Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q.1.

a) Attempt any THREE of the following :

i. State any four advantages of RAID technology.(4 Marks)

1. It provides **large volume storage** for multimedia systems.
2. Fault tolerance is achieved by maintaining **a hot backup** system duplicating the primary computer system.
3. Higher performance at **lower cost**.
4. Improvement in throughput speed.
5. Data recovery is easy.

ii. Explain the concept of synchronization related to multimedia system. (Figure – 1M; Explanation – 3M)

Note: Any other diagram explaining the synchronization can also be considered.

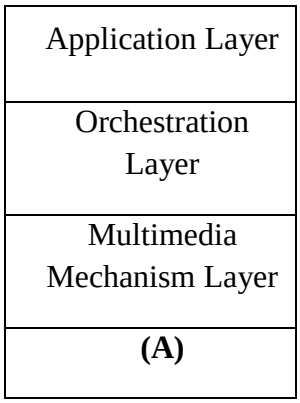
Synchronization *is the co-coordinated ordering of events in time.*

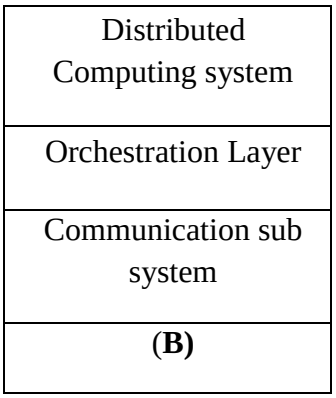
- The time sampled nature of digital video and video referred as isochronous data, requires that delay and jitter be tightly bounded from the point of generation or retrieval to the point of presentation. This requirement is referred as **intra-media synchronization**.
- If several continuous media streams are presented in parallel, potentially from different points of generation or retrieval, constraints on their relative time relationships are referred to as **inter-media synchronization**.
- A fundamental requirement for multimedia systems is to provide inter-media and intra-media synchronization.
- The intermediate subsystems involved in delivering a stream may introduce delay, jitter, and errors. These values are cumulative along any path. So, it is the cumulative delay, jitter, and error rate that must be managed to achieve the end-to-end QOS requirements.

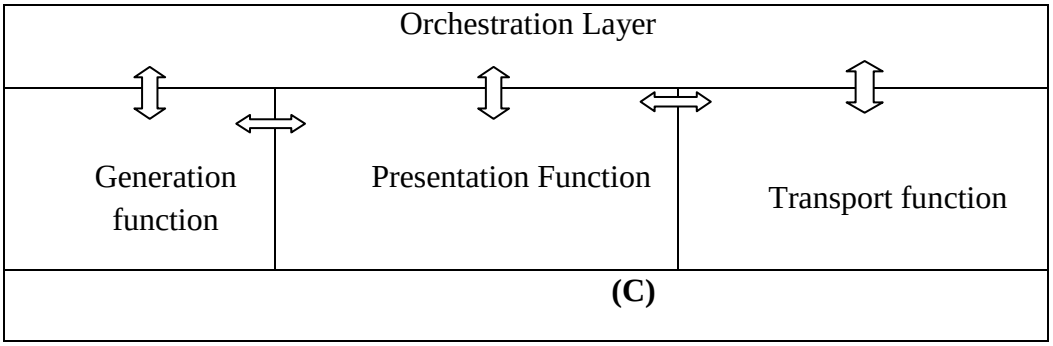
- Various mechanisms and formalism for synchronization have been developed, ranging from low-level hardware-based techniques to abstractions for concurrent programming languages.
- The systems using continuous media data do not require fundamentally new synchronization primitives, but they do require the consideration of two aspects of multimedia applications:

1. Synchronization of events has real time deadlines
2. The failure to synchronization can be handled using techniques such as frame repetition or skipping such that the application still continues to execute.

- The granularity of synchronization events is more detailed at the lower level. In order to meet the requirement of schedulability of a continuous media stream, each subsystem must provide a maximum delay with some probability p.
- Further in order to limit buffering requirements, the variation in delay, referred to as jitter, must also be bounded.
- The management of collection of resource managers to achieve end to end synchronization is referred to as orchestration.







iii. State any four objectives of JPEG. (1 mark each)

Following are the objective of JPEG

1. JPEG compression standard defines that the degree of compression & image quality are perfectly balanced.
2. Compression standard should be such that the user is able to select the desired compression/quality tradeoff using parameters

3. Compression standard should be applicable to practically any kind of source image, without regard to dimensions, image content, aspect ratio, etc.
4. Should have computational requirements that are reasonable for both hardware or software implementations, and
5. To support four different modes of operation:

a. **Sequential encoding**, where each Image component is encoded in the same order that it was scanned;

b. **Progressive encoding**, where the image is encoded in multiple passes so that a coarse image is presented rapidly, followed by repeated images showing greater and greater detail;

c. **Lossless encoding**, where the encoding guarantees exact reproduction of all the data In the source image;

d. **Hierarchical encoding**, where the Image Is encoded at multiple resolutions.

iv. List the types of multimedia authoring system and explain any one of them in brief.(1M for listing types, 3M for explanation any one from the list)

Types of multimedia authoring system:

1. Dedicated authoring system
2. Timeline-based authoring system
3. Structured multimedia authoring
4. Programmable authoring system
5. Multi-Source Authoring System
6. Telephone Authoring System

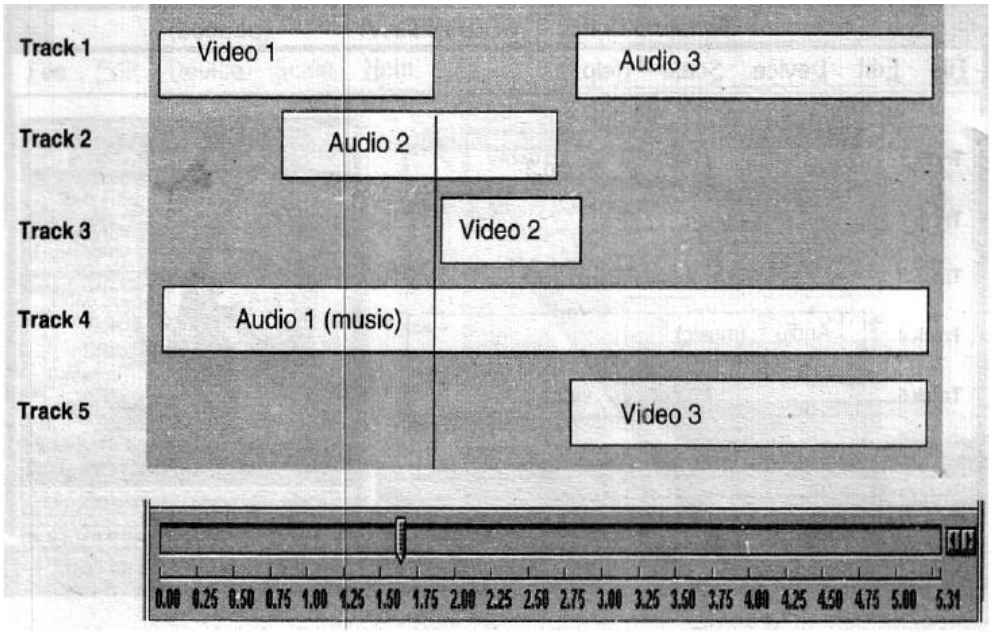
1. Dedicated authoring System

- Designed for a single user and generally for single systems
- Authoring is performed on objects captured by the local video camera and image scanner or on objects stored in some form of multimedia object library. For example, stock presentation to depict a new model of the product.
- Dedicated multimedia authoring systems are used by users who may not be as knowledgeable about multimedia composition management as a professional artist would be.
- The system need to engineer to provide user interfaces that are extremely intuitive and follow real world metaphors A VCR metaphor is a good example of a real-world user interface with which users are very familiar.

2. Timeline based authoring:-

- In a timeline-based authoring system, objects are placed along a time line.
- The timeline can be drawn on the screen in a window in a graphic manner, or it created using a script in a manner similar to a project plan.
- In either case, the user must specify a resource object and position it in the timeline.
- On playback, the object starts playing at that point in the timescale.

Figure shows a model for a timeline-based authoring interface.



Limitation of Timeline Approach

- Once the multimedia object has been captured in a timeline, it is fixed in location and cannot be manipulated easily.
- a single timeline causes a loss of information about the relative time-lines for each individual object. The information about the change from one scene to the next for example is lost.
- Editing a component causes all objects in the timeline to be reassigned because the positions of objects are not fixed in time, only in sequence.
- Copying portions of the timeline becomes difficult because it is used to predict the start of a new section.

3. Structure Multimedia authoring

This Approach was presented by Hardman to address complex multimedia authoring. Complex presentation are Composed of number of video clips with associated sound tracks, separate music tracks and other separate sound tracks. The music tracks can be added with video tracks at different points. it is

Designed to allow explicit manipulations of the structure of a multimedia presentation rather than the implicit manipulation of the structure. Explicit representation of the structure allows modular authoring of the component objects.

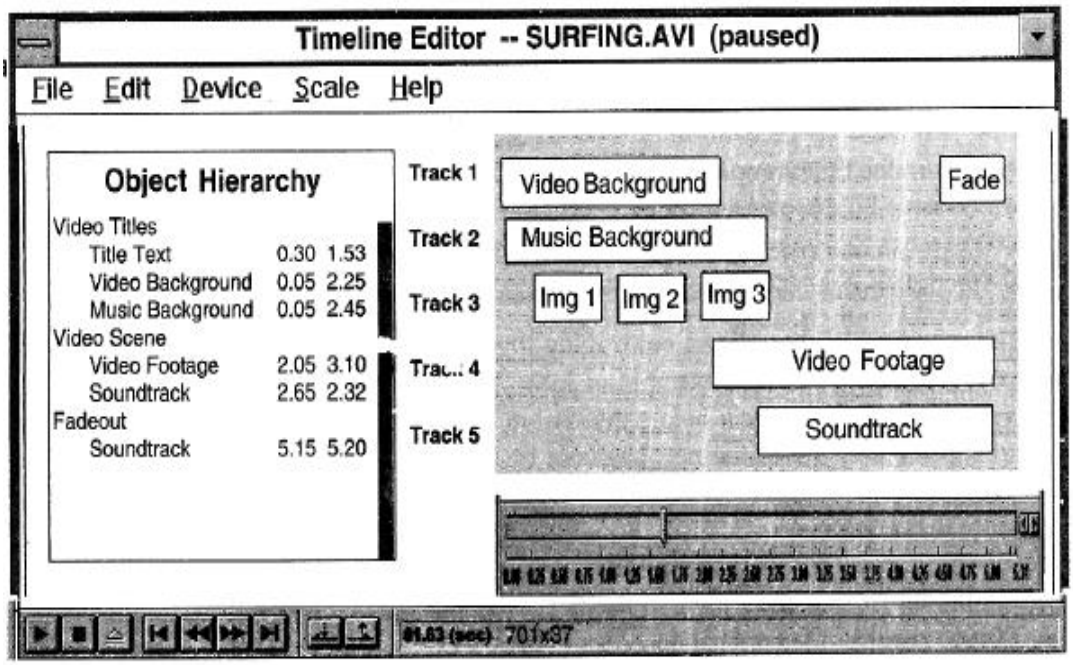
Structured multimedia authoring consists of two stages:

1. Construction of the structure of a presentation and the assignment of detailed timing constraints. The basic timing information is derived from the structure.
2. The timing constraints are derived from the constituent data items.

A successful structured authoring system must provide the following capabilities for navigating through the structure of presentation.

- Ability to view the complete structure
- Maintain a hierarchy of objects

- Capability to zoom down to any specific component
- View specific components in part or from start to finish
- Provide a running status of percentage -full of the designated length of the presentation
- Clearly show the timing relations between the various components
- Ability to address all multimedia types, including text, image, audio, video, and frame based digital images (used for animation)



4. Programmable Authoring system

A programmable system check for gaps or overlaps, and also it check the temporal adjustment parameters of the offending objects and make the necessary adjustments to achieve a good fit. Programmable authoring systems have improved on direct manipulation systems in the following areas:

- Providing powerful functions based on image processing and analysis
- Embedding program interpreters to use image-processing functions

By building user programmability in the authoring tool to not only perform task analysis but also manipulate the stream based on the analysis results. For example, the following functions represent the level of capability that has been achieved:

- Return the timestamp of the next frame
- Delete a specified movie segment
- Copy or cut a specified movie see to the clipboard
- Replace the current segment wit clipboard contents

The programmability allows performing these task through the program interpreter rather than manually. For example silences which occur before start of new segment. The program can be used to help the user get to the next segment by clicking a button rather than playing the video. Similarly the program can be used to locate scene changes and move the location cursor directly to that frame**.**

5. Multisource Multi-User Authoring Systems

The term rendering or rendition, defined in the dictionary as representing a verbal or artistic form, is used in multimedia systems to denote the display of multimedia objects on screen.

We need to address the following classes of objects:

- Transparent objects with no temporal qualities, such as graphics
- opaque objects with no temporal qualities, such as images
- Transparent objects with temporal qualities, such as sound or audio
- Opaque objects with temporal qualities, such as video

Just as there is an object hierarchy in terms of a temporal scale, we can have an object hierarchy in a geographic plane; that is, some objects may be linked to other objects by position, while others may be independent and fixed in position. Once the object is rendered, the author can manipulate it and change its rendering information. Knowing the spatial alignment of objects allows the authoring (or the rendering system in case of display only) to optimize the resolutions by degrading objects largely hidden from view more than the objects that are fully visible.

Objects are favored on this basis on the assumption that the objects which are visible are really the ones the user is concentrating on.

Even though it may appear that sound objects are not visible, in reality sound objects have a temporal quality that is even more stringent than video, and consequently, sound objects are favored over video.

Temporary breaks in voice or music are more disturbing than temporary breaks in video.

A multi-user authoring system must, in addition to the multi-user compositing function, provide resource allocation and scheduling of multimedia objects. This gives rise to a number of synchronization issues.

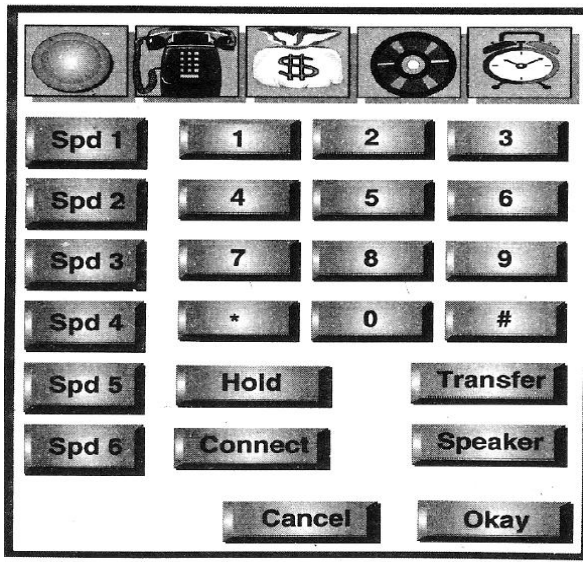
6. <u>Telephone Authoring Systems</u>

Including a speaker and a microphone in a workstation or personal computer allows the workstation or PC to support voice digitization and playback. Microprocessors in the Pentium class are fast enough to support a limited vocabulary for voice commands as well as full text-to-speech synthesis. A phone can be used to provide interactive access to electronic mail, calendars, information databases, public information databases and news reports, electronic newspapers, and a variety of other applications. Integrating all of these applications in a common authoring tool requires careful thought and planning.

Telephone authoring systems support the following distinct kinds of applications, with an increasing level of complexity:

- Workstation controls for phone mail
- Voice command controls for phone mail
- Embedding of phone mail in electronic mail
- Integration of phone mail and voice messages with electronic mail
- Voice synthesis in integrated voice mail and electronic mail
- Local/ remote continuous speech recognition

Figure shows a sample window that emulates typical telephone functions such as using speed dialing options, placing a call on hold, transferring a call, and changing phone answering options. This is a starting point for the authoring system for telephone integration.

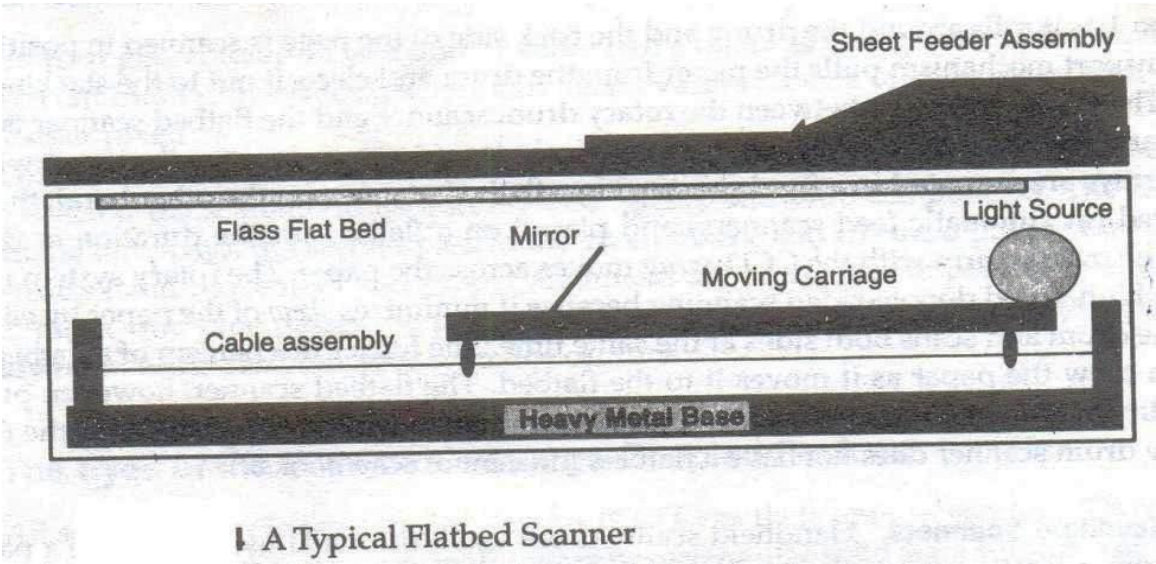


b) Attempt any one of the following:

i. Explain the use of scanner and with the help of diagram explain the working of flat bed scanner.(Use -1M,diagram-1M,working-2M)

Use: Scanner is used to capture an image of a document. It provides input to the computer in the form of scanned image of document.

Diagram:



A Typical Flatbed Scanner

Working:

Flatbed scanners are used to capture letter and legal-size documents. The document being scanned is placed on scanner bed which is of a glass plate. A light source, a fluorescent lamp, is mounted on a traction mechanism which moves from one end of the document to the other end during a scan session. A mirror is used to reflect each illuminated scan line to fixed CCD

array as the light source moves across the document. The CCD array determines the pixel intensity in the selected line for each pixel across the line. This information is sent via an SCSI interface to a workstation.

ii. What are the different technologies used in optical storage media explain any one of them in detail.(listing of technologies -1M and explanation of any one -3M)

Technologies used in optical media are:

1. CD-ROM-Compact Disc Read Only Memory
2. WORM-Write Once Read Many
3. Rewritable-Erasable
4. Multifunction-WORM and Erasable

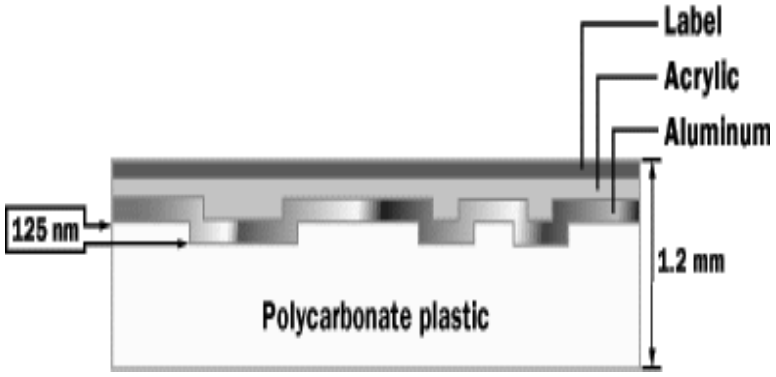
1. CD ROM

Features

- Ease of use & durability of media
- Random access capabilities
- Very high sound fidelity
- High storage volume

Physical construction of a CD ROM

- Polycarbonate disc 120mm in diameter,1.2mm thickness & 1.5mm spindle hole
- Polycarbonate disc contains lands & pits
- Each pit 100nm depth & 500nm in width
- The space between the two adjacent pits is called land
- Pits represent binary zero & transition from land to pit & pit to land is represented by binary one.
- Polycarbonate substance covered by reflective aluminum
- Reflective aluminum is protected by coat of lacquer to prevent oxidation



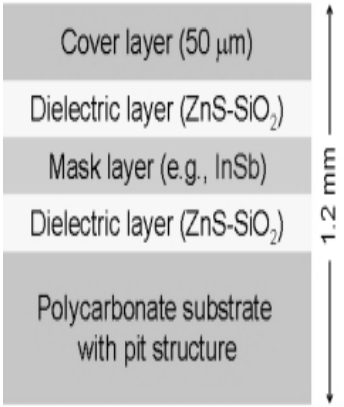
- Consists of a single track which starts from the centre from inside & spirals outside.
- The data is recorded on the tracks as lands & pits
- A single track divided into equal length sectors or blocks
- Each block consists of 2352bytes also called a frame
- 75 frames per second in an audio CD

2. WORM Optical drives(Relevant explanation should be consider)

- Write Once Read Many records data using high power laser beams
- Pits are created. Once written cannot be erased
- Once the disk is full, it becomes ROM
- Used in applications where data once written is not altered or deleted mistakenly
- But, the data can be edited!
- When new data is written, the old data is marked logically deleted

Structure :--

– **Six layers**
- Ploycarbonates substance
- Next three multiple recording layers made up of antimony-selenide
- Bismuth-tellurium
- Again antimony-selenide
- Recording layers covered by aluminum alloy or gold for the reflectivity
- The reflective layer is coated by lacquer to prevent oxidation

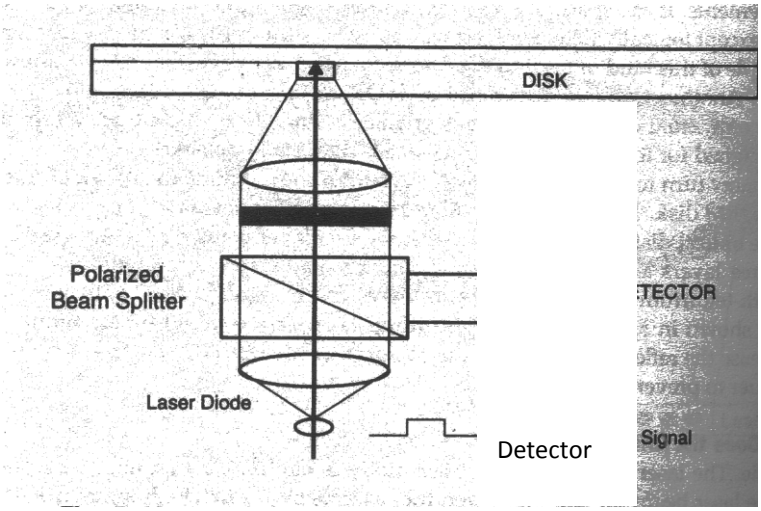


Data Recording

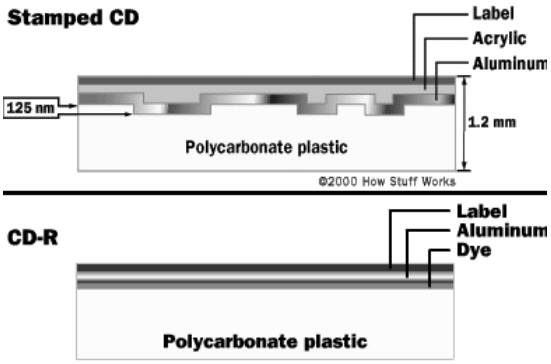
- Input signal is fed to a laser diode
- Laser beam is modulated by the input signal.. Switches it on or off
- When ON, strikes the three recording layers
- Absorbed by bismuth-tellurium & heat is generated
- This is the recorded area

Data Reading

- Weaker laser beam is focused onto the disk
- Laser beam reflected back
- Beam splitter mirror & lens arrangement sends the reflected beam to the photo detector
- Photo sensor converts it into electrical signal



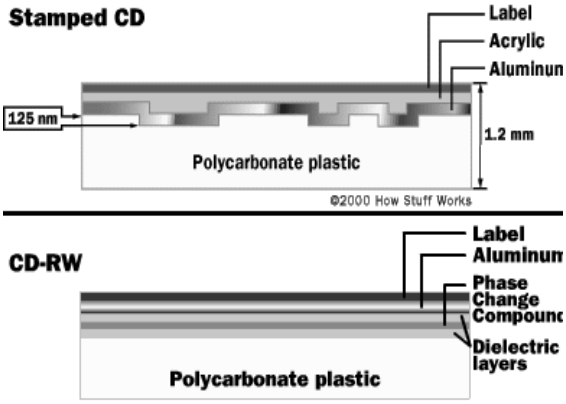
Recordable CD ROM



- Additional layers for recording
- A CD-R doesn't have the same bumps and lands as a conventional CD.
- Instead, the disc has a dye layer underneath a smooth, reflective surface.
- On a blank CD-R disc, the dye layer is completely translucent, so all light reflects.
- The write laser darkens the spots where the bumps would be in a conventional CD, forming non-reflecting areas.

Rewritable Phase change CD ROM

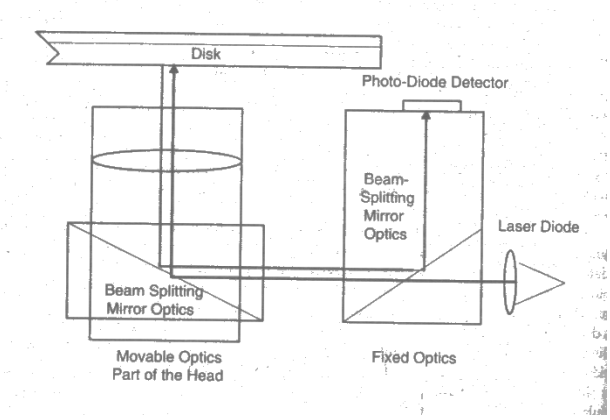
- In a CD-RW disc, the reflecting lands and non-reflecting bumps of a conventional CD are represented by phase shifts in a special compound.
- When the compound is in a crystalline state, it is translucent, so light can shine through to the metal layer above and reflect back to the laser assembly.
- When the compound is melted into an amorphous state, it becomes opaque, making the area non-reflective.



Magneto Optical Technology

- Combination of magnetic & laser technology
- Magnetically recordable & uses a weak magnetic field to record data under high temperatures.. Possible using laser beam
- Laser beam when switched on, heats the spot on magneto optical disk to 150 degree Celsius.
- This rise in temp. makes the spot extra sensitive to the magnetic field
- Magnetic polarity of the spot is changed during this time
- Then the laser beam is switched off so that spot quickly cools down with the new magnetic polarity. Under normal temperatures, weak mag. Fields has no effect on the spot.
- Two passes to write the data

a) Erase cycle - changes the polarity to zero. This happens because of the modulated signal to bias field
b) Write cycle – changes to 0 or 1 depending On the data.. This is because of the modulated signal to the laser beam to change the polarity of the spot.



Minidisk (MD)

- Generally known as MD-data
- Developed by Sony Corporation (for business & entertainment
- Carries music, video & data
- inch form factor (smaller than 3.5 diskettes
- Can be used in three formats..

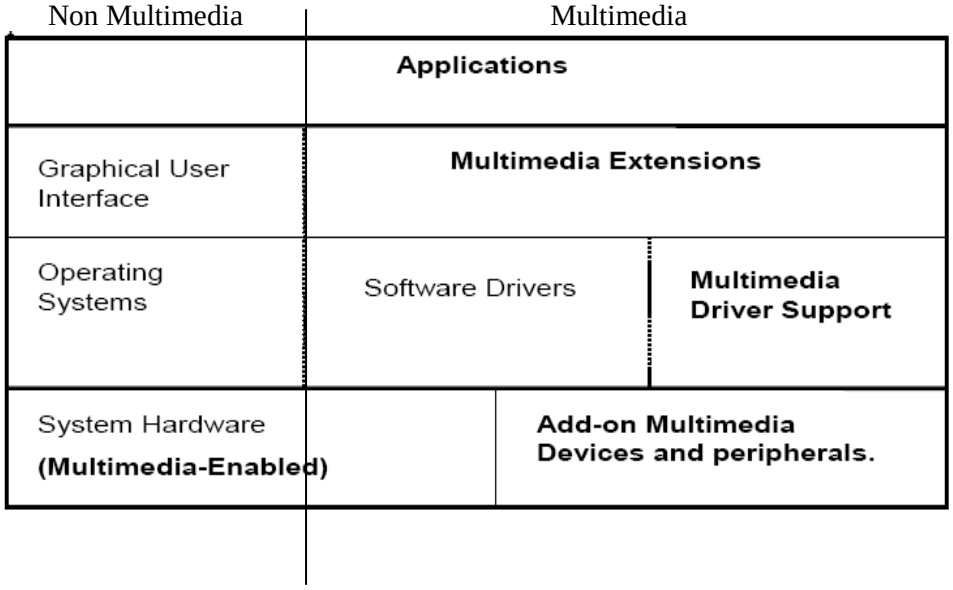
a) A pre-mastered optical disk
b) A recordable magneto-optical disk

c) A hybrid .. Partially mastered & partially recordable
d) Provides benefits of floppy disks low cost & magneto-optical disk's large capacity
- Extensive use of MDs in multimedia applications
- Stores 140 Mbytes of data
- Transfer speed 1.2Mbits/sec
- One MD data disk can contain 2000 frames of NTSC studio quality pictures
- MD data uses its own file management scheme.

Multifunctional Drives
It include three types of technologies
- Magneto-Optical Disc for both rewritable and WORM capability
- Magneto-Optical disc for rewritable and dye polymer disk for WORM capability
- Phase change technology for both rewritable and WORM capability.

Q.2. Attempt any Four of the following:

a) Explain the architecture of multimedia system with neat diagram.(Architecture diagram 2 marks and relevant explanation 2 marks)
Architecture of the multimedia System.



Explanation
- In this architecture, the left side is very similar to non-multimedia systems and right side shows the new architectural entities required for supporting multimedia applications.
- The add-on multimedia devices and peripherals include scanners, video cameras; VCR's and sound equipment along with their associated devices controllers and encoding hardware such as DVI-JPEG or MPEG enabled boards.
- For each of these special devices, a software device driver is needed to provide the interface for an application to the device.
- The graphical user interface, designed primarily for windows managed by applications at fixed resolution require control extensions to support applications such as full motion video or remote Desktop

- Multimedia operation places tremendous demands on the system hardware, in terms of both computing performance and storage.
- High resolution display technologies allow multiple applications to be operational at one time thereby requiring additional resources to manage program and data requirements.

b) Differentiate between lossy and lossless compression techniques. Give example for each.(any four relevant points including example-each point 1 M)

Lossless compression	Lossy Compression
1. Data is not altered or lost in the process of compression or decompression.	1. Data is altered or lost in the process of compression or decompression.
2. Decompression generates an exact replica of the original object	2. Decompression generates original object with invisible data loss that is loss of data does not directly affect the visibility of an object. Human eye can not notice the data loss.
3. Lossless standards: • Packbits encoding(Run length encoding) • CCITT Group 3 1D • CCITT Group 3 2D • CCITT Group 4	3.Lossy standard: • Joint Photographic Expert Group(JPEG) • Moving Picture Experts Group(MPEG) • Intel DVI • CCITT H.261 Video Coding Algorithm
4. Example: Text data compression and repetitive data compression in images like binary images, gray scale images.	4.Example: Audio, gray-scale or colour images and video objects compression

c) Describe tightly controlled and bounding related to QOS architecture.(each term explanation 2 M)

a. **Tightly controlled**-The traffic patterns of a stream are preserved at each switching point in the network. This simplifies computation of performance bounds for admission tests, but a queuing discipline can be complex to implement and the network can be significantly utilized.

b. **Bounding**- A bound (statistical or fixed) is specified for traffic on the edge of the network. Bounds are recomputed for each session along the route of the session. Issues in the use of this approach include the tightness of the resulting bounds and the extent to which traffic can be modeled by the statistical bounds.

d) What are different types of multimedia object server?(Any four servers with relevant explanation:1 mark each)

1. **Data processing server**: These are traditional database (RDBMS ODBMS) servers that contain alphanumeric data. In relational database, data fields are stored in columns in a table. In object oriented database, these fields are attributes of the object. The database serves the purpose of organizing the data and providing rapid indexed access to it.
2. **Document database servers:** These are used for electronic mail databases as well as for document based information repositories. These contain a special text fields that may be indexed within them using a hypertext engine. In addition, text fields in document databases that support hypermedia documents may have embedded or linked binary files, images, audio and video objects.
3. **Document imaging and still-video servers:** These servers store and manage image and still-video objects. These objects may be several hundreds of kilobytes in a size and in the form of basic operating system-level files or server. A file or an object may contain a one page image object or a complete document consisting of multiple pages. The server software may be setup with special caching mechanism to speed up access to images.
4. **Audio and voice mail servers:** These are used primarily for applications such as voice mail, voice annotations and voice help messages. Audio objects are large even in compresses form. Audio servers may serve two different types of applications: traditional telephone-based voice mail and voice mail messages linked with the document-based messaging system.
5. **Full-motion video servers:** These are designed to manage very large objects. Besides providing the usual indexing functions, video servers are made intelligent to support the isochronous playback requirements for video objects by reserving network bandwidth.

e) Explain JPEG-DCT encoding quantization.

JPEG DCT encoding and Quantization Process

DCT (discrete Cosine Transform) is a mathematical operation closely related to Fourier Transform. In the time domain, the signal requires lots of data points to represent the time in x-axis and the amplitude in y axis. Once the signal is converted to a frequency domain using Fourier transform, only few data points are required to represent the same signal. This technique can be applied to a color image. A color image is composed of pixels, these pixels have RGB color values, each with its x and y coordinates using 8 X 8 or 16 x 16 matrix for each primary color.

JPEG treats each color component separately. The R component is composed first, G component next and lastly B component.
In a 8 X 8 matrix of 64 values, each with x & y coordinates has a 3 dimensional representation of pixels called a spatial representation or frequency domain by DCT conversion.

The output matrix represents the frequency domain DCT components. Row 0 and column 0 has the DCT coefficient much larger than other 63 coefficients and is called DC coefficient;

because it represents an average of the overall value of the 8 X 8 input matrix. The other 63 coefficients are called AC coefficients and gets smaller and smaller in value as the distance from the dc coefficients increases. Thus DCT transforms the 8 X 8 block image to concentrate the frequency domain values in the upper left of the matrix.

DC	**AC**	**AC**	..				
AC	**AC**	**AC**	..				
AC	**AC**	**AC**	..				
:	:	:	..				
:	:	:	..				

Quantization:

This is a process of reducing the precision of an integer, thereby reducing the number of bits required to store the integer. The DCT output matrix is quantized to reduce the precision of the coefficient thereby increasing the compression. While reducing the precision, the AC coefficients are moved further away from DC coefficient.

The JPEG baseline algorithm supports four color quantization tables and two Huffman tables for both DC and AC coefficients. The tables are coded after determining the sensitivity of the human eye towards the various spatial frequencies. A typical quantized transform has a large number of zero valued components, particularly at higher frequencies. The quantized coefficient is described by the following equation,

$$QuantizedCoefficient(i,j) = \frac{DCT(i,j)}{Quantum(i,j)}$$

The quantized coefficient is the result of dividing a DCT output matrix by a quantum matrix to generate quantized DCT values. The quantum matrix contains quantum values which are also called step sizes. A JPEG quantum matrix has large values in the lower half of the quantum matrix which in turn results in zero valued quantized coefficients in the lower half of the quantized matrix.

f) Explain object display issues.(Each issue 1 mark with relevant explanation)

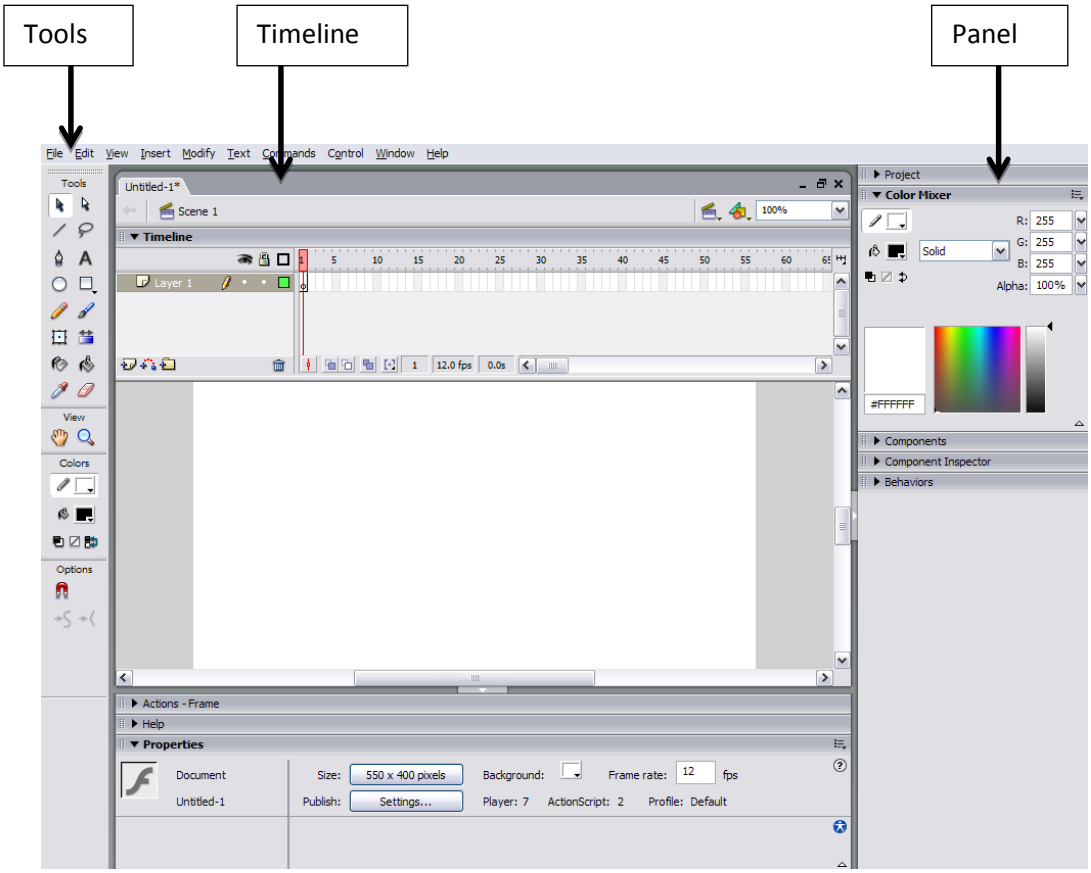
There are four Object display issues:

1. **Scaling**: the image object is scaled to fit in a user defined window at the full pixel rate for the window. For example, if the image is scanned at 3600 X 4400 pixels and the full resolution for the window is only 600 X 440, the image is being scaled by a factor of 6 X 10 i.e. 60 times.
2. **Zooming**: It allows the user to see more detail for a specific area of an image object. For example, zooming will show the picture in enlarge form where one can check a signature with more details.
3. **Rubber Banding**: With this user can use a mouse to define two corners of a rectangle. The selected area can be copied to the clipboard, cut, moved or zoomed.

4. **Panning**: It is used for finding detail that is not visible in the full image. If the image window is unable to display the full image at the selected resolution for display then the image can be panned left to right or right to left as well as top to bottom or bottom to top.

Q.3. Attempt any Four of the following:

a) Describe the timeline, toolbox, panels of the flash environment.(Diagram- 4 marks)



b) Why network jamming occur in network architecture for multimedia system? (4 points – 4 marks, Any other relevant answer should be given complete marks)

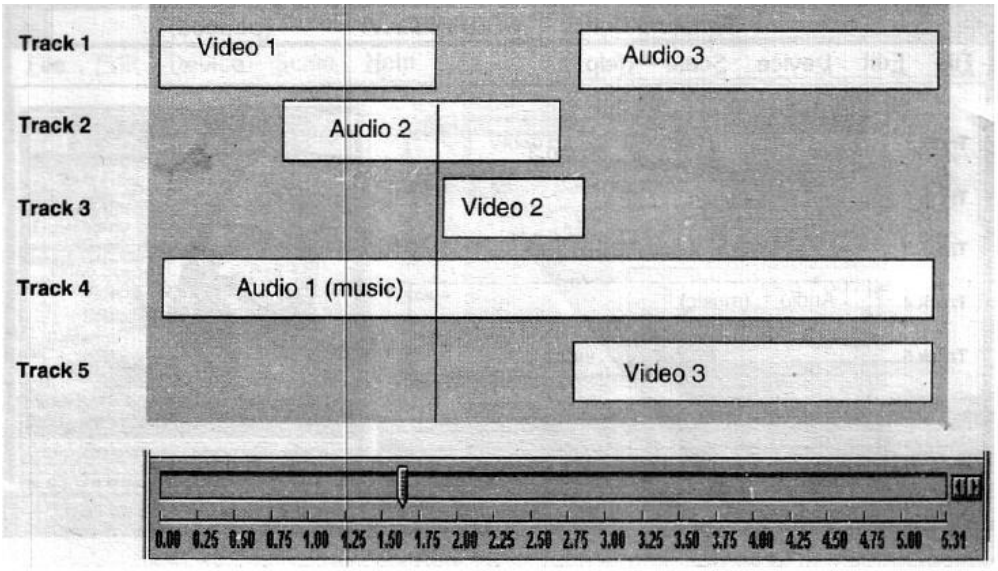
Network jamming in the network architecture for multimedia system occurs due to.

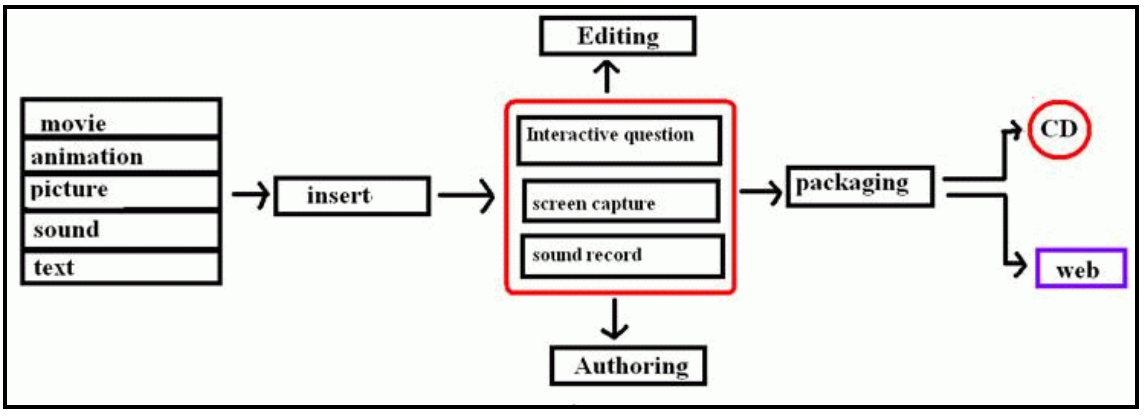
1. Delay in transmission.
2. Traffic
3. More users logged into the server than the required.
4. Low bandwidth.

c) Describe timeline based multimedia authoring system with neat diagram. (Explanation 3 Marks, Any relevant diagram 1 Marks)

1. In a Timeline Based authoring system, objects are placed along a timeline.

2. The timeline can be drawn on the screen in a window in a graphic manner, or it is created using a script in a manner similar to a project plan. But the user must specify resource object and position it in the timeline.
3. On playback the object starts playing at that point in the time scale. In most timeline based approaches, once the multimedia object has been captured in a timeline, it is fixed in location and cannot be manipulated easily.
4. A single timeline causes loss of information about the relative time lines for each individual object.
5. Editing a component causes all objects in the time line to be reassigned because the positions of objects are fixed in time, only in sequence.
6. Copying portions of timeline becomes difficult because it is difficult to predict the start of new section. This limitation of using timeline approach can be overcome by defining time relations directly between objects.





d) Describe simple video compression technique.(4 points – 4 marks)

1. The simple video compression technique is truncating – reducing data through arbitrary lowering of the bits per pixel.
2. This is done by throwing away some of the least significant bits for every pixel.
3. Truncating will begin contouring.

4. Truncating is attractive because its processing is extremely simple.

Simple video compression technique.
(truncation – 1M , CLUT 1-Mark , RLE – 1Mark , RLE-example 1-Mark)
In **simple** compression technique, 1.Truncation 2.CLUT 3.Run length methods are used.

Truncation: In truncation – data is reduced data by lowering of the bits per pixel. This is done by removing away some of the least significant bits for every pixel. If truncation removes major information pixel then contouring occurs, and our image will start looking like a cartoon. However, many images can stand this up to a point; so, for example, we can usually truncate to 16 bpp with good results on real images. 16 bpp is usually done by assigning bits to color components such as R:G:B 5:5:5 or Y:V:U 6:5:5. Instead of using 8:8:8 bpp. In the R:G:B 5:5:5 case, the. 16th bit could be used as a flag for some other purpose, such as a keying signal.

CLUT: Color **L**ook**u**p **T**able A **colour look-up table** (CLUT) is a mechanism used to transform a range of input colours into another range of colours. It can be a hardware device built into an imaging system or a software function built into an image processing application. The hardware colour look-up table will convert the logical colour (pseudo-colour) numbers stored in each pixel of video memory into physical colours, normally represented as RGB triplets, that can be displayed on a computer monitor. The palette is simply a block of fast RAM which is addressed by the logical colour and whose output is split into the red, green, and blue levels which drive the actual display (e.g., a CRT or *cathode ray tube*). This technique creates a different kind of artifact, is the color lookup table (CLUT) approach. With a CLUT, the pixel values in the bitmap represent an index into a table of colors, but the table of colors will have much greater bpp than the pixel values. It is usually done with pixels having no more than 8 bpp, which means that the entire picture must be reproduced with 256 or fewer colors at a time. The colors in the CLUT are chosen from a palette represented by the color depth in the lookup table. In this technique each image must be processed ahead of time to choose the 256 best colors for that Image (a unique CLUT must be created for. each image), and that is a nontrivial amount of preprocessing. Going higher than 8bpp with CLUT (more colors) will of course give better results.

A CLUT is characterized by:

1. The *number of entries* in the palette: determines the maximum number of colours which can appear on screen simultaneously (a subset of the wider *full palette*, which is to be understood as the total number of colours that a given system is able to generate or manage, e.g. *the full RGB colour palette*).
2. The *width of each entry* in the palette: determines the number of colours which the wider *full palette* can represent.

A common example would be a palette of 256 colours; that is, the number of entries is 256, and thus each entry is addressed by an 8-bit pixel value. The 8 bits is known as *colour depth*, *bit depth* or *bits per pixel* (*bpp*). Each colour can be chosen from a *full palette*, typically with a total of 16.7 million colours; that is, the width of each entry is 24 bits, 8 bits per channel, which means combinations of 256 levels for each of the red, green, and blue components: 256 × 256 × 256 = 16,777,216 colours.

Run Length Encoding – RLE

In this technique, blocks of repeated pixels are replaced with a single value and a count of how many times to repeat that value. It works well on images which have areas

of solid colors—for example, computer-generated images, cartoons, or CLUT images. Depending entirely on the kind of image, RL coding can achieve large amount of compression, but effectiveness is limited to image that contain large amount of repeated values.

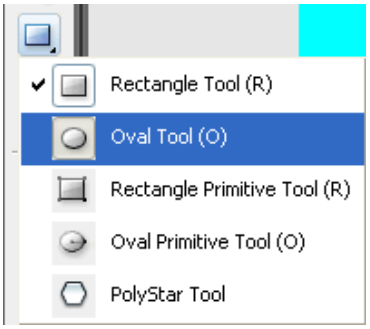
Run-length encoding (**RLE**) is a very simple form of data compression in which *runs* of data (that is, sequences in which the same data value occurs in many consecutive data elements) are stored as a single data value and count, rather than as the original run. This is most useful on data that contains many such runs: for example, relatively simple graphic images such as icons, line drawings, and animations. It is not useful with files that don't have many runs as it could potentially double the file size. For example, consider a screen containing plain black text on a solid white background. There will be many long runs of white pixels in the blank space, and many short runs of black pixels within the text. Let us take a hypothetical single scan line, with B representing a black pixel and W representing white:

WWWWWWWWWWWWBWWWWWWWWWWWWBBBWWWWWWWWWWW
WWWW WWWWWWWWWBWWWWWWWWWWWWW

If we apply the run-length encoding (RLE) data compression algorithm to the above hypothetical scan line, we get the following: 12W1B12W3B24W1B14W Interpret this as twelve W's, one B, twelve W's, three B's, etc. The run-length code represents the original 67 characters in only 18. Of course, the actual format used for the storage of images is generally binary rather than ASCII characters like this, but the principle remains the same. Even binary data files can be compressed with this method; file format specifications often dictate repeated bytes in files as padding space. However, newer compression methods such as DEFLATE often use LZ77-based algorithms, a generalization of run-length encoding that can take advantage of runs of strings of characters (such as BWWBWWBWWBWW).

e) Write the steps to create perfect circle using an oval tool in flash environment.

1. Choose the oval drawing tool.
2. To select the oval drawing tool you will need to click the tiny arrow at the bottom of the rectangle tool for a little while.
3. Different shape options will open up.
4. Select the “oval tool” option.



5. Select the oval (double click so both the stroke and the fill areas are selected) and convert to a graphic symbol named “ circle”. You can also get the “convert to symbol” option when you right click after selecting the shape.

Q.4.

a) Attempt any three of the following:

i. Explain in detail the design issues for multimedia authoring system.(2 Marks Each)

The issues in Design issues for multimedia Authoring

Enterprise wise 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 algorithm
4. Network interfaces
5. Storage formats

1. Display Resolution:

- Many multimedia systems have been designed for the Microsoft windows or apple's Macintosh environments.
- Multimedia objects are displayed in a window rather than using the full screen.
- The user perception of a picture in a window is very complex.
- The human eye perceives resolution on a per-inch basis; i.e. a picture window 640 pixels wide & 480 pixels high looks different with size.
- People usually watch a television picture from 10 to 15 feet away.
- A workstation monitor, on the other hand, is usually no more than 12 to 18 inches away.
- Rather than restricting all users to specific display resolutions, it is usually better the standardize interfaces at various acceptable resolutions & for different applications.
- A number of design issues considered for handling different display outputs, including:

1. Corporate norms for service degradations.
2. Level of standardization on display resolutions.
3. Display protocol standardization.
4. Corporate norms for network traffic degradations as they relate to resolution issues.

File format and data compression issues

- An important design issue here is to standardize on one or two compression formats for each type of data object.
- An important consideration is finding compression boards and capture hardware that support these standards.
- Software must also support these standards.
- The processing power of main CPU in most desktop PCs is sufficient to perform decompression in software.
- In almost all cases the objects are compressed in some form.
- In other words, it is useful to have attribute information about an object available without having to decompress the object itself.
- Such attribute information should include depending on object type:

1. Size of object & Object orientation

2. Annotation markers & history
3. Estimated time to decompress and display the objects
4. Compression type
5. Source filename
6. Date & time of creation
7. Index markers & Version numbers

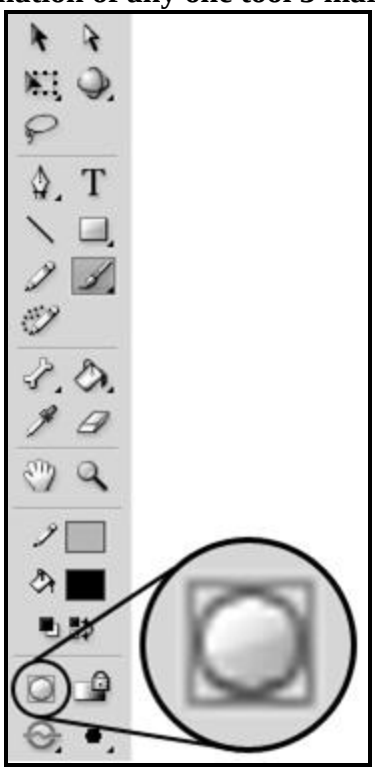
Service Degradation policies

- Another important design issue that must be resolved at the same time that display protocols and resolutions and file & data compression formats are endorsed is that of corporate norms for service degradations.
- Some multimedia objects created at high resolutions may not be very useful when viewed at lower resolutions.
- This design issue addresses how the system deals with overload on the networks due to peak demands on multimedia object retrieval.

Network Interfaces:

- Standardizing protocols in WANs is essential to ensure that multimedia objects can be transferred from one LAN via a WAN to another LAN without loss of information.
- An important area for standardization is the interconnection between LANs, and between LAN & WAN. In other words, all hubs, routers, switches and so on must be standardized.

ii. List the different object drawing tools in flash and explain any one in detail. (List 1 mark, Explanation of any one tool 3 marks)



The various tools in flash are:

1. Select tool : used to make the selection of the object
2. Brush tool: used to draw any object.
3. Pen tool: used to write text and draw using pen tool

4. Eraser tool: undo the created object
5. Fill tool: fill the selected colour in an object drawn.
6. Zoom tool: zooms the objects drawn.

Explain anyone...

iii. Explain RIFF file format in brief.(Explanation 3 marks, Syntax- 1Marks)

1. The first chunk is the root entry and must have a ID of 'RIFF' or 'RIFX', the prior being the most common version. 'RIFX' specifies 'Motorola' byte order (most significant byte first), whereas 'RIFF' specifies 'Intel' byte ordering (least significant byte first).
2. This document will stick to 'RIFF'. That first chunk contains all other chunks of the file in its Data. Its Size field will therefore always contain a value of filesize - 8.
3. The structure of Data is dependent on its ID. There are two directory- IDs, 'RIFF' and 'LIST'.
4. They contain a 4-byte ASCII header, leaving the following structure:

Name	Size	Description
ID	4 byte	four ASCII character identifier
Size	4 byte	size of Data
Data	Size bytes	the 'payload'
HeaderID	4 bytes	'Name' of the list
Data Size	4 bytes	List of chunks

5. There will never be a final extra byte, since the Size will always be even. The HeaderID in the RIFF chunk usually matches the file's extension.

iv. How the direct and index access to the information can be made in multimedia authoring and user interface?(Any related answer – 4 marks)

Direct:

1. Direct information access requires that the user have knowledge of the specific object that need to be accessed.
2. This may be information that the user has, or it may be information included in the object representation in a compound object.
3. For ex: the representation of a sub object for a video in a hypermedia document may include the object ID for the video.
4. This allows the playback server application to directly access the video object; the user does not have to search for it.

Indexed:

1. If the object ID of the object is an index entry that resolves to a filename on a specific server and disk partition, then the information access mechanism is an indexed mechanism.
2. Indexed access is beneficial in that it abstracts the real object from the access to the object.

b) Attempt any one of the following:

i. Explain in detail the client server operation for distributed multimedia system. (3marks each)

DISTRIBUTED CLIENT SERVER OPERATION:

1. **Clients in distributed work group computing** :

a. Request specific textual data
b. Request specific multimedia objects embedded or linked in retrieved container objects.
c. Require activation of rendering server application
d. Create and store multimedia object store on servers
e. Request directory information on location of object on servers.

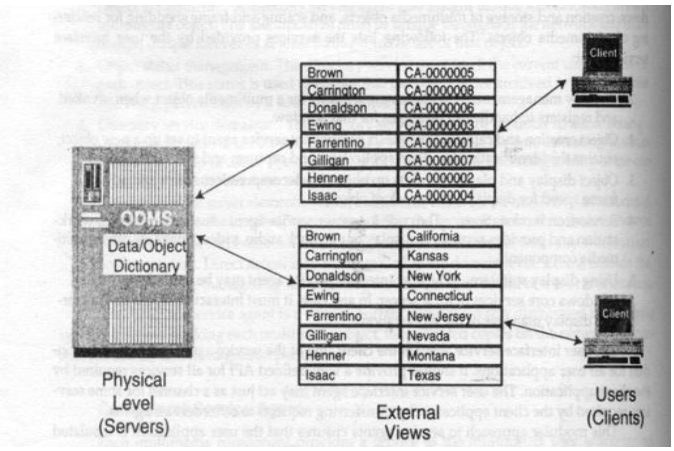
2. Server in distributed work group computing :

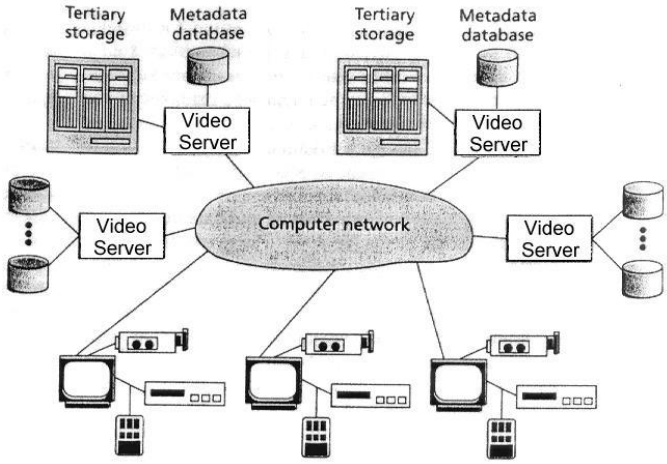
a. Provide storage for a variety of object classes.
b. Transfer objects on demand to clients
c. Provide hierarchical storage for moving unused objects to near line or offline media.

Generally client-server architecture are used for some time for relational databases such as Sybase and Oracle, multimedia applications require functionality beyond the traditional client-server architecture.

Most client-server systems were designed to connect a client across a network to a server that provided database functions.

Figure describes the client and server custom views in a large distributed database.





In multimedia databases, we have a combination of real-world data objects as well as projections in images, sound, and video. While raw data such as numbers or text fields are meaningful to the database, multimedia objects are not. The database must assign some form of identification and an understanding of the data. Furthermore, on retrieval these objects may need special processing before being rendered on user screens.

Role & characteristics of clients:-

1. Request specific Textual data
2. Request specific Multimedia object

3. Require activation of a rendering server application
4. Create & store multimedia objects on servers
5. Request directory information

Role & characteristics of servers:-

1. Provide storage for a variety of object classes
2. Transfer objects on demand to clients
3. Provide hierarchical storage
4. System administration functions
5. Transport system for high speed LAN & WAN server-server

ii. Explain the components of distributed multimedia system.(List – 1 mark, Explain all 5 1 mark each)

The components of multimedia systems are

1. **Capture devices**
   Video Camera, Video Recorder, Audio Microphone, Keyboards, mice, graphics tablets, 3D input devices, tactile sensors, VR devices. Digitising/Sampling Hardware
2. **Storage Devices**
   Hard disks, CD-ROMs, Jaz/Zip drives, DVD, *etc*
3. **Communication Networks**
   Ethernet, Token Ring, FDDI, ATM, Intranets, Internets.
4. **Computer Systems**
   Multimedia Desktop machines, Workstations, MPEG/VIDEO/DSP Hardware
5. **Display Devices**
   CD-quality speakers, HDTV,SVGA, Hi-Res monitors, Colour printers *etc.*

Q.5. Attempt any four of the following:

a) Explain role of middleware in distributed multimedia system. (4 Marks)

The primary role of middleware is to link back-end database server to front-end clients in a highly flexible and loosely connected network model. Middleware provides the glue for dynamically redirecting client requests to appropriate servers that are on-line, thereby also providing a potential load-balancing function under demanding conditions. Middleware is the primary catalyst for creating a distributed network of servers and clients.

Middleware performs a number of functions in this environment.

1. Provide the user with a local index, an object directory, for objects with which a client is concerned
2. Provide automatic object directory services for locating available copies of objects
3. Provide protocol and data format conversions between the client requests and the stored formats in the server.
4. Provide unique identification throughout the enterprise-wide network for every object through time.

b) What are I, P and B picture related to MPEG coding? (4 marks)

Moving pictures consist of sequences of video pictures or frames that are played back a fixed number of frames per second. Furthermore, to achieve the requirement of random

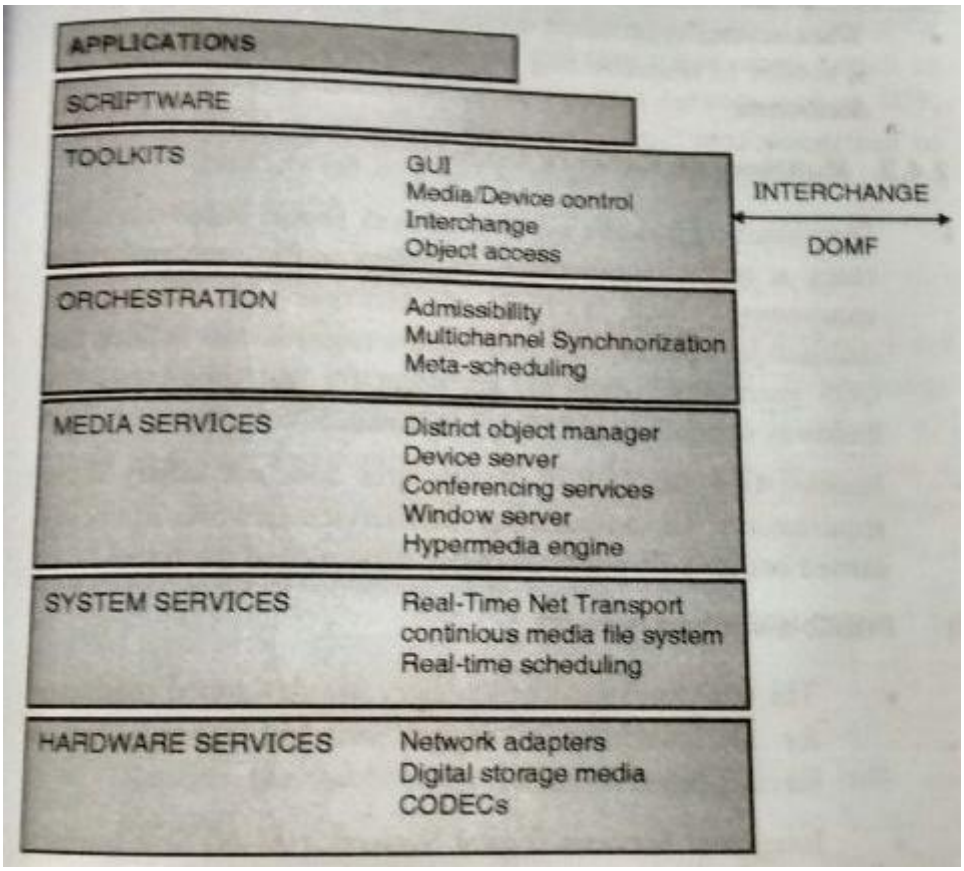
access, a set of pictures can be defined to form a group of pictures (GOP) consisting of one or more of the following three types of pictures:

- Intrapictures (I)
- Unidirectionally predicted pictures (P)
- Bidirectionally predicted pictures (B)

A GOP consists of consecutive pictures that begin with an intrapicture. The intrapicture is coded without any reference to any other picture in the group. Intrapictures can be placed anywhere in the sequence and can be utilized for random access to the sequence. Intrapictures can achieve only a moderate level of compression. Predicted pictures are coded with a reference to a past picture, either an intrapicture or a unidirectionally predicted picture. Bidirectionally predicted pictures are never used as references. In other words, an intrapicture or past unidirectionally predicted picture is utilized to code the current unidirectionally predicted picture by using motion compensation. An intrapicture or a Unidirectionally predicted picture can be the immediately previous picture, or it can be one of several pictures in the past (i.e. one of the previous pictures). When picture is coded with respect to a reference, motion compensation is used to improve compression.

c) Explain multimedia distributed processing model.

(2 marks diagram, 2 marks explanation)



The fig shows the layered view of multimedia distributed processing model. Each layer provides service to the above layer. Significant addition to the facilities of traditional computing environments includes:

- **Scripting language:** special purpose programming languages for controlling interactive multimedia documents, presentation and applications.
- **Media device control:** a combination of toolkit functions, programming abstraction and services which provide application programs access to multimedia peripheral equipments.
- **Interchange:** Multimedia data formats and services for interchange of multimedia content.
- **Conferencing services:** facilities for managing multiparty communication using high level call model abstractions.
- **Hypermedia Engine:** a hypermedia object server that stores multimedia documents for editing and retrieval.
- **Real time scheduler:** Operating system process or thread scheduling to meet the read time deadline

d) Explain TIFF structure with diagram

(2 marks diagram, 2 marks explanation)

A TIFF file consists of a header containing the following fields: byte-ordering flag (Intel or Motorola), TIFF file format version number, and a pointer to a table called an .image file directory.
The image file directory contains a table of entries of the various tags in the file and their associated information.

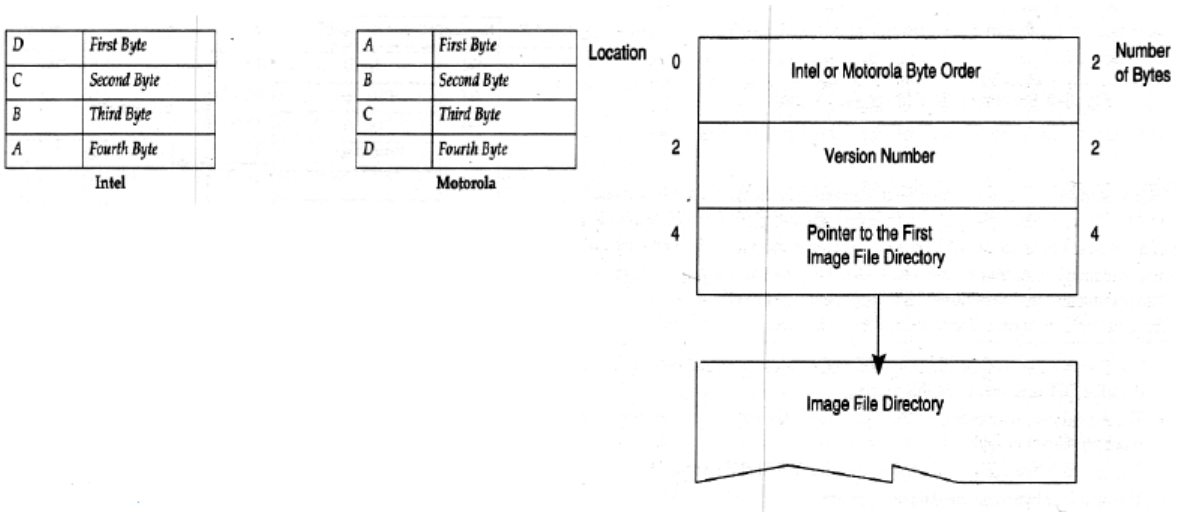


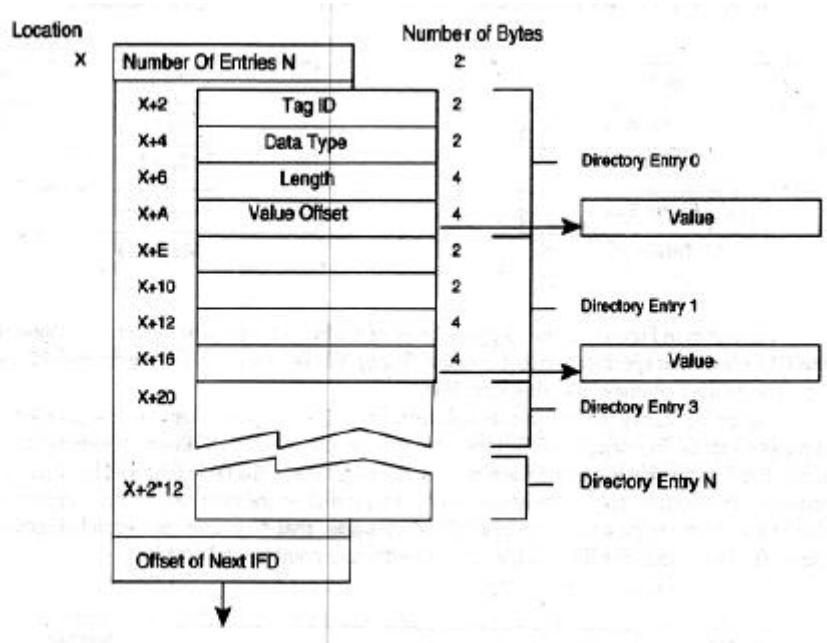
Figure shows the header structure of the TIFF file format. As shown in the figure,
Header - the header contains 8 bytes. The first two bytes represent the byte order for the file format, Intel or Motorola. This allows both IBM P'Cs (based on Intel 8086 architecture) and Apple Macintosh computers to read the file. For Intel this two byte order are hex 0x49 0x49, representing ASCII characters "II". For Motorola this two bytes order are hex Ox4D 6x4D, representing ASCII characters "MM".

Version - The next two bytes of the header represent the version number of the TIFF file format specification (e.g., version 5 or 6).
Image File Directory- The last four bytes of the header contain a pointer to the first image file directory (IFD).

Example of TIFF Header

Header	Description	Value
0x0000	Byte order(Intel)	0x4949
0x0002	Version (TIFF 5)	0x002A
0x0004	1st IFD Pointer	0x0014

If there is only one IFD, the pointer field is all zeroes. Multiple IFDs allow multiple image pages of a document to be contained in one file. Many manufacturers use TIFF files containing one image only that is, only one IFD.



The byte contents of each directory entry are as follows:

1. The first two bytes of the directory entry contain the tag number—tag ID
2. The second two bytes represent the type of data The byte values for supported data types BYTE, ASCII, SHORT,LONG, RATIONAL)
3. The next four bytes contain the length (or count) for that data type.
4. The final four bytes contain data or a pointer.
5. Bytes 5 through 8 (four bytes) contain the length or count for the data type specified in bytes For Example - if bytes 3 and 4 specify a value of 3 for a SHORT data type, each value in the data is two byte since short is of two bytes.
6. The last four bytes of the IFD entry contain either the data or a pointer. If the data is equal to or less than four 1 the value field contains the actual data. If the data is more

than four bytes, then the value field contains a pointer to the data as an offset in the TIFF file. The pointer allows data to be placed anywhere in the file.

e) What is object linking and embedding? State the difference between them.
(Object linking 1 Mark, Embedding 1 mark, each difference1 marks (any 2)

A linked object contains only the data needed to represent the object (its presentation data) and a pointer to an actual file that contains the original data plus information needed to edit the object.(its native data).

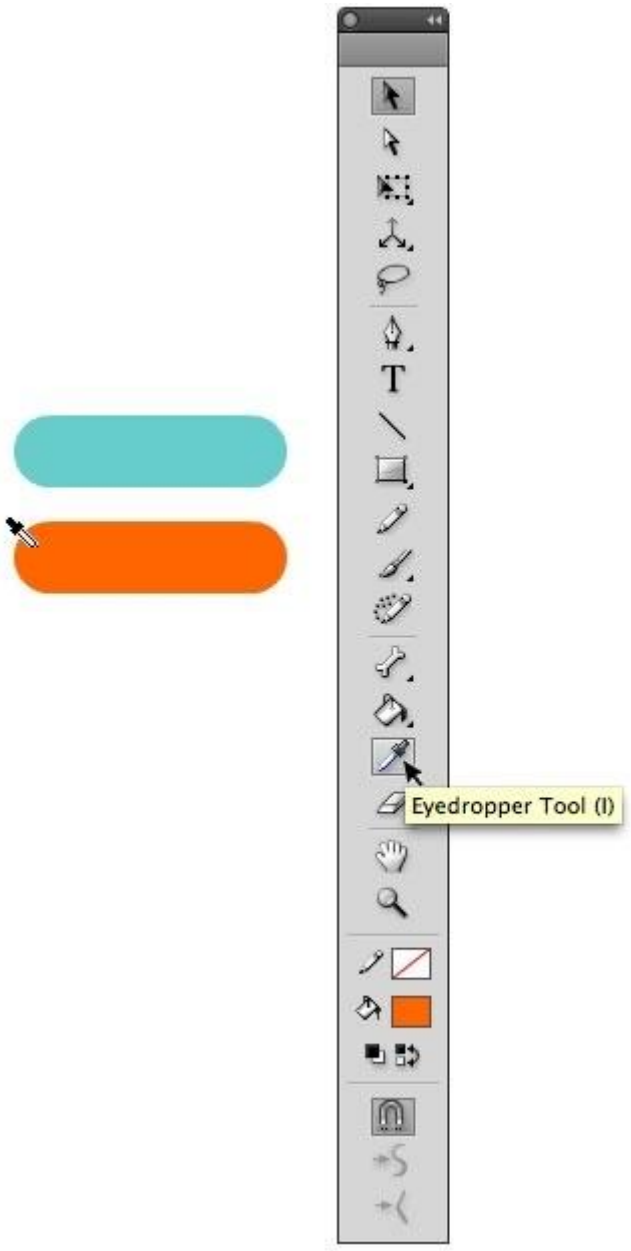
An embedded object, on the other hand, includes both presentation and native data. i.e. an embedded object has the object itself along with the information needed to edit the object. Embedding makes a document large, but it allows the document to be transferred to another workstation (with an embedded copy of the object)and edited. The original copy of the object is not affected when an embedded copy is edited. Embedded video objects cause the database to become very large, slowing data retrieval for all components of the hypermedia document.

Difference:

1. In object linking original copy of the object is affected whereas in embedding original copy of the object is not affected when embedded copy is edited.
2. Embedding an object increases the memory space required by the document in which object is embedded whereas in linking a link is included rather than the object.

f) Describe eye dropper tool in flash with example. (2 marks explanation, 2 marks example)

Use the Eyedropper tool in Adobe Flash Professional to copy fill and stroke attributes from one object and immediately apply them to another object. The Eyedropper tool also allows you to sample the image in a bitmap to use as a fill (or as a stroke using Flash Professional 8 or later).



To use the Eyedropper tool to apply the attributes of a stroke or filled area to another stroke or filled area, follow these steps:

1. Select the Eyedropper tool and click the stroke or filled area whose attributes you want to apply.
2. When you click a stroke, the tool automatically changes to the Ink Bottle tool. When you click a filled area, the tool automatically changes to the Paint Bucket tool with the Lock Fill modifier turned on.
3. Click another stroke or filled area to apply the new attributes.

Q. 6 Attempt any FOUR of the following

a) What is scene change frame detection? (4 Marks explanation)

Scene Change Frame Detection

- Video is temporal media.
- The scene we see changes every few seconds or minutes & replaced by a new image.
- Even within same scene, there is likely to be constant motion for some objects in a scene.
- Depending on the video, we can think of any animate or inanimate object as the subject of camera.
- A boat, a plane, a painting, and a dog are all examples of objects that can be the subjects of a camera.
- If the object itself does not move, the camera provides motion by panning or zooming.
- Within scene, the change from one frame to another is very small.

Requirement:

- Automatic scene change detection is very useful for browsing through very large video clips to find the exact frame sequence of interest.
- Spontaneous scene change detection provides an automatic indexing mechanism that can be very useful in browsing.
- Scene change detection is useful in viewing news reports as it is viewing design discussions or video tutorials.
- The different techniques used in it are histogram generation & for MPEG & JPEG encoded video uses DCT coefficients, DCT quantization.

b) What are issues while organizing distributed multimedia databases? (Detail issues 4 marks)

Multimedia databases consist of number of different types of multimedia objects. These databases may include relational database records, object-oriented databases with objects for alphanumeric attributes and storage servers for multimedia (such as still video, audio, images and full-motion video).

A multimedia database management system should provide for the efficient storage and manipulation of data represented as text, images, voice, graphics, and video. A uniform representation of the multimedia database is needed so that users can query and update it in an efficient manner through the M-DBMS.

In multimedia databases different types of data such as voice and video are stored in objects. Synchronization between these objects as well as accessing these objects based on content and context is needed. Also, appropriate query languages, data modeling techniques, mapping to the storage objects, and metadata management techniques need to be developed. Concept of transaction processing for multimedia data types have to be revisited and the synchronization mechanism have to be integrated into the transaction processing techniques.

In distributed multimedia databases, massive databases may be fragmented and stored as smaller chunks. Data may also be replicated for availability. The data from multiple databases have to be retrieved, merged, and synchronized for presentation to the user. The replicated copies have to be kept consistent. During data distribution, it may also be possible for the data to be represented using different schemes. There could also be heterogeneity with

respect to different data models, retrieval algorithms, query language, and transaction management techniques.

One of the initial steps to developing distributed multimedia database systems (DM-DBMS) includes the development of an appropriate data model for representing the distributed multimedia database. Several features such as synchronization mechanisms, relationships between the objects, decomposition and recombination of objects need to be considered. In addition to developing a conceptual model for the representation of the objects, an appropriate specification language to specify the relationship and constraints needs to be developed. Constraint specification has to be integrated with the object specification so that impedance mismatch can be minimized. Finally, the operations on the data model for retrievals and updates need to be specified.

Other steps includes defining the quality of the service that has to be provided to the users, developing an execution model, systems and functional architectures, storage structures and mappings, and algorithms for retrieval and update. Quality of service primitives would define the type of service that is to be provided for various scenarios. For example, in certain cases it would be sufficient to obtain incomplete answers while in other cases it is essential that complete and accurate answers be provided for queries. While the data model describes the conceptual representation of the distributed database, the storage structures describe the physical representation. The mappings would define the transformations between the conceptual and physical representations. Various types of architectures can be defined for a DM-DBMS. For example, one could assume that each database has its own data manager and these data managers are interconnected using some distributed processing module. In some cases, the local data managers may not exist and therefore, the DM-DBMS will have to perform the functions of the local data managers. Schema architectures such as the five-schema architecture have been proposed for distributed database systems. The suitability of such architectures needs to be determined. Various data distribution schemes also need to be examined. For example, one scheme may not support the fragmentation of an object while another scheme may support it. The retrieval algorithms for multimedia data types need to support content and context-based retrieval. In addition, query transformation and optimization schemes have to be developed for each operation on data model. Update algorithms for multimedia database is still a major research issue.

For organizing distributed databases with distinct storage mechanisms for various components brings forth a number of issues that must be addressed in design for the overall system to function reliably and efficiently.

These issues are given below:

1. How is the location of object determined?
2. Where should each object reside?
3. How are multiple copies of objects maintained to provide efficient and reliable access to all objects from any workstation in the network?
4. How are objects uniquely identified in an enterprise-wide network?
5. How are composite objects stored, created and managed?
6. How are they recompiled for playback?
7. How are various classes of service maintained for rendering of objects to ensure that voice and video objects are serviced for isochronous delivery?

c) What benefits are achieved by using compression in multimedia system?

(Any 4 relevant benefits 1 mark each)

Compression is the key to the future expansion of the web; it's certainly the key to the increasingly use of multimedia and 3-D technology. When multimedia data objects like binary document images, grey-scale images, color images, photographic or video images, animated images, full motion video etc are digitized, large volume of data are generated. Since every bit incurs a cost when stored, retrieved, transmitted and displayed. The data objects requires a very large amount of data storage due to which the access time for retrieving data increases. In order to manage large multimedia data objects efficiently, these data objects need to be compressed to reduce the file size for the storage of these objects. The goal of data compression is to represent an information source as accurately as possible using the fewest number of bits.
Ultimately compression techniques the data is compressed which becomes easy to store, cost is reduced to store the large data.

d) Why traditional input devices are not suitable for multimedia system? List multimedia input output devices.
(2 marks for explanation, 1 mark input devices, 1 mark output devices)

Limitations of traditional input devices:

- Traditional devices supports only alphanumeric data entry, but multimedia technology, can have a variety of other types of data inputs such as voice or audio, full audio video, still photos & images.
- Traditional devices make use of only keyboard and mouse, whereas multimedia devices include special devices such as digital pens, audio input equipment, video cameras and image scanners.
- In traditional devices text is stored in ASCII format or in EBCDIC format providing on measures of quality. With high quality multifont printers, text quality is independent of the text input and can be changed at any time.
- In traditional devices, the text capturing devices does not determine the end quality of the text, whereas multimedia objects depend on the input devices and storage for quality.
- Most of the traditional I/P devices produce analog input while the computer can process only the digital input. So multimedia objects need to convert the data from analog to digital from.

Input devices are any devices or the media that are used to input data for processing to give the final output. The various input devices are: keyboard, mouse, joystick, digitizer, light pen, scanner, track ball, touch screen, digital camera.

The output devices are any devices which are used to display the result of the processing of the input device. The various output devices are printer, monitor, and communication devices.

e) State any four objectives of MPEG. (Any four objectives 4 marks, 1 mark each)

Objectives

The MPEG standard is designed to be generic, meaning that it will support the needs of many applications. The objectives include:

- Delivery of acceptable video quality at compressed data rates in excess of 1.0 Mbits/s
- Support both either symmetric or asymmetric compression/decompression applications.
- Random access playback should be possible
- Fast-play and fast reverse in addition to normal playback should be supported
- Audio video synchronization should be maintained.
- Data errors should not be catastrophic
- The processing requirements should not preclude the development of low-cost semiconductor based implementation which may encode in real time.
- Editability should be available when **required** by application.