding it, whether it is an I frame or a P frame. As a reminder, I frames are coded spatially with no reference to any other frame in the sequence.

P-coding can be summarised as follows:



8. Briefly explain physical construction of CD ROM with neat diagram and also explain various recording standards.

CD-ROM

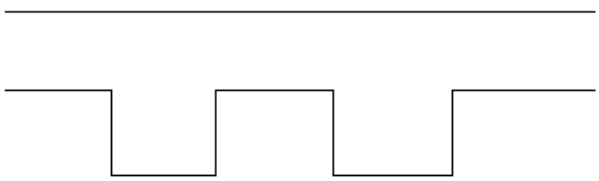
Physical Construction of CD ROMs:

It consists of a polycarbonate disk. It has 15 mm spindle hole in the center. The polycarbonate substrate contains lands and pits.

The space between two adjacent pits is called a land. Pits, represent binary zero, and the transition from land to pits and from pits to land is represented by binary one.

The polycarbonate substrate is covered by reflective aluminium or aluminium alloy or gold to increase the reflectivity of the recorded surface. The reflective surface is protected by a coat oflacquer to prevent oxidation. A CD-ROM consists of a single track which starts at the center from inside and spirals outwards. The data is encoded on this track in the form of lands and pits. A single track is divided into equal length sectors and blocks**.**

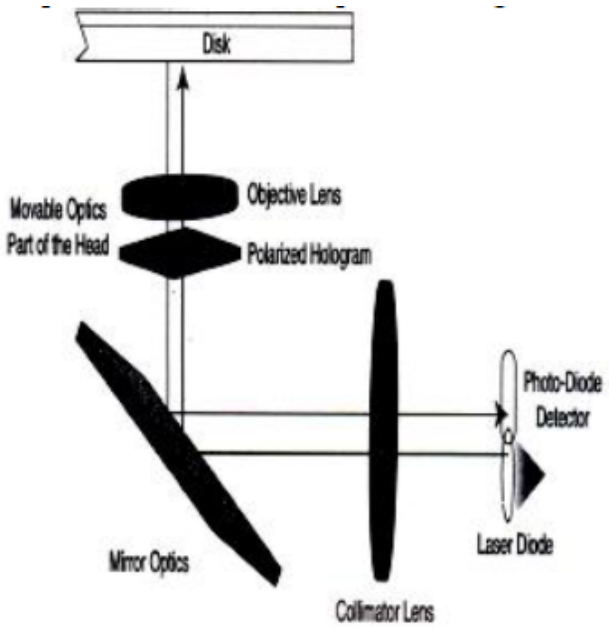
CD-ROM Physical Layers



Each sector or block consists of2352 bytes, also called a frame. For Audio CD, the data is indexed on addressed by hours, rninutes, seconds and frames. There are 75 frames in a second.

Magnetic Disk Organization: Magnetic disks are organized by CYlinder, track and sector. Magnetic hard disks contain concentric circular tracks. They are divided into sector.

Component of rewritable phase change cd-rom



Organization of magnetic media

CD-ROM Standards : A number of recording standards have emerged for CD-ROMs.

They are:

CD-DA (DD-Digital Audio) Red Book: CD-ROM is developed by philips and sony to store audio information. CD-DA is the basic medium for the music industry.

The standard specifies multiple tracks, with one song per track. One track contains one frame worth of data: 2352 bytes. There are 75 frames in a second. Bandwidth = 176 *KB/s*.

CD-ROM Mode 1 Yellow Book: The Mode 1 Yellow Book Stnadard was developed for error correction. The Yellow Book Standard dedicates 288 bytes for error detection codes (EDCs) and error correction codes (ECCs).

CD-ROM Mode 2 Yellow Book

The Mode 2 Yellow Book standard was developed for compressed audio and video applications where, due to lossy compression, data integrity is not quite as important. This standard maintains the frame stmcture but it does not contain the *ECC/EDC* bytes. Removing the *ECC/EDC* bytes allows a frame to contain an additional 288 bytes of data, resulting in an increase of 14% more data. The frame stmcture is shown in the Table below:

Synchronization	Header	Data
12 Bytes	4 Bytes	2336 Bytes
0-11	13-15	16-2351

CD-ROMXA

XA stands for Extended Architecture. The standard was created for extending the present CD-ROM format.

CD-ROM XA contains multiple tracks. Each track's content is desclibed by mo~e. CD-ROM XA also allows interleaving audio and video objects with data for synchroni~ed playback. It does not support video compression. It supports audio compression. It uses Adaptive differential pulse Code Modulation algorithms.

CD-MO Orange Book Part 1

This standard defines an optional pre-mastered area conforming to the Red, Yellow or Green book standards for read-only, and a recordable area. It utilizes a read/write head similar to that found in magnetooptical drives. We can combine the pre-master multimedia objects as the base and develop their own versions.

CD-R Orange Book Part 2

This standard allows writing data once to a writeable disk. Here, the CD contains a polycarbonate substrate with pits and lands.

The polycarbonate layer is covered with an organic dye recording layer.

As in CD-ROM construction, the track starts from the center and spirals outwards. CD-R uses a high powered laser beam. The laser beam alters the state of the organic dye such that when the data is read, the altered state of dye disperses light instead of reflecting it. The reflected beam is measured for reading the state of each bit on the disk.

Mini-Disk

Mini-Disk for Data is known as MD-Data. It was developed by Sony Corporation. It is the data version of the new rewritable storage format. It can be used in three formats to support all users.

A premastered optical disk.

A recordable magneto-optical disk.

A hybrid of mastered and recorded.

Its size is 2.5 inch. It provides large capacity. It is low cost. It is used in multimedia applications.

UNIT-5
HYPERMEDIA

1. Give two examples of Multimedia Authoring Systems.

Two examples for multimedia authoring systems are,

i. Professionals who prepare documents
ii. Audio or soundtracks

2. List the components of a distributed multimedia application.

i. Application Software
ii. Container object store
iii. Image and still video store
iv. Audio and video component store
v. Object dictionary service agent
vi. Component service agent
vii. User interface service agent
viii. Networks(LAN and WAN)

3. Define the term Multimedia Authoring.

Multimediaauthoring is the process of designing and developing a multimedia product. The author brings all of the different multimedia components together into one program and provides structure, navigation, and interactivity for the user. For educational multimedia, it is also important to create an effective instructional environment. The authoring process can be used to develop many different types of products, including:

i. Educational applications
ii. Computer-based training
iii. Reference systems
iv. Simulations

4. What is rubber banding?

Rubber Banding is another form of zooming. The user can use a mouse to define two corners of a rectangle. The selected area can be copied to a clipboard, cut, moved or zoomed.

5. What is VFW?

Video for Word (VFW) establishes new components for data interchange such as AVI. VFW provides capture , edit and playback tools for full-motion digital video.The tools provided by VFW are,

i. The VidCap tool
ii. The VidEdit tool
iii. The VFW playback tool

6. What are the functions of an object request broker in managing distributed multimedia objects.

The Object Request Broker performs the following functions

i. Object Recompilation
ii. Playback control
iii. Format conversions
iv. List the essential steps needed for designing a good hypermedia system.

7. What is VIM standard for?

VIM stands for Vendor Independent Messaging.This is a standardized format for cross product messages.

8. What is contrast between multimedia and hypermedia?

Multimedia

i. Multimedia means that computer information can be represented through audio, video, and animation in addition to traditional media (e.g. text, graphics drawings, and images).
ii. Multimedia tends to feature several media types
iii. It is used to encompass the non-linear organization of text
iv. Language-learning program

Hypermedia

i. Hypermedia, a term derived from hypertext, extends the notion of the hypertext link to include links among any set of multimedia objects, including sound, motion video, and virtual reality.
ii. Involves linking various media.
iii. Has hypertext
iv. Intelligent feedback.

9. Classify the User interface development tools.

User interface development tools are as follows

i. Media editor
ii. Authoring applications
iii. Hypermedia object creation
iv. Multimedia object locator and creator

10. What is workflow?

Workflow is the sequence of events that determine the flow and processing of data. Workflow allows business process management in a predetermined organized manner and allows the flow of information from a desktop or a system to another desktop or system.

11. What are the classifications of workflow?

i. Production workflow or Transaction based workflow
ii. Mail enabled or Adhoc workflow
iii. Document-based workflow
iv. Knowledge-based workflow
v. Object-oriented workflow

12. What are the classes of multimedia application classes?

i. Game systems
ii. Multimedia Information Repositories
iii. Interactive TV
iv. Video and Phone conferencing & Hypermedia Mail Messages
v. Shared Workshop
vi. Enterprise-wide Multipurpose Systems

13. Explain about dedicated system?

In a dedicated system the creation, storage and manipulation of multimedia objects are performed completely within the system. A dedicated system is dependent on a network or external storage management. In a dedicated system there is no communication with other systems.

14. Explain about departmental system?

Departmental systems use a LAN to provide shared object storage management. Here capturing of multimedia objects may be for local use or for distribution to other users in the department. It also provides some level of shared processing of multimedia objects.

15. Explain about enterprise-wide systems?

Enterprise-wide multipurpose systems consist of large number of LAN's and WAN's that are interconnected. It allows sharing of departmental level or enterprise level storage management. An enterprise-wide system supports a combination of dedicated local applications, departmental applications and interdepartmental applications such as e-mail and corporate information repositories.

16. Explain Virtual Reality Systems?

Virtual Reality systems are designed to produce the cognitive effect of feeling immersed in the environment. It is created by the computer using sensory inputs such as vision, hearing, feeling and sensation of motion.

17. State the key design issues that provide virtual reality functionality?

Human factors

i. Multimedia Inputs and Outputs
ii. Virtual Reality Modeling
iii. Virtual Reality Design considerations

18. What is the purpose of MIME?

Multipurpose Internet Mail Extension specification defines mechanisms for generalizing the message content to include multiple body parts and multiple data types.

19. What are the services provided by a directory service agent?

i. Directory service,
ii. Object assignment,
iii. Object status management,
iv. Directory service domains,
v. Directory service server elements,
vi. Network access.

20. What is panning?

Panning implies that the image window is unable to display the full image at the selected resolution for display. In that case the image can be panned left to right or right to left as well as top to bottom or bottom to top. Panning is useful for finding detail that is not visible in the full image.

PART-B

1. What are the components of a hypermedia message? Discuss in detail.

Hypermedia Message Components

A hypermedia message may be a simple message in the form of text with an embedded graphics, sound track, or video clip, or it may be the result of analysis of material based books, CD ROMs, and other on-line applications. An authoring sequence for a message based on such analysis may consist of the following components.
1. The user may have watched some video presentation on the material and may want to attach a part of that clip in the message. While watching it, the user marks possible quotes and saves an annotated copy.
2. Some pages of the book are scanned as images. The images provide an illustration or a clearer analysis of the topic
3. The user writes the text of the message using a word processor. The text summarizes the highlights of the analysis and presents conclusions.

These three components must be combined in a message using an authoring tool provided by the messaging system. The messaging system must prompt the user to enter the name of the addressee forthe message.
The message system looks up the name in an online directory and convert it to an electronic addresses well as routing information before sending the message. The user is now ready to compose the message. The first step is to copy the word processed text report prepared in step 3 above in the body area of the message or use the text editor provided by the messaging system. The user then marks the spots where the images are referenced and uses the link and embed facilitites of the authoring tool to link in references to the images. The user also marks one or more spots for video clips and again uses the link and embed facilities to add the video clips to the message When the message is fully composed, the user signs it (electronic signature) and mails to the message to the addressee (recipient). The addressing system must ensure that the images and video clips referenced in the message are also transferred to a server "local' to the recipient.

Text Messages
In earlier days, messaging systems used a limited subset of plain ASCII text. Later, messaging systems were designed to allow users to communicate using short messages. Then, new messaging standards have added on new capabilities to simple messages. They provide various classes of service and delivery reports.

Pratap To : Karan Copy to: Madhan Date : 01 Jan'07 subject: WISHING A HAPPY NEW YEAR Hai Karan, I wish you a very bright and prosperous new year. - Pratap Delivery notification: Normal Priority: High

Typical Electronic mail message
Other capabilities of messaging systems includ~ a name and address directory of all users accessible to the messaging system.
Rich-Text Messages
Microsoft defined a standard for exporting and importing text data that included character set, font table, section and paragraph formatting, document formatting, and color information-called Rich Text Format (RTF), this standard is used for storage as well as Import and export of text files across a variety of word-processing and messaging systems.
When sections of this document are cut and pasted into another application, the font and formatting information is .retained. This allows the target application to display the text m the nearest equivalent fonts and formats.
Rich-text messages based on the RTF formats provide the capability to create messages in one word processor and edit in another at the recipient end. Most messaging systems provIde richtext capability for the field of a message.

Voice Messages

Voice mail systems answer telephones using recorded messages and direct the caller through a sequence of touch tone key operations until the caller is connected to the desired party or is able to leave a recorded message.

Audio' (Music)

The Musical Instrument Digital interface (MIDI) was developed initially by the music industry to allow computer control of and music recordings from musical instruments such as digital pianos and electric keyboards. MIDI interfaces are now being used for a variety of peripherals, including digital pianos, digital organs, video games with high-fidelity sound output, and business presentations.

Full-Motion Video Management

Use of full-motion video for information repositories and memos are more informative. More information can be 'conveyed and explained in a short full-motion video clip than can be conveyed In a long text document. Because a picture is equivalent to thousand words.

Full Motion video Authoring System

An authoring system is an important component of a multimedia messaging system. A good authoring system must provide a number of tools for the creation and editing of multimedia objects. The subset of tools that are necessary are listed below:

1. A video capture program - to allow fast and simple capture of digital video from analog sources such as a video camera or a video tape. .
2. Compression and decompression Interfaces for compressing the captured video as it is being captured.
3. A video editor with the ability to decompress, combine, edit, and compress digital video clips.
4. Video indexing and annotating software for marking sections of a videoclip and recording annotations.

Identifying and indexing video clips for storage.

Full-Motion Video Playback Systems The playback system allows the recipient to detach the embedded vIdeo reference object, Interpret its contents and retrieve the actual video clip from a specialized video server and launch the Playback application. A number of factors are involved in playing back the video correctly.

They are:

1.How the compression format used for the storage of the video clip relates to the available hardware and software facilities for decompression.

2.Resolution of the screen and the system facilites available for managing display windows. The display resolution may be higher or lower than the resolution of the source of the video clip.

3.The CPU processing power and the expected level of degradation as well as managing the degraded output on the fly.

4.Ability to determine hardware and software facilities of the recipient's system, and adjusting playback, parameters to provide the best resolution and perfonnance on playback.

The three main technologies for playing full motion video are microsoft's video for windows: Apple's Quicktime, and Intel's Indeo.

Video for Windows (VFW): It is the most common environment for multimedia messaging.

VFW provides capture, edit, and playback tools for full-motion video. The tools provided by VFW are: The VidCap tool, designed for fast digital video capture.

The VidEdit tool designed for decompression, edition, and compressing full-motion digital video. The VFW playback tool.

The VFW architecture uses OLE. With the development of DDE and OLE, Microsoft introduced in windows the capability to link or multimedia objects in a standardized manner. Hence variety :;windows based applications can interact with them. We can add full-motion video to any windows-based application with the help ofVFW. The VFW playback tool is designed to use a number of codecs (software encoder/decoders) for decompressing and playing video files. The default is for A VI files.

Apple's QuickTime

An Apple QuickTime product is also an integrated system for playing back video files. The QuickTime product supports four compression methodologies.

Intel's Indeo

Indeo is a digital video recording format. It is a software technology that reduces the size of un compressed video files through successive compression methodologies, including YUV sub sampling, vector quantization, Huffman's run-length encoding, and variable content encoding. Indeo technology is designed to be scalable for playing back video; It determines the hardware available and optimizes playback for the hardware by controlling the frame rate. The compressed file must be decompressed for playback. The Indeo technology decompresses the video file dynamically in real time for playback. Number of operating systems provide Indeo technology as standard feature and with other software products (eg. VFW).

Hypermedia Linking and Embedding

Linking and embedding are two methods for associating multimedia objects with documents.

Linking Objects

When an object is linked, the source data object, called the link source, continues to stay whenever it was at the time the link was created. This may be at the object server where it was created, or where it has been copied.

Only reference is required in the hypermedia document. The' reference is also known as link. This link reference includes information about the multimedia object storage, its presentation parameters, and the server application that is needed to dIsplay/play or edit it. When this document is copied, the link reference is transferred. But the actual multimedia document remains in its original location. A linked object is not a part of the hypermedia document and it does not takeup storage space within the hypermedia document. If the creator, or authorised user edits the original stored multimedia object, subsequent calls to the linked object bring the copy.

Embedded Objects

If a copy of the object is physically stored in the hypermedia document, then'the multimedia object :3 said to be embedded. Any changes to the original copy of t4at object are not reflected in the embedded copy. When the hypermedia document is copied, the multimedia object is transferred with it to the new locations.

Graphics and images can be inserted in a rich-text document on embedded using such techniques as OLE Voice and audio components can be included in a text message; or they cim be part of a full voice-recorded message that has embedded text and other components.

2. How would you link or embed multimedia objects in hypermedia systems?

Hypermedia Linking and Embedding

Linking and embedding are two methods for associating multimedia objects with documents.

Linking Objects

When an object is linked, the source data object, called the link source, continues to stay whenever it was at the time the link was created. This may be at the object server where it was created, or where it has been copied.

Only reference is required in the hypermedia document. The' reference is also known as link. This link reference includes information about the multimedia object storage, its presentation parameters, and the server application that is needed to dIsplay/play or edit it. When this document is copied, the link reference is transferred. But the actual multimedia document remains in its original location. A linked object is not a part of the hypermedia document and it does not takeup storage space within the hypermedia document. If the creator, or authorised user edits the original stored multimedia object, subsequent calls to the linked object bring the copy.

Embedded Objects

If a copy of the object is physically stored in the hypermedia document, then'the multimedia object :3 said to be embedded. Any changes to the original copy of t4at object are not reflected in the embedded

copy. When the hypermedia document is copied, the multimedia object is transferred with it to the new locations.
Graphics and images can be inserted in a rich-text document on embedded using such techniques as OLE Voice and audio components can be included in a text message; or they cim be part of a full voice-recorded message that has embedded text and other components.

3. Explain the features and facilities incorporated in any one of the integrated document management system.

Integrated Document Management
It is for managing integrated documents.
Integrated document Management for messaging:
Integrated document Management for Messaging Specialized messaging system such as Lotus Notes provide Integrated document management for messaging. The user can attach embed or link a variety of multimedia objects.
When document is forwarded to other users, all associated multimedia objects are also forwarded and avaiiable to the new receivers of the forward message.
Multimedia Object Server and Mail Server Interactions:
The mail server is used to store i'lll e-mail messages. It consists of a file server with mail files for each user recipient. This file server act as a mail box.
All received mail is dropped in the user's mail file. The user can review or delete these mails. When mail messages include references to multimedia objects, mail file contains only link information.

4. What are the different kinds of user interface development tools? What are the design issues of multimedia authoring? Explain.

User Interface Design Multi media applications contain user interface design. There are four kinds of user interface development tools. They are
1. Media editors
2. An authoring application
3. Hypermedia object creation
4. Multimedia object locator and browser

A media editor is an application responsible of the creation and editing of a specific multimedia object such as an image, voice, or Video object. Any application that allows the user to edit a multimedia object contains a media editor. Whether the object is text, ~voice, or full-motion video, the basic functions provided by the editor are the same: create, delete, cut, copy, paste, move, and merge.
Navigation through the application
Navigation refers to the sequence in which the application progresses and objects are created, searched and used.
Naviation can be of three modes:
(i) Direct: It is completely predefined. In this case, the user needs to know what to expect with successive navigation actions.
Free-form mode: In this mode~ the user determines the next sequence of actions.
Browse mode: In this mode, the user does not know the precise question and wnats to get general information about a particular topic. It is a very common mode in application based on large volumes of non-symbolic data. This mode allows a user to explore the databases to support the hypothesis.
Designing user Interfaces
User Interface should be designed by structured following design guidelines as follows:
1.Planning the overall structure of the application
2.Planning the content of the application

3.Planning the interactive behavior
4.Planning the look and feel of the application

A good user interface must be efficient and intuitive by most users.
The interactive behaviour of the application determines how the User interacts with the application. A number of issues are determined at this level.
They are Data entry dialog boxes
Application designed sequence of operation depicted by graying or enabling specific menu items Context-Sensitive operation of buttons. Active icons that perform ad hoc tasks (adhoc means created for particular purpose only)
A look and feel of the application depends on a combination of the metaphor being used to simulate real-life interfaces, Windows guidelines, ease of use, and aesthetic appeal.

Special Metaphors for Multimedia Applications

In this section let us look at a few key multimedia user interface metaphors.

The organizer metaphor

One must begin to associate the concept of embedding multimedia object in the appointment diary or notepad to get obvious view of the multimedia aspe.cts of the organizer.
Other use of multimedia object in an organizer is to associate maps or voice mail directions with addresses in address books.
The lotus organizer was the first to use a screen representation of the office diary type organizer
'Telephone Metaphor: The role of the telephone was changed b the advent of voice mail system. Voice mail servers convert the analog voice and store it in digital form. With the standards for voice ~ail file formats and digital storage of sound for computer. Now, computer system is used to manage the phone system. The two essential components of a phone system are speakers and microphones. They are included in most personal computers.
Figure 5.5 shows how a telephone can be created on a screen to make it a good user interface
The telephone keypad on the screen allows using the interface just as a telephone keypad is used. Push buttons in dialog boxes and function selections in memos duplicate the function provided by the keypad.
Push buttons, radio buttons, list boxes, and data entry fields and menu selections allow a range of functionality than can be achieved by the telephone.
Aural User Interface: A Aural user interface allows computer systems to accept speech as direct input and provide an oral response to the user actions. Speech enabling is an important feature in this UI. To design AUI system first, we have to create an aural desk top which substitutes voice and ear for the keyboard and display and be able to mix and match them Aural cues should be able to represent icons, voice, menus and the windows of graphical user interface.
AUl design involves human perception, cagnitive science and psycho-acoutic theory. AUI systems learn systems to perform routine functions without user's feedback. An AUI must be temporal and use time based metaphors.
AUI has to address the following issues
1. Recent user memory
2. Attention span
3. Rhythms
4. Quick return to missed oral cues

The VCR metaphor: The User interface metaphor for VCR is to draw a TV on screen and provide live buttons on it for selecting channels, increasing sound volume and changing channel.
User interface for functions suchas video capture, channel play, and stored video playback is to emulate the camera, television and VCR on screen Fi5.6 shows all functions of typical video camera when it is in a video capture mode.

5. Briefly explain the components of distributed multimedia systems.

DISTRIBUTED MULTIMEDIA SYSTEMS

If the multimedia systems are supported by multiuser system, then we call those multimedia systems as distributed multimedia systems.

A multi user system designed to support multimedia applications for a large number of users consists of a number of system components. A typical multimedia application environment consists of the following components:

1. Application software.
2. Container object store.
3. Image and still video store.
4. Audio and video component store.
5. Object directory service agent.
6. component service agent.
7. User interface and service agent.
8. Networks (LAN and WAN).

Application Software

The application software perfom1s a number of tasks related to a specific business process. A business process consists ofa series of actions that may be performed by one or more users.

The basic tasks combined to form an application include the following:

(1) Object Selection - The user selects a database record or a hypermedia document from a file system, database management system, or document server.

(**2) Object Retrieval**- The application ret:ieves the base object.

(**3) Object Component Display** - Some document components are displayed automatically when the user moves the pointer to the field or button associated with the multimedia object.

(4) User Initiated Display - Some document components require user action before playback/display.

(5) Object Display Management and Editing: Component selection may invoke a component control subapplication which allows a user to control playback or edit the component object.

Document store

A document store is necessary for application that requires storage oflarge volume of documents. The following describes some characteristics of document stores.

1. Primary Document Storage: A file systems or database that contains primary document objects (container objects). Other attached or embedded documents and multimedia objects may be stored in the document server along with the container object.

2. Linked Object Storage: Embedded components, such as text and formatting information, and linked information, and linked components, such as pointers to image, audio, and video. Components contained in a document, may be stored on separate servers.

3. Linked Object Management: Link information contains the name of the component, service class or type, general attributes such as size, duration of play for isochronous objects and hardware, and software requirements for rendering.

Image and still video store

An image and still video is a database system optimized for storage of images. Most systems employ optical disk libraries. Optical disk libraries consist of multiple optical disk platters that are played back by automatically loading the appropriate platter in the drive under device driver control.

The characteristics of image and still video stores are as follows:

(i) Compressed information (ii) Multi-image documents

(iii) Related annotations (iv) Large volumes

(v) Migration between high-volume such as an optical disk library and high-speed media such as magnetic cache storages(vi) Shared access: The server software managing the server has to be able to manage the different requirements.

Audio and video Full motion video store

Audio and Video objects are isochronous. The following lists some characteristIcs of audio and full-motion video object stores:
(i) Large-capacity file system: A compressed video object can be as large as six to ten M bytes for one minute of video playback.Temporary or permanent Storage: Video objects may be stored temporarily on client workstations, servers PFoviding disk caches, and multiple audio or video object servers. Migration to high volume/lower-cost media. Playback isochronocity: Playing back a video object requires consistent speed without breaks. Multiple shared access objects being played back in a stream mode must be accessible by other users.

Object Directory Service Agent

The directory service agent is a distributed service that providea directory of all multimedia objects on the server tracked by that element of the directoryy service agent.
The following describes various services provided by a directory service Agent.
(1) Directory Service: It lists all multimedia objects by class and server location.
(2) Object Assignment: The directory service agent assigns unique identification to each multimedia object.
(3) Object Status Management: The directory service must track the current usage status of each object.
(4) Directory Service Domains: The directory service should be modular to allow setting up domains constructed around groups of servers that form the core operating environment for a group of users.
(5) Directory Service Server Elements: Each multimedia object server must have directory service element that reside on either server or some other resources.
(6) Network Access: The directory service agent must be accessible from any workstation on the network.

Component Service Agent

A service is provided to the multimedia used workstation by each multimedia component. This service consists of retrieving objects, managing playback of objects, storing objects, and so on. The characteristics of services provided by each multimedia component are object creating service, playback service, component object service agent, service agents on servers and multifaceted services means (multifaceted services component objects may exist in several forms, such as compressed Or uncompressed).

User Interface Service Agent

It resides on each user workstation. It provides direct services to the application software for the management of the multimedia object display windows, creation and storage of multimedia objects, and scaling and frame shedding for rendering of multimedia objects.
The services provided by user interface service agents are windows management, object creation and capture, object display and playback, services on workstations and using display software. The user interface service agent is the client side of the service agents. The user interface agent manages all redirection since objects are located by a look-up mechanism in the directory service agent

Network

Token Ring: It is a Local Area Network architecture that combines token passing with a hybrid star/ring topology. It was developed by IBM. Token Ring Network uses a multistation Access unit at its hub ..

ATM (Asynchronous Transfer Mode)

It is a network architecture that divides messages into fixed size units (called cells) of small size and that establishes a switched connection between the originating and receiving stations.
A TM appears to be a potential technology for multimedia systems for connecting object servers and user workstations. ATM is actually a good candidate for two reasons: as a hub and spoke teclmology, it adapts very well to the wiring closest paradign; and it allows workstations to operate at speeds defined by the workstation. Figure 5.12 below illustrates LAN topology using an A TM Switching System.

FDDI II (Fiber Distributed Data Interface II)

It is a standard for creating highspeed computer networks that employ fiber-optic cable. FOOl II operates exactly like token ring, . with one difference: FOOl employs two wires through all the hosts in a network.
FOOl II is a single media LAN and its full bandwidth supports all users.
FOOl II appears to be a very useful high-speed technology for connecting servers on an additional separate network and providing the dedicated high bandwidth necessary for rapid transfer and replication of information objects. Figure 5.13 shows a multiievel network based
WANS (Wide Area Network)
This includes LANs, dial up ISDN, T1 (1.544 Mbits/sec) and T3 (45.3 Mbits/sec) lines and regular telephone dial-up lines. The two big issues here are:
• :. W ANs may have a mix of networking and communication protocols.
• :. WAN has a variety of speeds at which various parts of it where it communicates.
Protocol Layering: Layering helps to isolate the network from the . application. Layering of protocols started with the release ofthe ISO model.

6. Writes short notes on the following: (i) Multimedia object manager(ii) User Interface design(iii)Multimedia authoring systems.
i)Multimedia Object Manager:
The multimedia object manager performs the functions of managing all requests from the multimedia applicationsfor retrieving existing multimedia objects or storing new or edited multimedia objects created by the user. Themultimedia object directory manager keeps track of all multimedia objects currently open in the domain and maintains deelte locks on them.
Data structure maintained by the multimedia object manager:
The following list the data structure maintained and used by the multimedia object manager:

- The multimedia directory database
- Dynamic lock status on all multimedia objects
- In memory data structures for all multimedia objects being streamed out to applications for display and to video object players.
- In memory data structures for all multimedia objects being replicated on a demand basis by the multimedia replicator.

ii)User Interface Design Multi media applications contain user interface design. There are four kinds of user interface development tools. They are
1. Media editors
2. An authoring application
3. Hypermedia object creation
4. Multimedia object locator and browser

A media editor is an application responsible of the creation and editing of a specific multimedia object such as an image, voice, or Video object. Any application that allows the user to edit a multimedia object contains a media editor. Whether the object is text, ~voice, or full-motion video, the basic functions provided by the editor are the same: create, delete, cut, copy, paste, move, and merge.
Navigation through the application
Navigation refers to the sequence in which the application progresses and objects are created, searched and used.
Naviation can be of three modes:
(i) Direct: It is completely predefined. In this case, the user needs to know what to expect with successive navigation actions.
Free-form mode: In this mode~ the user determines the next sequence of actions.

Browse mode: In this mode, the user does not know the precise question and wnats to get general information about a particular topic. It is a very common mode in application based on large volumes of non-symbolic data. This mode allows a user to explore the databases to support the hypothesis.

Designing user Interfaces

User Interface should be designed by structured following design guidelines as follows:

1.Planning the overall structure of the application
2.Planning the content of the application
3.Planning the interactive behavior
4.Planning the look and feel of the application

A good user interface must be efficient and intuitive by most users.

iii) Multimedia Authoring Systems

Multimedia authoring systems are designed with two primary target users:

They are

(i) Professionals who prepare documents, audio or sound tracks, and full motion video clips for wide distribution.

(il) Average business users preparing documents, audio recordings, or full motion video clips for stored messages' or presentations.

The authoring system covers user interface. The authoring system spans issues such as data access, storage structures for individual components embedded in a document, the user's ability to browse through stored objects, and so on.

Most authoring systems are managed by a control application.

Design Issues for Multimedia Authoring

Enterprise wide standards should be set up to ensure that the user requirements are fulfilled with good quality and made the objects transferable from one system to another.

So standards must be set for a number of design issues

1. Display resolution
2. Data formula for capturing data
3. Compression algorithms
4. Network interfaces
5. Storage formats.

Display resolution

A number of design issues must be considered for handling different display outputs. They are:

(a) Level of standardization on display resolutions.

(b) Display protocol standardization.

(c) Corporate norms for service degradations

(d) Corporate norms for network traffic degradations as they relate to resolution issuesSetting norms will be easy if the number of different work station types, window managers, and monitor resolutions are limited in number.But if they are more in number, setting norms will be difficult.Another consideration is selecting protocols to use. Because a number of protocols have emerged, including AVI, Indeo, Quick Time and so on.So, there should be some level of convergence that allows these three display protocols to exchange data and allow viewing files in other formats.

File Format and Data Compression Issues

There are variety of data formats available for image, audio, and full motion video objects.

Since the varieties are so large, controlling them becomes difficult. So we should not standardize on a single format. Instead, we should select a set for which reliable conversion application tools are available.

Another key design Issue is to standardize on one or two compression formula for each type of data object. For example for facsimile machines, CCITT Group 3 and 4 should be included in the selected

standard. Similarly, for full motion video, the selected standard should include MPEG and its derivatives such as MPEG 2.
While doing storage, it is useful to have some information (attribute information) about the object itself available outside the object to allow a user to decide if they need to access the object data. one of such attribute information are:
(i) Compression type (ii) Size of the object
(iii) Object orientation (iv)Data and time of creation
(v) Source file name (vi)Version number (if any)
(vii) Required software application to display or playback the object.

Service degradation policies: Setting up Corporate norms for network traffic degradation is difficult as they relate to resolution Issues:
To address these design issues, several policies are possible. They are:
1. Decline further requests with a message to try later.
2. Provide the playback server but at a lower resolution.
3. Provide the playback service at full resolution but, in the case of sound and full motion video, drop intermediate frames.

Design Approach to Authoring
Designing an authoring system spans a number of design issues. They include:
Hypermedia application design specifics, User Interface aspects, Embedding/Linking streams of objects to a main document or presentation, Storage of and access to multimedia objects. Playing back combined streams in a synchronized manner.
A good user interface design is more important to the success of hypermedia applications.
Types of Multimedia Authoring Systems
- Dedicated Authority Systems
- TimeLine –based authoring
- Structured Multimedia Authoring
- Programmable Authoring Systems
- Multisource Multi-user Authoring Systems
- Telephone Authoring systems

7. Describe the design approaches issues and types of authoring tools with neat diagrams wherever necessary.

Types of authoring tools:
- **Card based**
- **Icon based**
- **Time based**
- **Object based**

Card based:

- Cards are developed that have different elements associated with them.
- Cards are put in stack.
- Cards or pages combine to make up a book.
    - example of authoring tools
        - HyperCard (Mac)
        - ToolBook (Mac / Windows)

Icon based:

- Icons are gathered along the line.
- Provide visual development.
- Flow chart is created to show the organisation of icons or elements:
    - including activity list, results and done with dragging the icon/elements along the lines
    - each Icon represents a particular event – button, graphics, text, video
    - examples of authoring tools
        - Authorware(Mac/Windows)
        - IconAuthor (Windows)

Time based:

- The most popular used.
- Using "timeline" for organizing activities
- Also using "framing" – timely adjusted depending on the frame size
- Example:- Macromedia Director / Flash (Mac/Windows)

Object based:

- Support environment based on object.
- Every object is modified using **properties** & **modifiers**
- The environment is based on 'Hierarchy' (section and sub-section).
- Examples of the tools :
    - mTropolis (Mac/Windows)
    - AppleMedia Tool (Mac/Windows)
    - MediaForge (Windows)
- Authoring tools should possess the following capabilities:
    - Interactivity
    - Playback
    - Editing
    - Programming / Scripting
    - Cross Platform
    - Internet Playability
- **Interactivity**
    - Simple Branching
        - Ability to jump to any part of the product
        - Eg:- by mouse click, keyboard input
    - Conditional Branching
        - Ability to jump to any part of products if agreed to certain condition (statement IF-THEN)
    - Structured Language
        - complex programming to enable the interactivity and navigation
- **Playback**
    - Ability to see and to test the ongoing or the completed project.
- **Distribution and delivery:**
    - Able to create a 'RUN TIME' mode.

  This will exclude the need of the authoring tools during execution
- **Editing**
    - generally, authoring tools are capable on text and image editing

- capable on doing other editing too, depending on the software used
- project organisation
- FLOWCHARTING and STORYBOARDING availability
- this will help on configuring interactivity