8/4/20

Model Exam.

CS8092 - Computer Graphics and Multimedia.

Part - A.

1. Two dimensional structures constructed by the process of regional filling, i.e., process of filling image or region are called as Filled Area Primitives. Filling can be of boundary or interior region. Boundary filling Algorithms are used to fill the boundary while Flood-Fill algorithms are used to fill the interior.

2.
- ⇒ Light travels in straight line
- ⇒ It is made up of electric & magnetic waves that oscillate perpendicular to each other.
- ⇒ Photons propagate with a speed of $3 \times 10^8 ms^{-1}$.
- ⇒ Material is not needed for propagation
- ⇒ Shows the phenomenon of reflection, refraction, diffraction & polarization.

3. Two dimensional viewing is a transformation process of real world coordinates into window coordinates which is relative to the viewing volume, especially, the points behind the viewer. Clipping is a computer graphics process to remove lines, objects or line segments, all of which are outside the viewing plane

4. For deciding the visible and invisible portion, a process called clipping is used. Clipping determines the elements in the visible & invisible portion.

Types of clipping:

- → Point clipping
- → Line Clipping
- → Area Clipping
- → Text Clipping
- → Curve Clipping.

5. Quadric surfaces are defined by quadratic equations in 3D space. Spheres and cones are examples of quadrics. The quadric surface of revolution in which a finite curve in 2D is swept in 3D space about an axis to create a surface.

6.	Perspective	Parallel.
	→ The objects is projected in a three dimensional ways.	→ The object is projected in a different way like a telescope.
	→ It forms a realistic picture of the object	→ The image formed by parallel projection is not so realistic.

7. The basic data types used in multimedia are:

- text
- images
- audio
- video
- animations
- holograms
- Full-motion video
- hyperlinks and
- marquee.

8. Entropy coding or huffmann coding is a type of lossless coding to compress digital data by representing frequently occuring pattern with few bits and rarely occuring pattern with many bits.

9. Basic components of hypermedia are:

- Graphics
- Audio
- video
- plain text and
- hyperlinks

10. A hypermedia message can be a complex collection of a variety of objects. It is an integrated message consisting of text, binary files, images, bitmaps, audio and video.

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11.a. $(x_0, y_0) = (0, 0)$

$r = 10.$

$x_0 = 0$

$y_0 = r = 10.$

1. Initial decision param p_0 =

$p_0 = 1 - r$

(0,10) $= 1 - 10$

$p_0 = -9$

2. $\because$ $P_{initial} < 0$; case 1 is true.

$\therefore$ $x_{k+1} = x_k + 1 = 0 + 1 = 1$

(1,10) $y_{k+1} = y_k = 10$

$p_{k+1} = p_k + 2x_{k+1} + 1 = -9 + (2 \cdot 1) + 1$

$= -6.$

3. $p_{k+1} < 0$; case 1 is true.

$x_{k+1} = x_k + 1 = 1 + 1 = 2$

(2,10) $y_{k+1} = y_k = 10.$

$p_{k+1} = -6 + 2(2) + 1$

$= -1.$

4. $p_{k+1} < 0$; case 1 is true

$x_{k+1} = x_k + 1 = 2 + 1 = 3.$

(3,10) $y_{k+1} = y_k = 10$

$p_{k+1} = -1 + 2(3) + 1$

$= 6.$

5. $P_{K+1} > 0$; case 2 is true.

$$x_{K+1} = x_K + 1 = 3+1 = 4$$

$$y_{K+1} = y_K - 1 = 10-1 = 9.$$

$$P_{K+1} = P_K - 2(y_{K+1}) + 2(x_{K+1}) + 1.$$

(4, 9)

$$= 6 - 2(9) + 2(4) + 1$$

$$= 6 - 18 + 8 + 1$$

$$= -3.$$

6. $P_{K+1} < 0$; case ~~both~~ 1 is true.

$$x_{K+1} = x_K + 1 = 4+1 = 5.$$

(5, 9)

$$y_{K+1} = y_K = 9.$$

$$P_{K+1} = -3 + 2(5) + 1$$

$$= 8.$$

7. $P_{K+1} > 0$; case 2 is true.

$$x_{K+1} = x_K + 1 = 5+1 = 6$$

(6, 8)

$$y_{K+1} = y_K - 1 = 8$$

$$P_{K+1} = 8 - 2(8) + 2(6) + 1$$

$$= 8 - 16 + 12 + 1$$

$$= 5.$$

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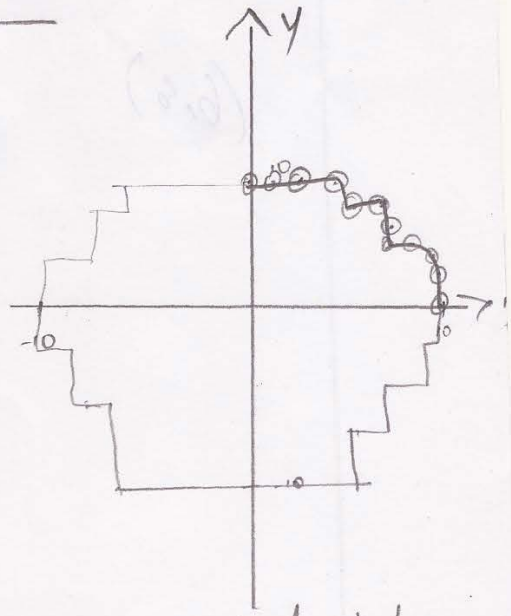
Points for Octant 1.

P_k	P_{k+1}	(X_{k+1}, Y_{k+1})
		(0, 10)
-9	-6	(1, 10)
-6	-1	(2, 10)
-1	6	(3, 10)
6	-3	(4, 9)
-3	8	(5, 9)
8	5	(6, 8)

Point for octant 2 can be obtained by swapping x & y of octant 1.

Points for Quadrant 1.

Octant - 1	Octant - 2
(0, 10)	(8, 6)
(1, 10)	(9, 5)
(2, 10)	(9, 4)
(3, 10)	(10, 3)
(4, 9)	(10, 2)
(5, 9)	(10, 1)
(6, 8)	(10, 0)



generated circle.

The points for other quadrants can be obtained by mirroring & changing signs.

12. a.

Homogeneous Coordinate System:

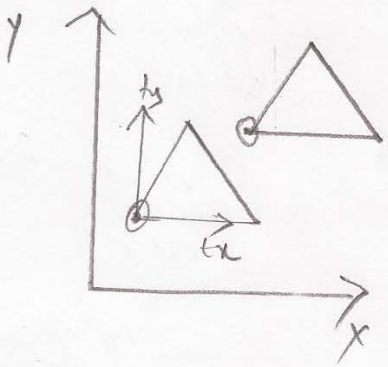
In order to combine the three possible transformation operations into one, a homogenous coordinate system is used. (HCS)

In HCS, 2D points (x, y) are represented as triple coordinates.

Homogeneous coordinates are generally used in design and construction applications. Here, we perform translations, rotations, scaling to fit the picture in its proper position.

Matrix Representation of HCS Transformations:

1. Translation:



$$T = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ tx & ty & 1 \end{bmatrix} \quad (or)$$

$$\begin{bmatrix} 1 & 0 & tx \\ 0 & 1 & ty \\ 0 & 0 & 1 \end{bmatrix}$$

compound translation: $T_1 + T_2$

$$\Rightarrow T_{new} = \begin{bmatrix} 1 & 0 & tx_1 \\ 0 & 1 & ty_1 \\ 0 & 0 & 1 \end{bmatrix} + \begin{bmatrix} 1 & 0 & tx_2 \\ 0 & 1 & ty_2 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & tx_1 + tx_2 \\ 0 & 1 & ty_1 + ty_2 \\ 0 & 0 & 1 \end{bmatrix}$$

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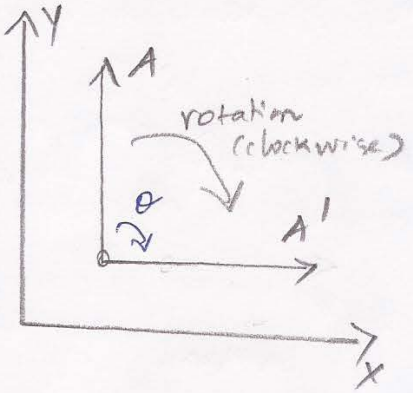
2. Rotation:



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

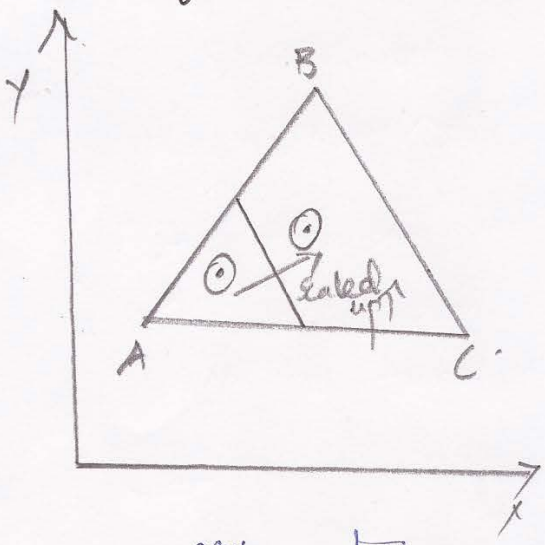
for compound rotation operation,

$$R_{new} = R_1 + R_2 * = \begin{bmatrix} \cos\theta_1 & -\sin\theta_1 & 0 \\ \sin\theta_1 & \cos\theta_1 & 0 \\ 0 & 0 & 1 \end{bmatrix} + \begin{bmatrix} \cos\theta_2 & -\sin\theta_2 & 0 \\ \sin\theta_2 & \cos\theta_2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} \cos\theta_1 + \cos\theta_2 & -(\sin\theta_1 + \sin\theta_2) & 0 \\ \sin\theta_1 + \sin\theta_2 & \cos\theta_1 + \cos\theta_2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

which results in $(\theta_1 + \theta_2)$ angular rotation.

3. Scaling:



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

compound scaling:

$$S^{new} = S_1 \cdot S_2$$

$$= \begin{bmatrix} S_{x_1} & 0 & 0 \\ 0 & S_{y_1} & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} S_{x_2} & 0 & 0 \\ 0 & S_{y_2} & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$S^{new} = \begin{bmatrix} S_{x_1} S_{x_2} & 0 & 0 \\ 0 & S_{y_1} S_{y_2} & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

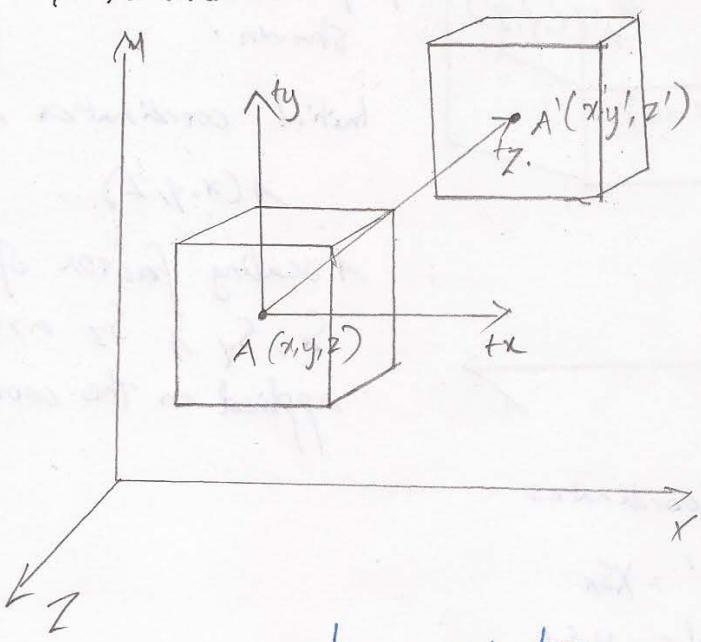
13(a). 3D Transformation includes a set of operations applicable on an 3D object in the given viewing plane, such that its size, shape and position can be altered as needed.

Possible transformations include

1. Translation
2. Rotation
3. Scaling.
4. Reflection
5. Shearing.

and combinations of these operations.

1. Translation.



Consider a 3D cube with center of mass A as shown in the left side.

Initial = (x, y, z)

$A(x, y, z)$ is translated to a new coord $A'(x', y', z')$, as shown below.

$$x' = x + t_x$$
$$y' = x + t_y$$
$$z' = x + t_z.$$

where t_x, t_y, t_z are shift vectors.

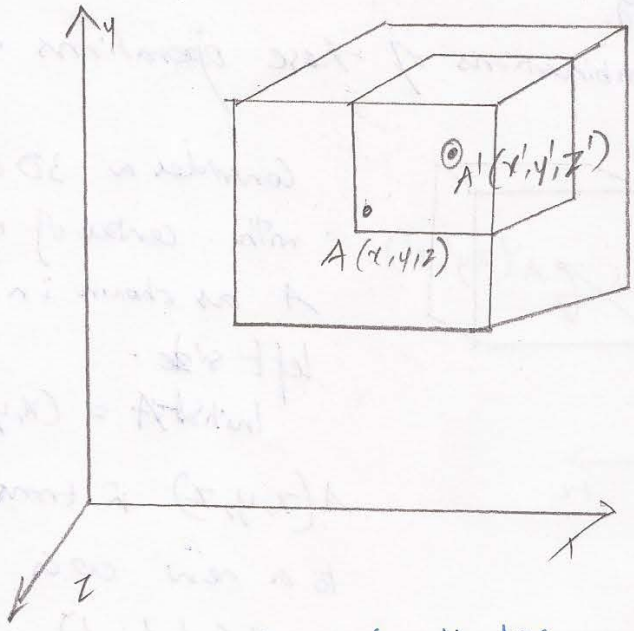
resolutions.

shift vector $T = \begin{bmatrix} 1 & 0 & 0 & t_x \\ 0 & 1 & 0 & t_y \\ 0 & 0 & 1 & t_z \\ 0 & 0 & 0 & 1 \end{bmatrix}$

$$\begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & t_x \\ 0 & 1 & 0 & t_y \\ 0 & 0 & 1 & t_z \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix}$$

$$\Rightarrow A' = T[A] .$$

2. Scaling.



Consider scaling operation performed on a cube as shown.

Initial coordinates are

$A(x, y, z)$

A scaling factor of S_x, S_y & S_z are applied on the coordinates.

New Coordinates

$$x' = xS_x$$
$$y' = yS_y$$
$$z' = zS_z .$$

In Matrix format,

$$\begin{bmatrix} X_{new} \\ Y_{new} \\ Z_{new} \\ 1 \end{bmatrix} = \begin{bmatrix} S_x & 0 & 0 & 0 \\ 0 & S_y & 0 & 0 \\ 0 & 0 & S_z & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix}$$

$A' = [S] A$ where S is the scaling vector.

14 (b) Multimedia Data Interface Standards.

File Formats.

i). Device Independent Bitmap: (DIB)

This file format contains bitmap, color and color palette information.

ii). 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.

iii) RIFF Device Independent Bitmap (RDIB):

Resource Interchange File Format (RIFF) is the standard file format for Windows & OS/2 to process more complex bitmaps.

iv) Palette File Format (PAL):

Allows defining a palette of 1 to 256 RGB colors.

v) Rich Text Format (RTF)

Allows embedded graphics and other file formats within a document. Produced by Lotus Notes.

vi) Wave Audio File Format (WAV):
Digital file representation of digital audio.

vii) Windows Metafile Format (WMF):
Vector graphic format used by MS Windows as an interchange format.

viii) Multimedia Movie Format (MMF):
Format for digital video animation.

ix) Apple's movie format:
Standard format for exchanging files (videos) between QuickTime-Enabled systems.

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

xi) Digital Video Media Control Interface:
Microsoft's high level control interface for VCR controls, including play, rewind, record, etc.

xii) Vendor Independent Messaging (VIM)
Developed by a consortium of ~~vend~~ vendors providing a standardised product for cross-platform messages.

xiii) Apple Audio Interchange File Format (AIFF):
Apple's standard File Format for compressed audio and voice data.

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Video Processing Standards:

1. Intel's DVI:

DVI stands for 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.

Ex: Intel i750B.

2. Apple QuickTime Movie (.mov):

QuickTime is designed to support multimedia applications. It is integrated with macOS and iOS. QuickTime refers to both the extensions to the macOS and to the compression/decompression functionality of the environment. QuickTime is designed to be the graphics standard for timebased graphic data types.

3. Microsoft AVI

AVI stands for Audio-Video Interleave.

It is similar to Apple's QuickTime. It offers low-cost low-resolution video processing for the average desktop user. It is layered & scalable. It allows user to select parameter such as window size, frame rate, quality and compression algorithms.

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15-6. Hypermedia Message Components:

A hypermedia message may be a simple message in the form of text with an embedded graphics, sound, or video clip.

An authoring sequence for a message may consist of the following components:

=> 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.

=> Some pages of the book are scanned images. The images provide an illustration or a clearer analysis of the topic.

=> The user writes the text of the message using a word processor.

Components:

1. Text Messages:
   - => Initially was limited to ASCII text only.
   - => New messaging standards allow users to communicate using complex messages including emojis.
   - => Supports service & delivery reports.

2. Email:

Name and address directory capability to messaging systems.

3. Rich-text messages:

Microsoft defined a standard for exporting and importing text data that included character set, font table, section & paragraph formatting, document formatting & color information.

4. Voice Messages

Voice mail systems answer telephones using recorded messages & direct the caller through or sequence of touch tone key operations.

5. Audio

MIDI was developed initially to allow computer control of and music recordings from musical instruments like digital pianos.

6. Full-Motion Video.

→ Use of full-motion video for information repositories and memos are more informative.

→ More information can be conveyed and explained in a short motion clip than a long text document.

7. Video for Windows (VFW):

⇒ Most common environment for multimedia messaging.

⇒ VFW provides capture, edit & playback tools for full-motion video.

8. Intel's Indeo:

⇒ Digital video Recording format.

⇒ Reduces size of uncompressed video using successive compression technologies.

9. Hypermedia Linking and Embedding.

⇒ Linking and embedding are 2 methods of linking multimedia objects with documents.

⇒ Deals with

1. Linking as in hypertext applications.
2. Linking multimedia objects stored separately from the document using a pointer.
3. Linking & embedding in a context specific to Microsoft Object Linking and embedding.

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16.a. Distributed Multimedia Systems.

Introduction:

A distributed system is designed to support the development of applications and services which have physical architecture consisting of multiple autonomous processing elements that do not share primary memory but cooperate by sending messages over a communication network.

Distributed multimedia systems consist of, multimedia databases, proxy and information servers and clients and are intended for the distribution of multimedia content over networks

Characteristics:

- Delivering of the streams of multimedia data. (Audio samples, video frames)
- To meet the timing requirements (QoS - Quality of Service).
- Flexibility (adapting to user needs
- Availability
- Scalability

Requirements of Distributed Multimedia Systems.

- Providing support for continuous media types such as audio, video and animation.
- Need for sophisticated quality of service management.

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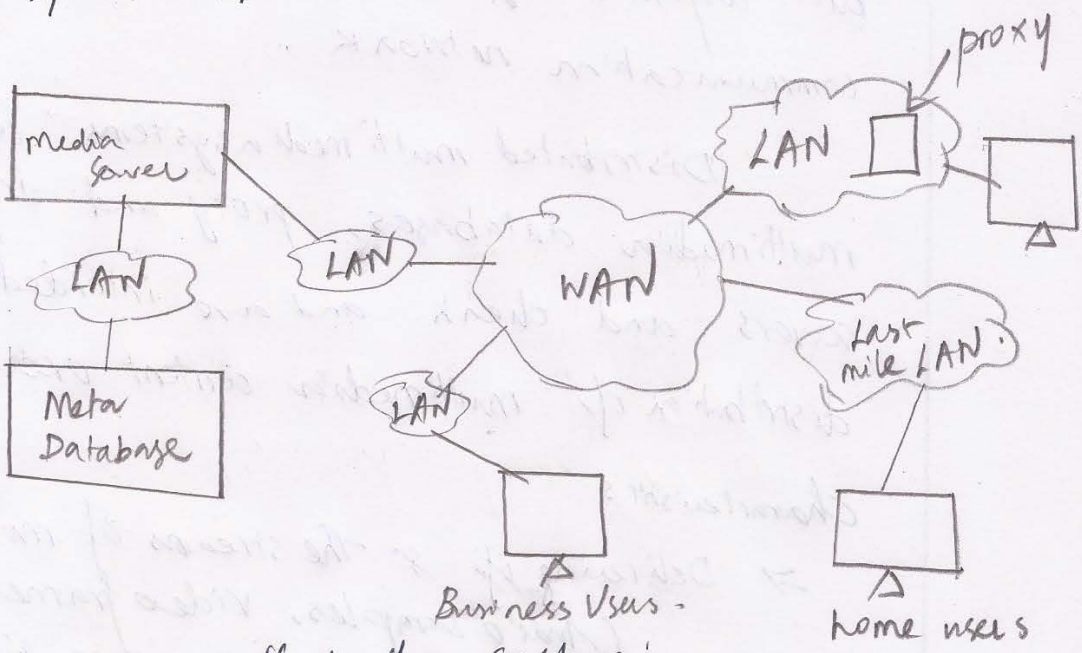
⇒ support multi-party communications.

Architecture.

The following components constitute a DMMS.

1. Database
2. Proxy/Information Servers
3. Clients
4. Wired/wireless Networks



Factors that affect the system:

1. Server bandwidth: Adequate bandwidth of the network to support media streams.
2. Cache bandwidth: Sufficient cache space needed for fast delivery.
3. Number of copies: Adequate no. of copies of the movies at the multimedia databases.
4. No. of clients: Increasing no. of clients increase server workload.

Approaches:

1. Proxy based Approach
2. Parallel or Cluster Server Approach.
3. Caching.

Quality of Service (QoS):

→ DMMS are real-time systems as data must be delivered on time.

→ Acceptable service is measured by:

* Bandwidth (Throughput)
* Latency (Data Access Time)
* Data Loss Rate (Acceptable Loss Ratio)

QoS Management:

Process of managing resources to meet the Acceptable service criteria.

Resources include:

→ CPU/ processing power.
→ Network bandwidth.
→ Buffer memory (on both ends)
→ Other communication factors.

QoS Managers:

Software that runs on network nodes which have 2 functions namely

1. QoS Negotiation
2. Admission Control.

Ways to achiere QoS:

- → Buffering (on both ends)
- → Compression.
- → Bandwidth Reservation
- → Resource Scheduling.
- → Traffic Shaping
- → Flow specifications
- → Stream adaptation

Applications of DMMS:

Following are few applications of Distributed Multimedia Systems:

* Digital Libraries
* Distance Learning
* Conference
* Audio Streaming
* Video Streaming.
* E-commerce, etc.