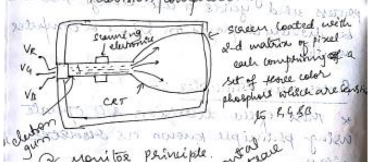
4 (a)

Raster-Scan principles :-

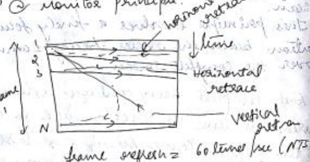
* Most of the television sets operate using principle known as raster -scan.
* This principle involves a finely focused electron beam the raster being scanned over the complete screen.
* Each complete scan contains a discrete horizontal lines the first of which starts at the top left corner screen and last of which ends at the bottom right corner

* At this point the beam is reflected back again to top left corner and the scanning operation repeats.
* This type of scanning method is called progressive scanning

Television/computer Monitor



@ monitor principle.



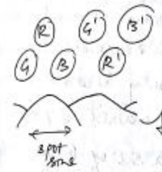
frame refresh = 60 times/sec (NTSC)
= 50 times/sec

N = 525 (NTSC)

N = 625 (PAL/CCIR/SECAM)

National Television Standard Committee (NTSC), PAL(UK) ...

pixel format on each scan line



RGB/R'G'B' → phosphor triodes

fig- phosphor triad arrangement

* one complete set of horizontal scan lines called frame ▤ } frame
* Each frame is made up of N individual scan lines
* N=525 (North & south America and most of Asia)
  N=625 (Europe & other Countries)
* The inside of the display screen of picture tube is coated with light sensitive phosphor that emits light when energized by the electron beam.
* The amount of light emitted, its brightness is determined by the power in the electron beam at that instant
* During each horizontal (and vertical (frame) retrace, the electron beam is turned off to create an image on screen, and the level of beam is changed as each line is scanned.

4 (b)

...scale known as **decibels** or **dB**:

$$D = 20 \log_{10} (V_{max}/V_{min}) \text{dB}$$

Hence when determining the quantization interval – and thus number of bits to be used – it is necessary to ensure that the level of quantization noise relative to the smallest signal amplitude is acceptable.

2.2 An analog signal has a dynamic range of 40 dB. Determine the magnitude of the quantization noise relative to the minimum signal amplitude if the quantizer uses (i) 6 bits and (ii) 10 bits:

Answer:

$$D = 20 \log_{10} \frac{V_{max}}{V_{min}} \text{ dB} \quad \text{Quantization noise} = \pm \frac{q}{2} = \pm \frac{V_{max}}{2^n}$$

Hence $40 = 20\log_{10} \frac{V_{max}}{V_{min}}$

and $V_{min} = \frac{V_{max}}{100}$

(i) $n = 6$ bits

Hence $\frac{q}{2} = \pm \frac{V_{max}}{2^6} = \pm \frac{V_{max}}{64}$

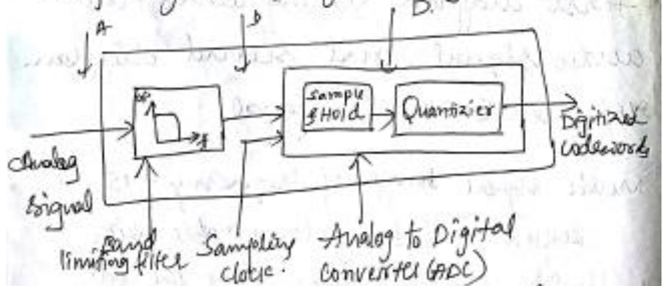
(ii) $n = 10$ bits

Hence $\frac{q}{2} = \pm \frac{V_{max}}{2^{10}} = \pm \frac{V_{max}}{1024}$

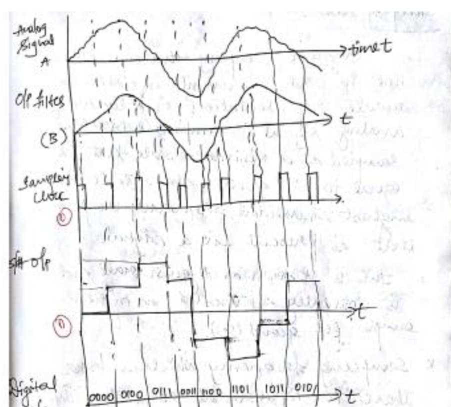
As we can see from these values, with 6 bits the quantization noise is greater than V_{min} and hence is unacceptable. With 10 bits, however, the quantization noise is an order of magnitude less than V_{min} and hence will have a much reduced effect.

Encoder Design:

* Encoder is used to convert time varying signal to digital signal.



* Encoder consist of bandlimiting filter and Analog to digital converter. In turn ADC consist of Sample and hold circuit

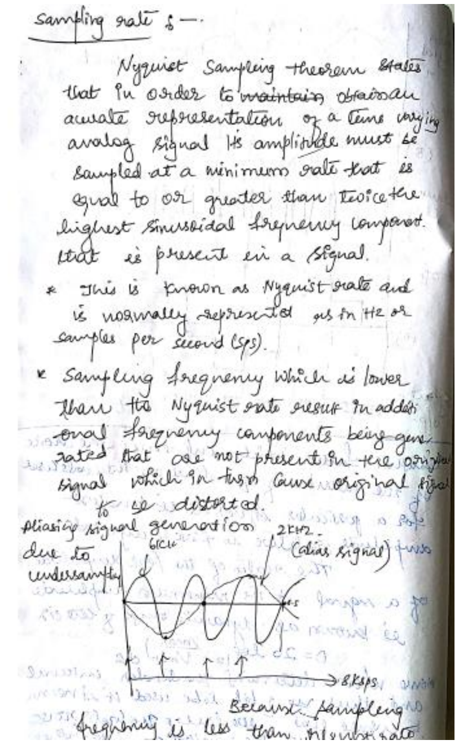


Another factor which influences the choice of the number of quantization intervals used for a particular signal is its smallest amplitude relative to peak amplitude.

The ratio of the peak amplitude of a signal to its minimum amplitude is known as dynamic range of the signal

$$D = 20 \log_{10} \left(\frac{V_{max}}{V_{min}} \right) dB$$

Hence when determining quantization interval and thus no. of bits to be used it is necessary to ensure that the level of quantization noise relative to the smallest signal amplitude is acceptable



Sampling rate :—

Nyquist Sampling theorem states that in order to ~~maintain~~ obtain an accurate representation of a time varying analog signal its amplitude must be sampled at a minimum rate that is equal to or greater than twice the highest sinusoidal frequency component that is present in a signal.

* This is known as Nyquist rate and is normally represented as in Hz or samples per second (sps).
* Sampling frequency which is lower than the Nyquist rate result in additional frequency components being generated that are not present in the original signal which in turn cause original signal to be distorted.

Aliasing signal generation due to undersampling

Because sampling frequency is less than Nyquist rate

6.

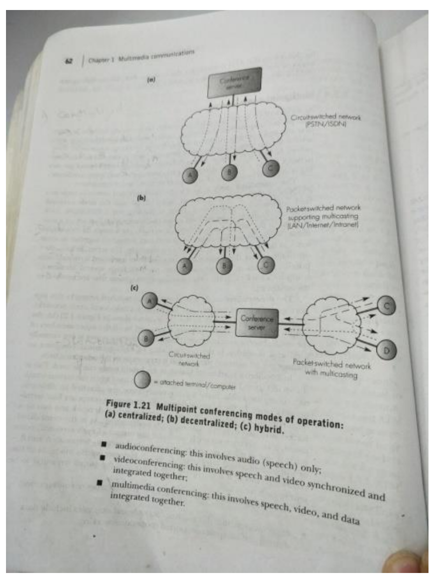


Figure 1.21 Multipoint conferencing modes of operation: (a) centralized; (b) decentralized; (c) hybrid.

- audioconferencing: this involves audio (speech) only;
- videoconferencing: this involves speech and video synchronized and integrated together;
- multimedia conferencing: this involves speech, video, and data integrated together.

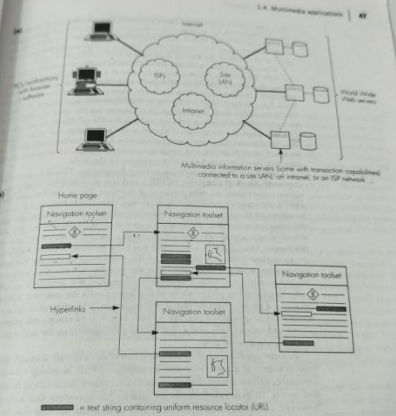


Figure 1.14 Interactions with a World Wide Web server: (a) schematic; (b) hypertext linkages between the pages of a set of documents.

option, at well-defined points throughout the pages that make up a document, to jump either to a different page of the same document or to a different document. Also, to return subsequently to a specific point on a page at a later time. The optional linkage points within documents are defined by

primary color yielding in excess of 16 million (2^{24}) colors. In practice, however, the eye cannot discriminate between such a range of colors and so in some instances a selected subset of this range is used. The selected colors in the subset are then stored in a table and each pixel value is used as an address to a location within the table which contains the corresponding three color values. The table is known as the **color look-up table** or **CLUT**. For example, if each pixel is 8 bits and the CLUT contains 24 bit entries, this will provide a subset of 256 (2^8) different colors selected from a palette of 16 million (2^{24}) colors. In this way, the amount of memory required to store an image can be reduced significantly.

Aspect ratio

Both the number of pixels per scanned line and the number of lines per frame vary, the actual numbers used being determined by what is known as the **aspect ratio** of the display screen. This is the ratio of the screen width to the screen height. The aspect ratio of current television tubes is 4/3 with older tubes – on which PC monitors are based – and 16/9 with the wide-screen television tubes.

In the United States, the standard for color television has been defined by the **National Television Standards Committee** (**NTSC**) while in Europe three color standards exist **PAL** (UK), **CCIR** (Germany), and **SECAM** (France). As we indicated earlier, the NTSC standard uses 525 scan lines per frame while the three European standards all use 625 scan lines. In neither case, however, are all lines displayed on the screen since some are used to carry control and other information. In practice, therefore, the number of visible lines per frame – which is equal to the vertical resolution in terms of pixels – is 480 with an NTSC monitor and 576 with the other three standards. Thus in order to avoid distortion on a screen which has a 4/3 aspect ratio – for example when displaying a square of, say, ($N \times N$) pixels – it is necessary to have 640 pixels ($480 \times 4/3$) per line with an NTSC monitor and 768 ($576 \times 4/3$) pixels per line with a European monitor. This produces a lattice structure that is said to produce **square pixels** and is shown in diagrammatic form in Figure 2.15. Some example screen resolutions associated with the more common computer monitors based on television picture tubes – together with the amount of memory required to store the corresponding image – are shown in Table 2.1

As we can deduce from the table, the memory requirements to store a single digital image can be high and vary between 307.2 kbytes for an image displayed on a **VGA** (**video graphics array**) screen with 8 bits per pixel through to approximately 2.36 Mbytes for a **SVGA** (**Super VGA**) screen with 24 bits per pixel. It should be noted that the more expensive computer monitors are not based on television picture tubes and hence are not constrained by the 4/3 aspect ratio. An example is $1280 \times 1024 \times 24$ which may have a refresh rate as high as 75 frames per second to produce a sharper image.