CMR INSTITUTE OF TECHNOLOGY

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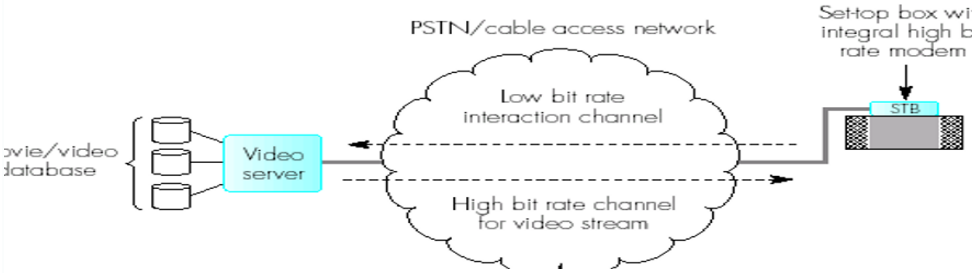
Internal Assesment Test - IV

Sub:	Multimedia Communication							Code:	17EC741
Date:	03//02/2022	Duration:	90 mins	Max Marks:	50	Sem:	VII	Branch:	ECE-A,B,C,D

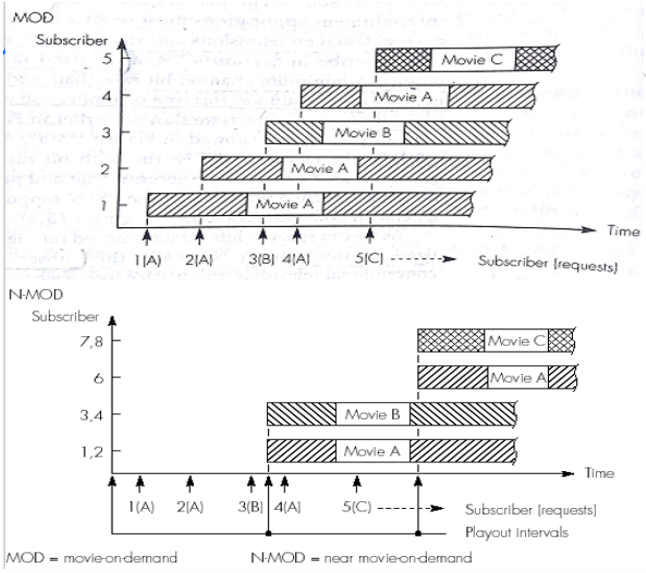
Answer Any FIVE FULL Questions

			CO	RBT
1.	Explain with neat diagrams, the entertainment applications of multimedia communication.	[10]	CO1	L1

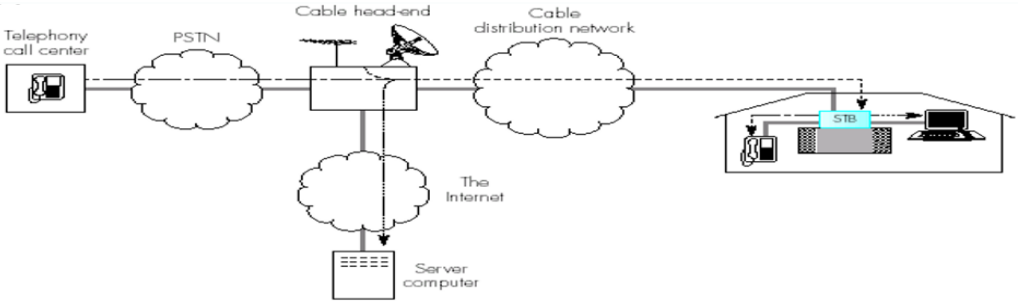
- The entertainment applications require *higher quality/ resolution* for video and audio since wide-screen televisions and stereophonic sound are often used.
- Digitized video with sound requires *bit rate* – **1.5Mbps** – network must support – *PSTN with high bit rate modem.*



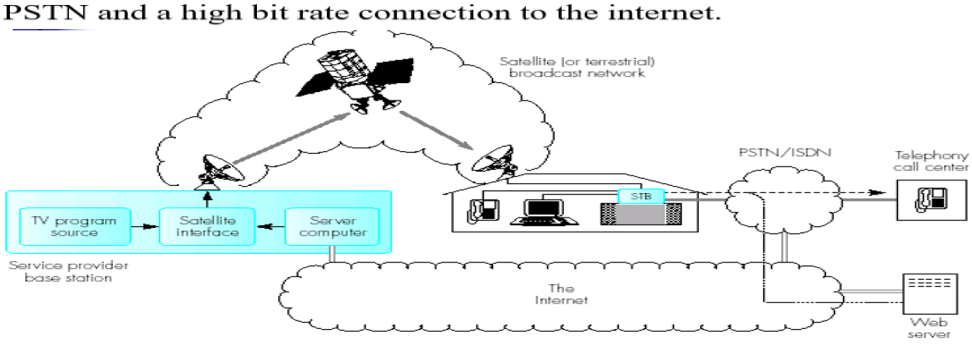
- Subscriber terminal - TV with a selection device for interaction purpose.
- User interactions are relayed to the server through a *set-top-box (STB)* with a high speed modem.
- **Movie-on-demand/Video-on-demand.**
  - Using menu, user can *browse* through the library of movies/videos and *initiate* the showing of a selected movie *at any time.*
  - User can *control showing* of the movie – play, pause, etc.
  - Server must be capable of *playing out simultaneously* a *large no.* of video streams equal to the no. of users.
  - Require *high speed* information flow from the server *(multi-movies + multi-copies).*



- **N-MOD** - to avoid the heavy load, requests for a particular movie are not played immediately.
- Requests are ***queued*** until the *start of the next play-out time.*
- Reduces *bandwidth* and *cost.*

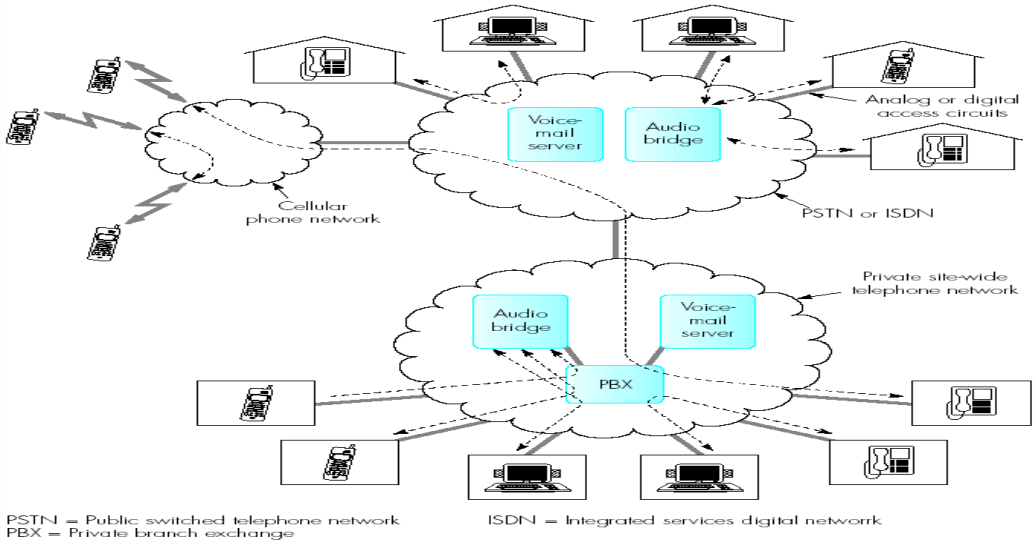


- Broadcast TV network includes cable, satellite & terrestrial networks
- The set-top box (STB) provides both a low bit rate connection to the PSTN and a high bit rate connection to the internet.



- The STB associated requires a high speed modem to provide the connections to the PSTN and the Internet

2. With a neat diagram, explain how voice mail and teleconferencing is supported in relation to speech only interpersonal communication involving both public (PSTN/ISDN) and private network. Also, explain the role of voice mail server and audio bridge. [10] CO1 L2



[10] CO3 L2

[10] CO3 L1

[10] CO2 L1

[10] CO2 L1

CO2 L1

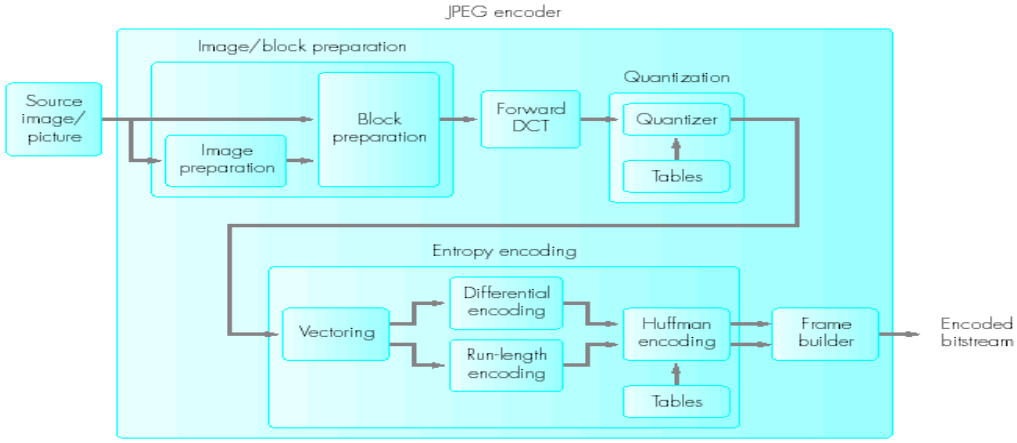
- Traditional interpersonal communication - *telephones connected to PSTN/ISDN/PBX.*
- Multimedia PC with a microphone and speakers - used to make telephone calls through PC.
- Requirements – telephone interface card and associated software - technology is *computer telephony integration (CTI).*
- *Advantages* - users can create own private directory of numbers and can initiate a call by selecting the desired no. on the PC screen.
- Access circuits require more capacity/**bandwidth.**

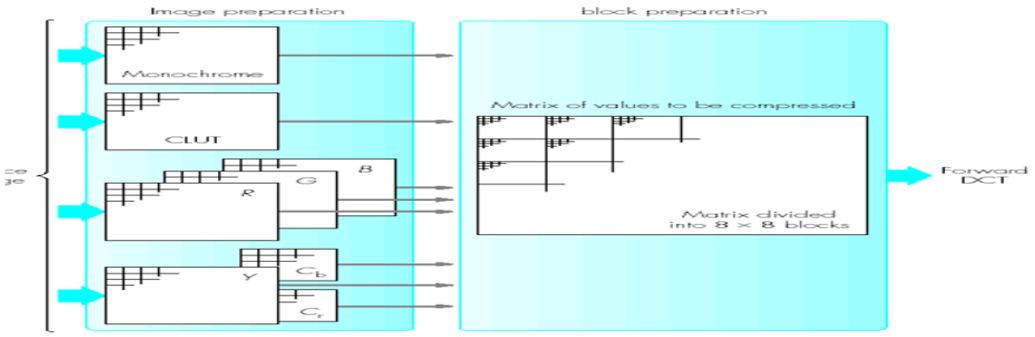
1. **Voice mail**: Used when the called party is unavailable. A *spoken message - voice mail* is saved in the *voice mailbox,* which is present at a central *voice mail server* – this message can be read by the owner next time they contact the server.
2. **Teleconferencing**: Involves multiple interconnected telephones/PCs. Each person can talk to all the others involved in the call - ***conference call / teleconferencing call / audio-conferencing call***. Requires - central unit - ***audio bridge*** **-** provides the necessary support to set up the call automatically.

- Internet telephony initially supported PC-to-PC communications - technology is extend to PC-*to-telephony*.

3. Explain the schematic of JPEG encoder with the help of suitable diagrams.

- **Source image** - is made up of one or more 2-D matrices of 8-bit grey-level values that represent the image.
- For the colour image if a **CLUT** is used then a single matrix of values is required.
- For **R, G, B** format image - **3 matrices** are required each for R G B.
- For **Y, C_b, C_r** format image- matrix size for the chrominance components is smaller than the Y matrix (Reduced representation).
- **Block preparation** - is carried out before DCT for efficient transformation.
- Once the image format is selected then the values in each matrix are compressed separately using the DCT.





- **Block preparation**- each matrix is divided into a set of smaller 8x8 sub-matrices (block).
- These *BLOCKS* are fed sequentially to the DCT.
- Values in each matrix are compressed separately using the DCT.

- Each pixel value is quantized using ***8 bits*** which produces a value in the range ***0 - 255*** for the ***R, G, B*** or ***Y*** and a value in the range ***–128 to +127*** for C_b and C_r.
- To compute forward DCT, all the values are first centered around zero by subtracting ***128*** from each intensity/ Y value.
- If the *input matrix* is ***P[x,y]*** and the *transformed matrix* is ***F[i,j]*** then the DCT for the ***8X8 block*** is computed using the expression:
- ***C(i) & C(j) = ½ for i=j=0 & 1*** for all other values of i,j.

$$F[i,j]=\frac{1}{4}C(i)C(j)\sum_{x=0}^{7}\sum_{y=0}^{7}P[x,y]\cos\frac{(2x+1)i\pi}{16}\cos\frac{(2y+1)j\pi}{16}$$

- Using DCT there is *very little loss of information* during the DCT phase.
- The losses are due to the use of fixed point arithmetic.
- The main source of information loss occurs during the *quantization and entropy encoding* stages where the compression takes place.
- The ***human eye responds primarily to the DC coefficient*** and the lower frequency coefficients (*The higher frequency coefficients below a certain threshold will not be detected by the human eye*).
- This property is exploited by *dropping the spatial frequency coefficients* in the *transformed matrix* (dropped coefficients cannot be retrieved during decoding).
- **Quantization** - *reduce the size of the DC and AC coefficients* - less bandwidth is required for their transmission -by using a divisor.
- Human *eye sensitivity varies* with spatial frequency -amplitude threshold below which the eye will detect a particular frequency also varies.
- Threshold values vary for each of the 64 DCT coefficients and are held in a 2-D matrix known as the **quantization table.**
- Choice of threshold value - compromise between the *level of required compression* and the resulting *amount of information loss that is acceptable.*
- JPEG has *two quantization tables* - ***one for luminance*** and other for ***chrominance coefficients***. Customized tables are also allowed to be sent with the compressed image.
- From the *quantization table* and the *DCT and quantization coefficients* number of observations can be made:
  - The computation of the quantized coefficients involves *rounding the quotients* to the nearest integer value.
  - The threshold values used increase in magnitude with increasing spatial frequency.
  - The DC coefficient in the transformed matrix is largest.
  - Many of the higher frequency coefficients are zero.

4. Explain the concept of Arithmetic coding. Compute the arithmetic code word for the message "went." Comprising a string of characters with probabilities e=0.3, n=0.3, t=0.2, w=0.1, . =0.1

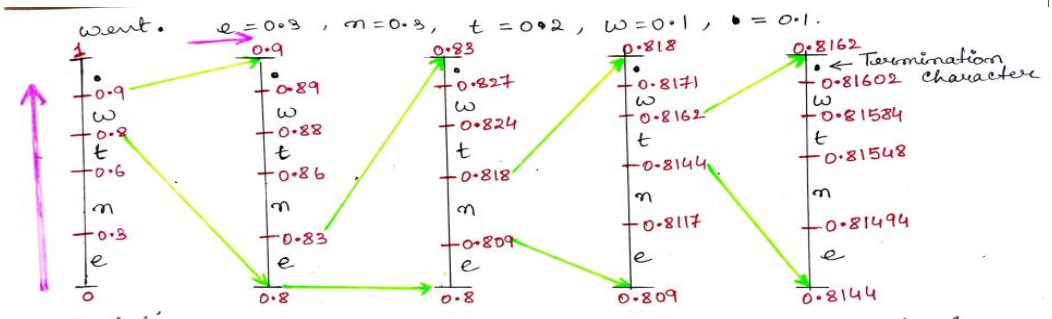
Steps for Arithmatic coding

Step 1: Divide the numeric range 0–1 into no. of different symbols present in the message.

Step 2: Expand the 1st letter to be coded along with range & subdivide this range into no. of symbols.

Step 3: Repeat the procedure untill termination character is encoded.

went. e = 0.3 , n = 0.3, t = 0.2 , w = 0.1 , • = 0.1.



Calculation

→ $d = 0.9 - 0.8 = 0.1$ for expanding w.

Range of e = 0.8 : 0.8 + 0.1 × 0.3 = 0.8 : 0.83

Range of n = 0.83 : 0.83 + 0.1 × 0.3 = 0.83 : 0.86

Range of t = 0.86 : 0.86 + 0.1 × 0.2 = 0.86 : 0.88

Range of w = 0.88 : 0.88 + 0.1 × 0.1 = 0.88 : 0.89

Range of • = 0.89 : 0.9

→ Message went. is converted into arithmatic codeword.

→ Range of the codeword

$0.81602 < \text{codeword} < 0.8162$

→ $d = 0.83 - 0.8 = 0.03$ for expanding e

Range of e = 0.8 : 0.8 + 0.03 × 0.3 = 0.8 : 0.809

Range of n = 0.809 : 0.809 + 0.03 × 0.3 = 0.809 : 0.818

Range of t = 0.818 : 0.818 + 0.03 × 0.2 = 0.818 : 0.824.

Range of w = 0.824 : 0.824 + 0.03 × 0.1 = 0.824 : 0.827

Range of • = 0.827 : 0.83

→ $d = 0.818 - 0.809 = 0.009$ for expanding n

Range of e = 0.809 : 0.809 + 0.009 × 0.3 = 0.809 : 0.8117

Range of n = 0.8117 : 0.8117 + 0.009 × 0.3 = 0.8117 : 0.8144

Range of t = 0.8144 : 0.8144 + 0.009 × 0.2 = 0.8144 : 0.8162.

Range of w = 0.8162 : 0.8162 + 0.009 × 0.1 = 0.8162 : 0.8171.

Range of • = 0.8171 : 0.818

→ $d = 0.8162 - 0.8144 = 0.0018$ for expanding t

Range of e = 0.8144 : 0.8144 + 0.0018 × 0.3 = 0.8144 : 0.8194

Range of n = 0.8194 : 0.8194 + 0.0018 × 0.3 = 0.8194 : 0.81548

Range of t = 0.81548 : 0.81548 + 0.0018 × 0.2 = 0.81548 : 0.81584

Range of w = 0.81584 : 0.81584 + 0.0018 × 0.1 = 0.81584 : 0.81602.

Range of • = 0.81602 : 0.8162.

5. Derive the time to transmit the following digitized images at both 64Kbps and 1.5Mbps networks. A 640×480×8 VGA-compatible image a 1024×768×24 SVGA-compatible image. Write brief note on (i) Digitized picture. (ii) Colour mixing

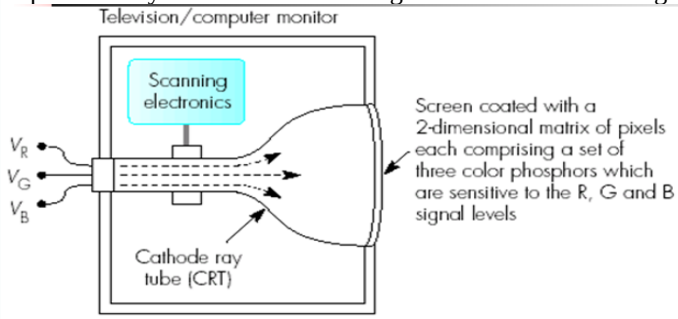
(i) At 64 kbps, 10 ms = 640 bits
Hence choose a packet size of, say, 800 bits with a FIFO buffer of 1600 bits – 2 packets – and start playout of the bitstream after the first packet has been received.

(ii) At 256 kbps, 10 ms = 2560 bits
Hence choose a packet size of, say, 2800 bits with a FIFO buffer of 4800 bits.

(iii) At 1.5 Mbps, 10 ms = 15000 bits
Hence choose a packet size of, say, 16 000 bits with a FIFO buffer of 32 000 bits.

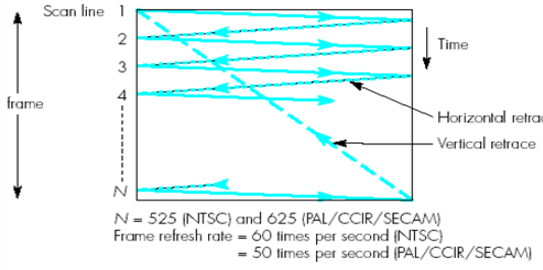
Notice that if the computed packet size exceeds the network maximum packet size, then the equivalent number of packets must be sent before playout starts. For example, if the maximum network packet size was 8000 bits, then for case (iii) above playout would not start until two packets have been received and the FIFO buffer should hold four packets.

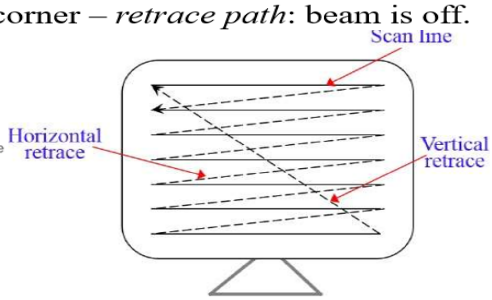
6. Explain briefly about Raster scanning and Interlaced Scanning Procedure.



- Picture tubes in most TV sets operate using - **raster-scan/progressive scan.**
- Used in ***computer graphics.***

- ***Finely-focussed electron beam*** being scanned over the complete screen.
- Each complete scan has no. of discrete horizontal lines - *starts at the top left corner* and *ends at the bottom right corner*, then the beam is deflected back again to the top left corner – *retrace path*: beam is off.





- **Frame** - each complete set of horizontal scan.
- Each frame is made of ***N individual scan lines***: N= ***525 – N & S America & 625 – Europe and other countries***.
- Inside of display screen is coated with ***Light-sensitive phosphor*** – that emits light when energized by electron bean.
- Amount of light emitted- **brightness** is determined by the *power* in the electron beam.