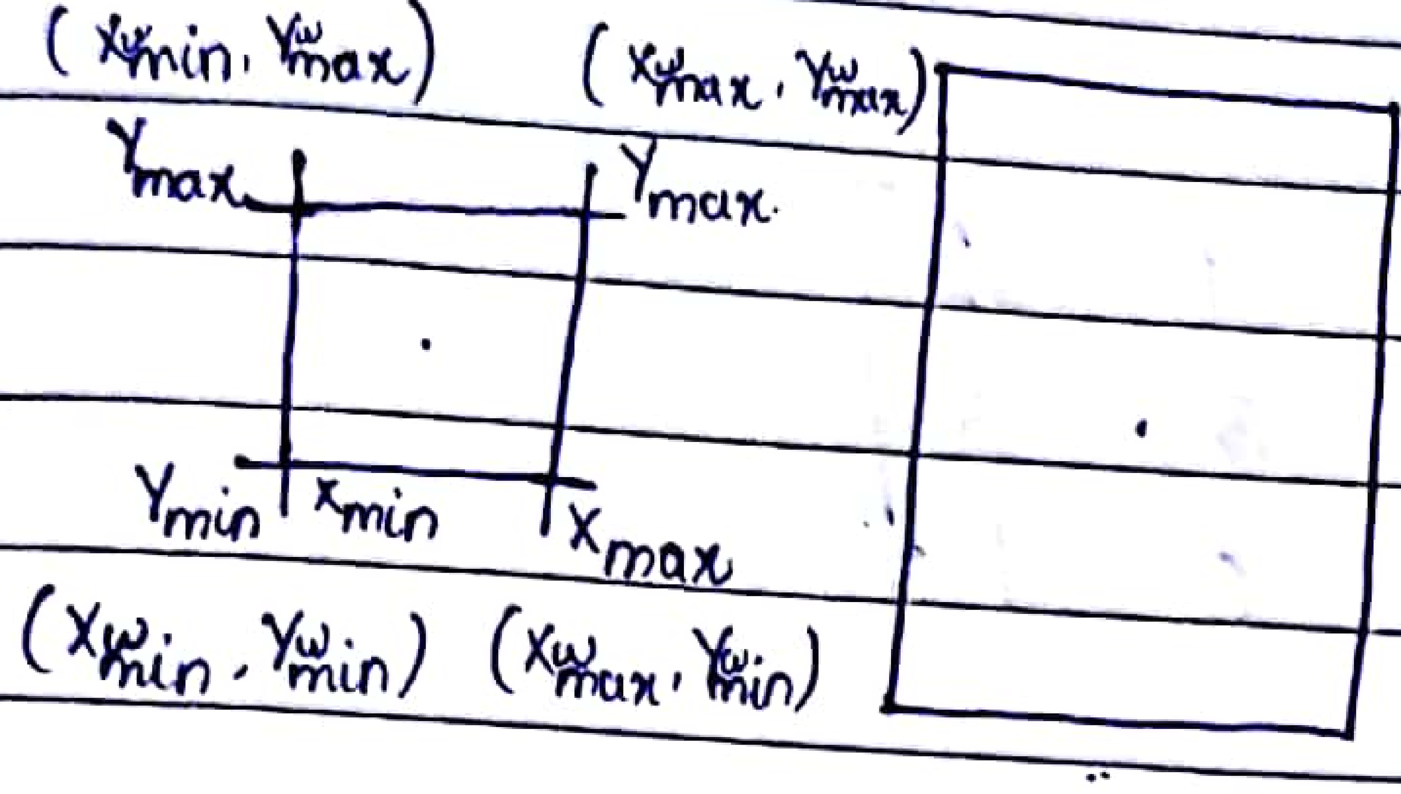
1/09/17

Viewing and clipping



Translation → Scaling → Re-translation

$$\begin{bmatrix} -Xw_{min} \\ -Yw_{min} \\ 1 \end{bmatrix} \rightarrow \text{Translation}$$

$$\begin{bmatrix} 1 & 0 & -XW_{min} \\ 0 & 1 & -YW_{min} \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} S_x & 0 & 0 \\ 0 & S_y & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & XW_{min} \\ 0 & 1 & YW_{min} \\ 0 & 0 & 1 \end{bmatrix}$$

$$S_x = \frac{XV_{max} - XV_{min}}{XW_{max} - XW_{min}} \qquad S_y = \frac{YV_{max} - YV_{min}}{YW_{max} - YW_{min}}$$

Q. Derive a normalization matrix that maps a window specified by coordinate (1,1) & (4,5) onto a view port specified by coordinate (2,4) & (8,10)

Sol^n- $S_x = \frac{6}{3} = 2$ $\qquad S_y = \frac{6}{4} = \frac{3}{2}$

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & -XW_{min} \\ 0 & 1 & -YW_{min} \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} S_x & 0 & 0 \\ 0 & S_y & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & XV_{min} \\ 0 & 1 & YV_{min} \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & -1 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 2 & 0 & 0 \\ 0 & 3/2 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 4 \\ 0 & 0 & 1 \end{bmatrix}$$

$y = 3x+5$
for any pt $P(h,k)$

Given a Δ having vertices (x_1, y_1) (x_2, y_2) (x_3, y_3) Find new vertices of Δ after performing cw rotation abt line $y = mx + c$.

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

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

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

$$= \begin{bmatrix}\cancel{\sin 2\theta}\ \cos 2\theta&\cancel{\cos 2\theta}\ -\sin 2\theta&\cancel{-c\cos\theta}\ -c\sin\theta\\\cancel{\cos 2\theta}\ -\sin 2\theta&\cancel{-\sin 2\theta}\ -\cos 2\theta&\cancel{c\sin\theta}\ c\cos\theta+c\\0&0&1\end{bmatrix}\begin{bmatrix}x_1&x_2&x_3\\y_1&y_2&y_3\\1&1&1\end{bmatrix}$$

$$= \begin{bmatrix}x_1\sin 2\theta + y_1\cos 2\theta - c\cos\theta & x_2\sin 2\theta + y_2\cos 2\theta - c\cos\theta & ---\\ x_1\cos 2\theta - y_1\sin 2\theta + c\sin\theta + c & --- & ----\\ 1 & 1 & 1\end{bmatrix}$$

$y = 3x + 5$

$$\Rightarrow \begin{bmatrix}3/5 & -4/5 & -5/\sqrt{10}\\ -4/5 & -3/5 & 15/\sqrt{10} + 5\\ 0 & 0 & 1\end{bmatrix}$$

classmate
Date
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~~A A with verith A(2,2) B(5,2) C(5,5) is rotat~~

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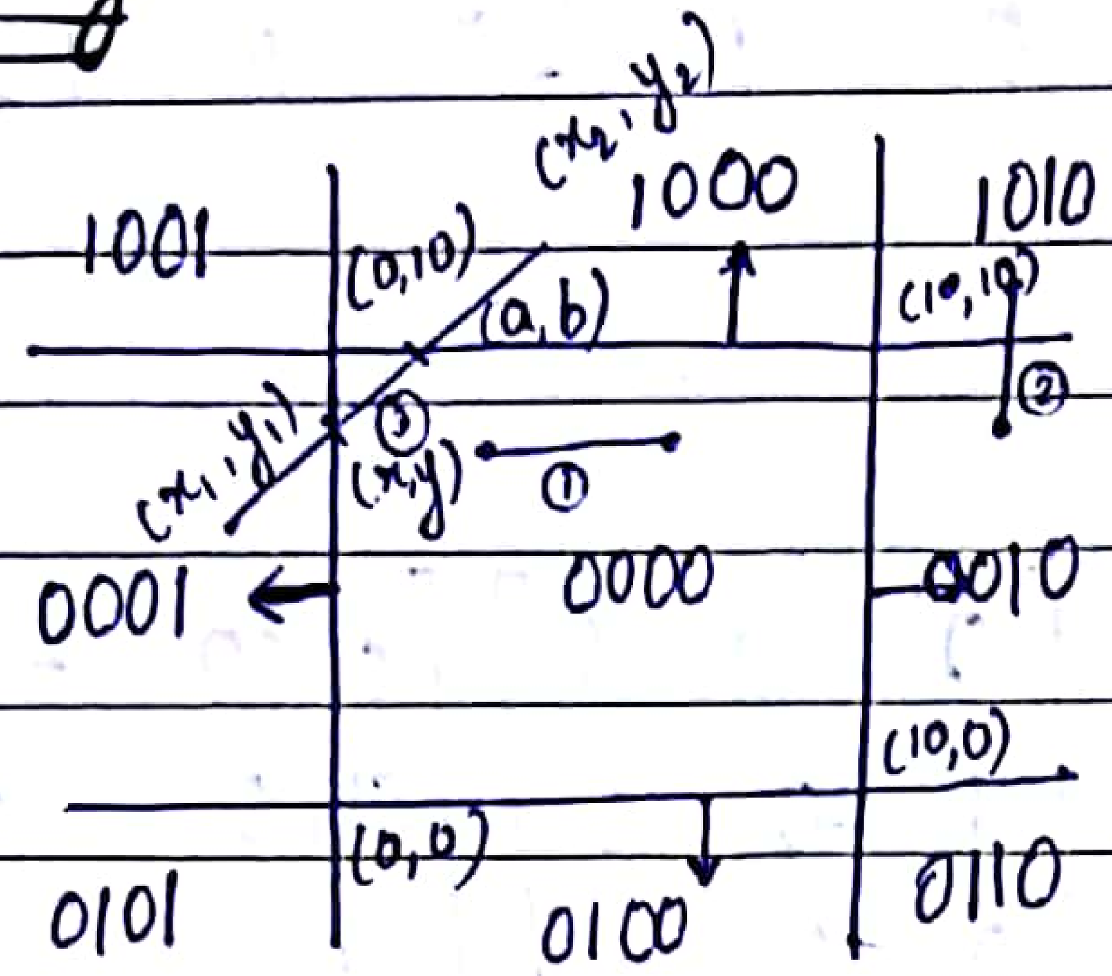
Clipping



TBRL

1.) Calculate the region code
2.) Find the AND of no. of bits

1 ← AND → 0
↓ reject ↓ accept

③	①	②
1000	0000	1010
0001	0000	0010
0000	0000	0010
Accept	Accept	Reject

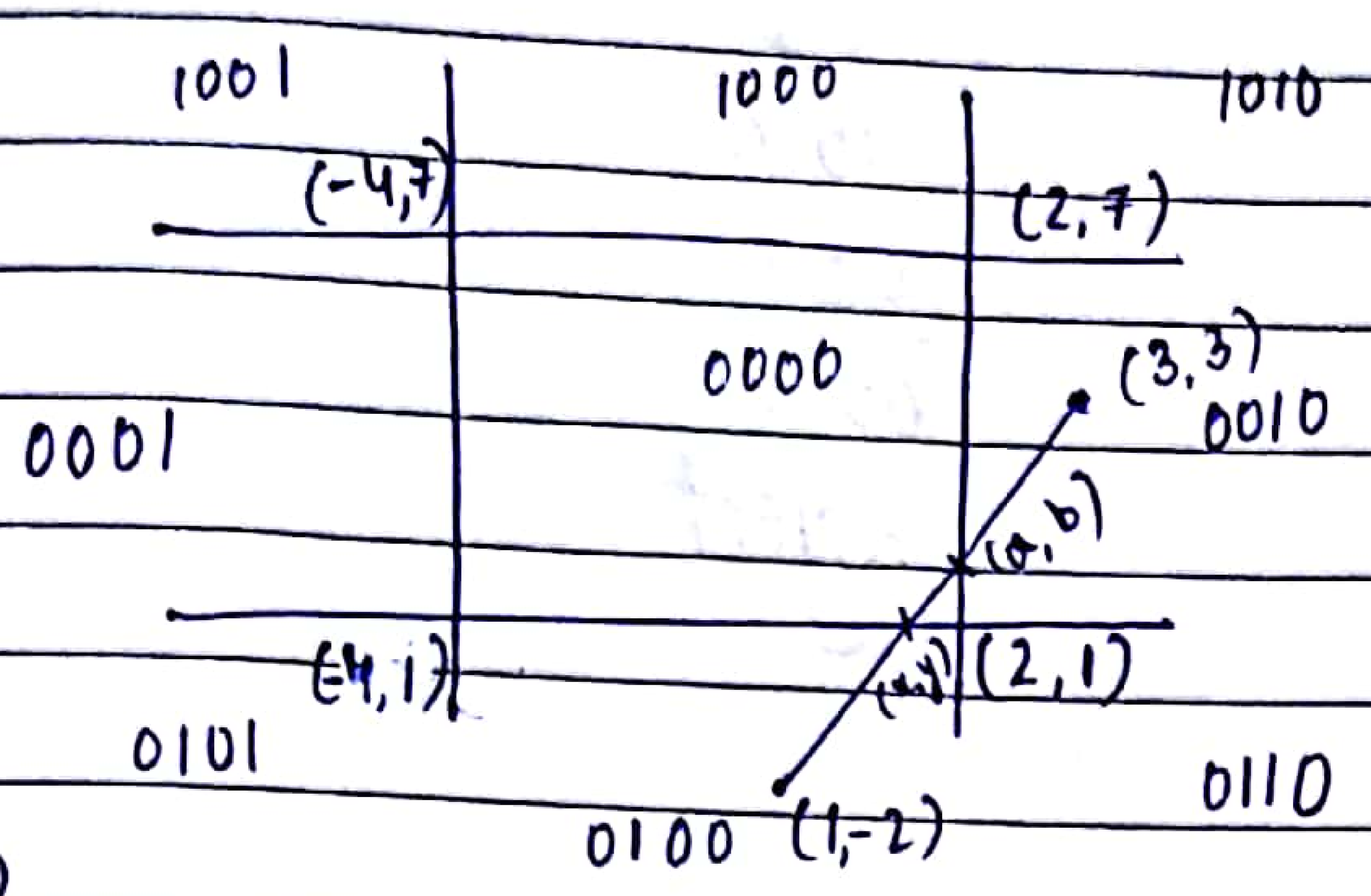
3.) Find OR → 0
↓ 1 ↓ Completely accept
↓ partially accept

③	①
1000	0000
0001	0000
1001	0000
Partial.	Accept

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{y - y_1}{x - x_1} = \frac{y_2 - b}{x_2 - a}$$

Q. Using Cohan Suderland mid point algorithm which has lower left corner at (-4,1) and upper right corner at (2,7). The line value & A = (1, -2) B = (3, 3).

Scanned by CamScanner



AND

0100
0010
____
0000

OR

0100
0010
____
0110

Partially accept

$$m = \frac{3+2}{3-1} = \frac{1+2}{x-1}$$

$$\frac{5}{2} = \frac{3}{x-1}$$

$$5x - 5 = 6$$

$$x = \frac{11}{5} \qquad \left(\frac{11}{5}, 1\right)$$

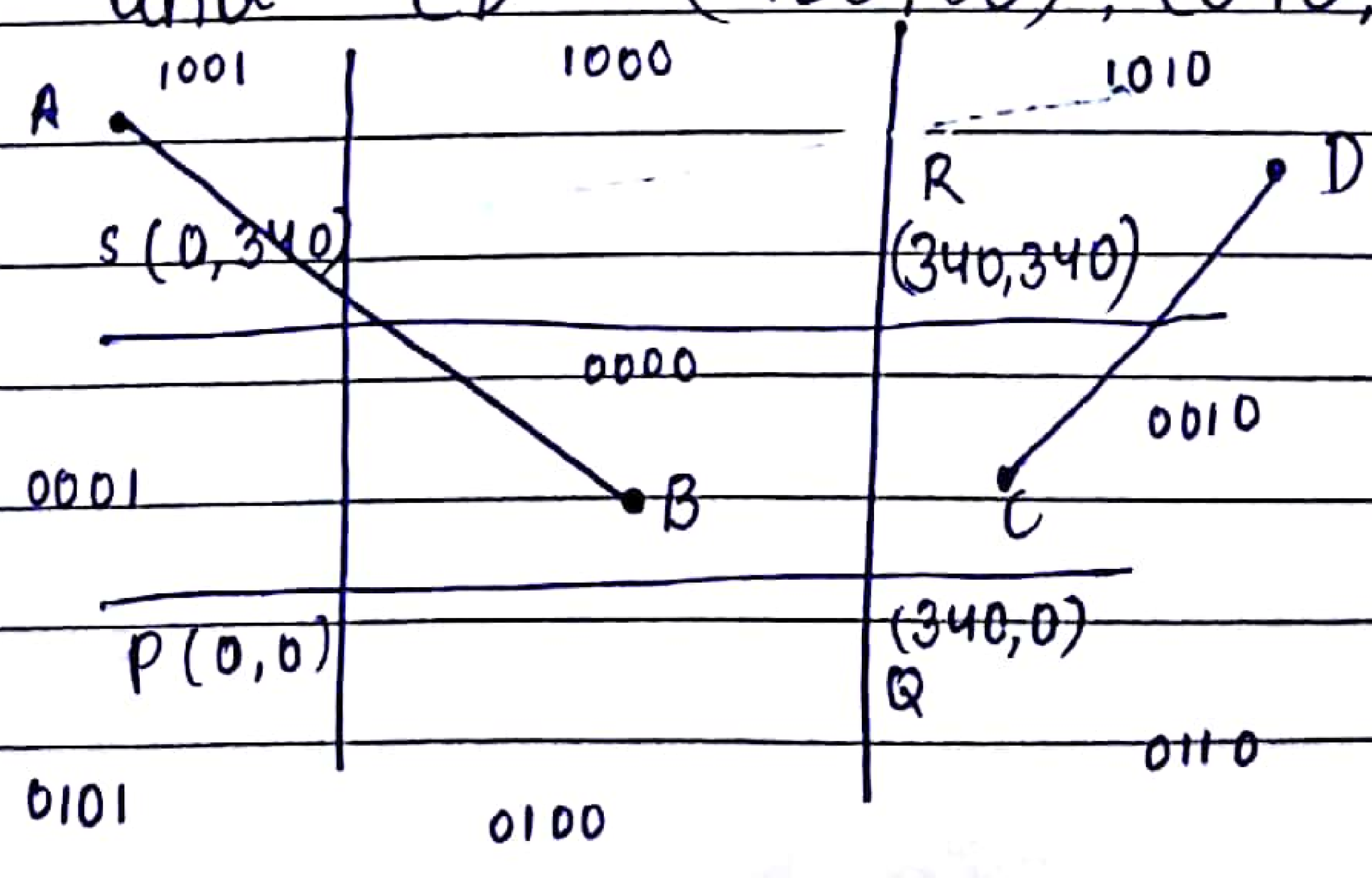
$$m = \frac{5}{2} = \frac{3-b}{3-2}$$

$$\Rightarrow 5 = 6 - 2b$$

$$2b = 1 \Rightarrow b = 1/2$$

$$\left(2, \frac{1}{2}\right)$$

Q. ~~Consider a~~ Given a clipping window P(0,0), Q(340,0), R(340,340) and S(0,340). Find the visible portion of the line AB (-170, 595), (170, 255) and CD = (425, 85), (595, 595)



/09/17

Illumination Model

(1) Ambient light

Each object is displayed using an intensity intrinsic to it which has no external ~~life~~ light source or called as self luminous object. This model can be expressed by eqⁿ:

$$I = \cancel{k_f}\, K_i$$

where I = Resulting intensity
K_i = object's intrinsic intensity

The process of evaluating & the illumination eqⁿ at one or more pt. is referred to as lightening the object

→ Instead of self luminosity there is a diffused non-dirⁿal source of light. The product of multiple reflections of light from ~~mam~~ many surfaces present in the envt. This is k/a ambient light

$$I = \underbrace{K_a}_{\text{Ambient coefficient}} I_a$$

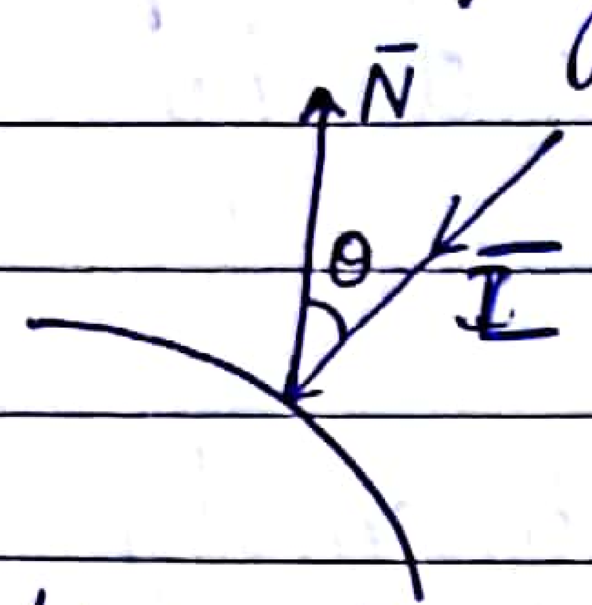
I_a = Intensity of the ambient light. Constant for all objects

K_a = Amt. of ambient light reflected from the object surfaces ranges from 0 to 1 and it depends on the materials property.

(2) Diffused Reflection

Point light

Illuminating an object by a pt. light source where rays touch the surface & uniformally Emanate uniformally in all dir^n's from a single pt. object's brightness varies from one part to another depending on the dir^n of and distance to the light source.



This reflection is also k/a Lambertian reflection.

Dull ~~mate~~ surfaces ~~like~~ such as chalk exhibit diffused reflection called Lambertian reflection. These surface appear equally bright from all viewing angles b'coz they reflect light with equal intensities in all dir^n's. Brightness depends only on angle θ b/w L & N where L is light source and N is surface normal.

$$I = K_d I_p \cos\theta$$
$$(\bar{N}.\bar{L})$$

(#) $I = K_a I_a + K_d I_p (\bar{N}.\bar{L})$

(3) Light source attenuation

If the projections of two ||el surfaces of identical material lit from the eye overlap in an image will not distinguish where one surface leaves off and other begins.

No matter how different are their distances from the light source.

$$I = I_a K_a + f_{att} \times K_d I_p (\bar{N} \cdot \bar{L})$$

$$f_{att} = \frac{1}{d_L^2} = \min\left(\frac{1}{c_1 + c_2 d_L + c_3 d_L^2}, 1\right)$$

$d_L \rightarrow$ distance from the light source

$0 < f_{att} < 1$

④ Colored lights and Surfaces

$$I_R = K_a I_{aR} O_{dR} + O_{dR} K_d I_{pR} (\bar{N} \cdot \bar{L}) \times f_{att}$$

$O_d \rightarrow$ Object's diffused color

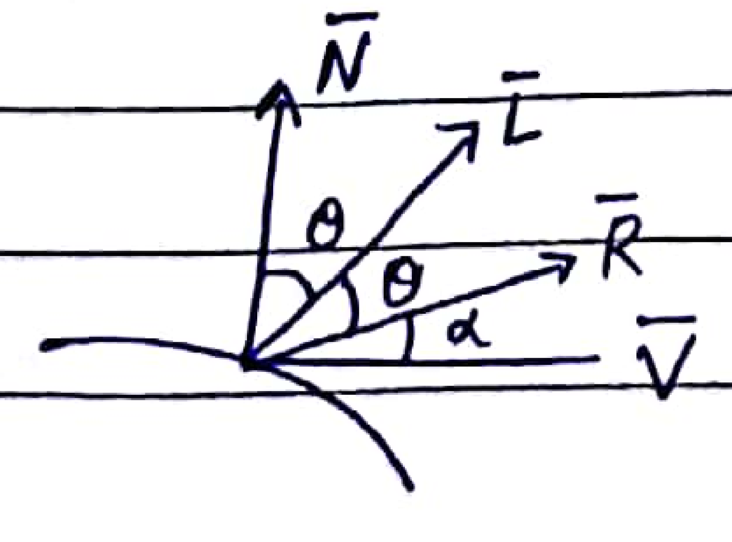
$$I_G = K_a I_{aG} O_{dG} + f_{att} K_d I_{pG} O_{dG} (\bar{N} \cdot \bar{L})$$

$$I = K_a I_{a\lambda} O_{d\lambda} + f_{att} K_d I_{p\lambda} O_{d\lambda} (\bar{N} \cdot \bar{L})$$

$\lambda \rightarrow$ Intensities of all the colors in rainbow combined.

⑤ Specular Reflection

Specular reflection can be observed on any shiny surface. Illuminate any object with the white bright light. The highlight is caused by specular reflection where the light reflected from the rest of the object is the result of diffused reflection ~~su~~ objects such as waxed apple, shiny plastics has a transparent surface composed of pigment particles embedded in a transparent material. Light specularly reflected from the colorless surface has much the same color as that of the light source.



Viewer can see specularly reflected light from a mirror only when the angle is α that is 0. α is the angle b/w R and the dir^n of the viewpoint.

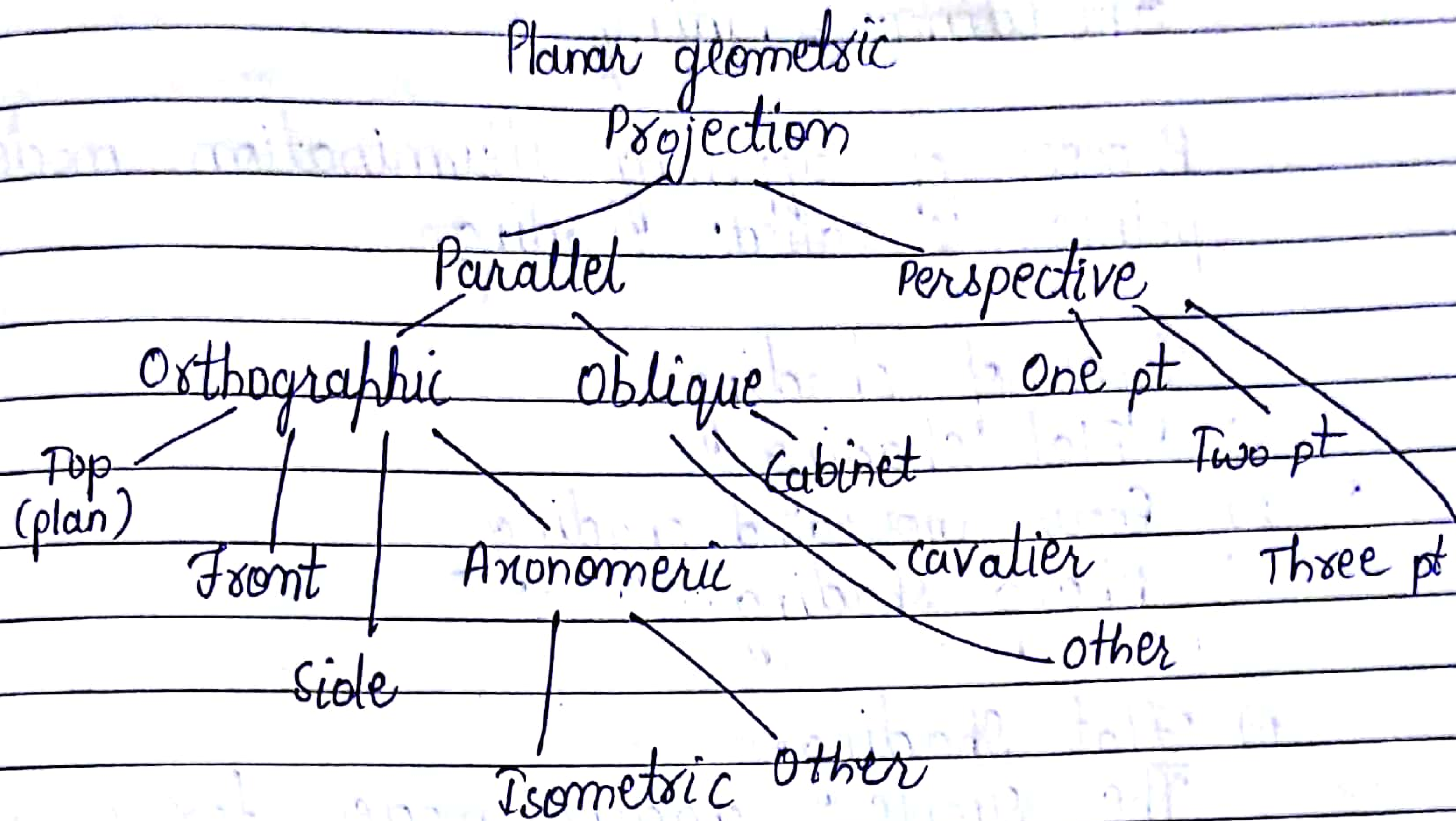
Phong Illumination Model

It assumes that max^m specular reflectance occurs when $\alpha = 0$ and falls off sharply as α increases. And this rapid ~~follow is~~ fall off is approximated by $\cos^n \alpha$, where n is material's specular reflection component. Value of n varies from 1 to several hundreds.

$$I_\lambda = I_{a\lambda} K_a O_{d\lambda} + \cancel{f_{att} K_d I_{p\lambda} O_{d\lambda} (K_d}$$
$$f_{att} I_{p\lambda} [K_d O_{d\lambda} (\bar{N} . \bar{L}) + W(\theta) \cos^n \alpha]$$

$W(\theta) = K_s$ $\quad\quad$ $\cos\alpha = \bar{R} . \bar{L}$

specular constant


Planar geometric Projection
Parallel
Perspective
Orthographic
Oblique
One pt
Two pt
Three pt
Top (plan)
Front
Side
Axonometric
Cabinet
cavalier
other
Isometric
Other

26/09/17

~~Shielding~~ Shading

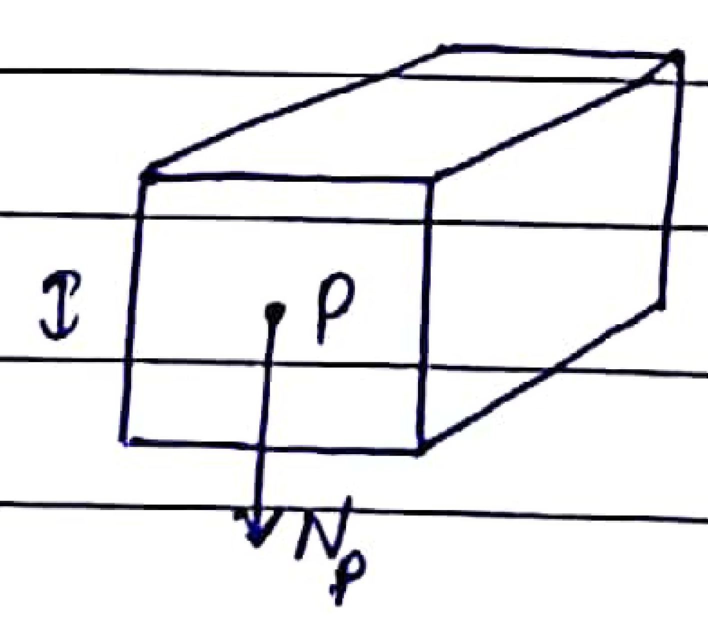
Process of applying illumination model to surface points is called Shading.

Types of shading:
1.) Flat shading
2.) ~~Grout~~ Gourand shading
3.) Phong shading

1.) Flat Shading

The simplest shading model for a polygon in which only one intensity is used for the whole polygon. Also k/a constant shading.

Step i) Select a point P on the face of the polygon
ii) Find the normal to the face.
iii) Find intensity I at pt. P.
iv) Fill the polygon with I.



Assumption:
Light source at infinity.

Advantages & Disadvantages
i) Computationally, it is fast
ii) Not smooth.
iii) ~~Give~~ ~~Mat~~ Mach Band Effect

Assumptions:
i) Light source is at infinity ($\bar{N} . \bar{L}$ = constant) means ~~accr~~ across the ~~plan~~ polygon face

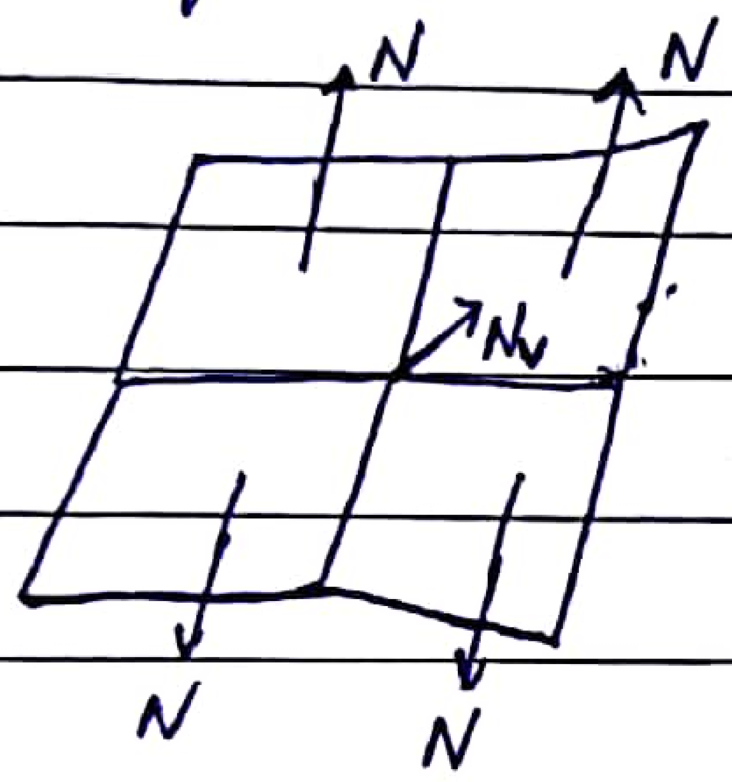
ii) The viewer is at infinity so that $\bar{N}.\bar{V}$ is also constant across the polygon face.

iii) The polygon represents the actual surface being modeled and not ~~a~~ an approximation to a curved surface.

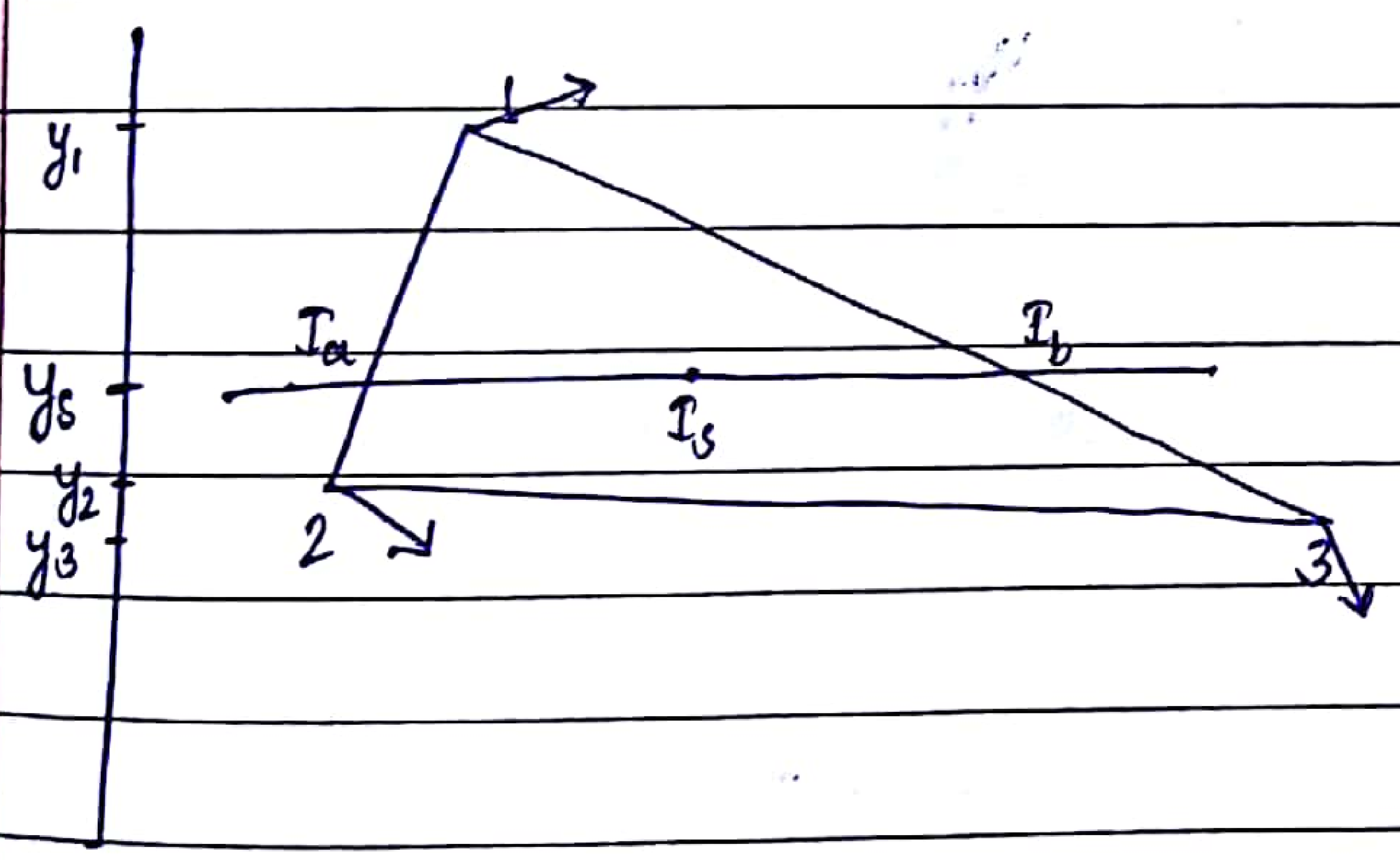
2.) <u>Gourand Shading</u>

i) It is smooth shading. It computes intensity at vertices of the polygon which needs vertex normal.

ii) Fill the interior with shade (intensity) using interpolation. Normal at the vertex is average of normal of the faces incident at the vertex.



$$N_v = \frac{\sum_{i=0}^{k} N}{|N|}$$

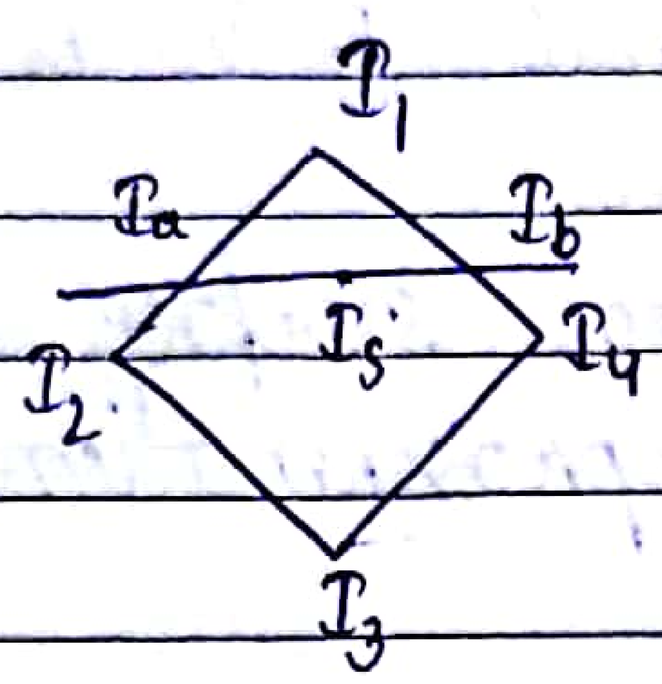


$y_s \rightarrow$ scan line

$$I_a = \frac{y_1 - y_s}{y_1 - y_2} I_2 + \frac{y_s - y_2}{y_1 - y_2} I_1$$

$$I_b = \frac{y_1 - y_s}{y_1 - y_3} I_3 + \frac{y_s - y_3}{y_1 - y_3} I_1$$

$$I_s = \frac{x_s - x_a}{x_b - x_a} I_b + \frac{x_b - x_s}{x_b - x_a} I_a$$



$$I_a = \frac{y_1 - y_s}{y_1 - y_2} I_2 + \frac{y_s - y_2}{y_1 - y_2} I_1$$

$$I_b = \frac{y_1 - y_s}{y_1 - y_4} I_4 + \frac{y_s - y_4}{y_1 - y_4} I_1$$

$$I_s = \frac{x_s - x_a}{x_b - x_a} I_b + \frac{x_b - x_s}{x_b - x_a} I_a$$

Intensity of every pt. will be different

③ Phong Shading

SMIL
Synchronized Multimedia ~~Intract~~ Integration Language

Multimedia

Multimedia is a combination of text, graphic, sound, animation and video that is delivered interactively to the user by electronic or digitally manipulated means.

Interactive Multimedia
When the user is given the option of controlling the elements.
A combination of hypertext, graphics, audio, video, (linked elements) and interactivity ~~cull~~ culminating in a complete non-linear computer-based experience is hypermedia.

Linear v/s Non-Linear

Linear
A multimedia project is identified as Linear when:
→ It is not interactive
→ User have no control over the content that is being showed to them

Non-Linear
→ It is ~~not~~ interactive
→ Users are given navigational control
→ Users have control over the content that is being showed to them.

Authoring Tools
Use to merge multimedia elements (text, audio, graphic, animation, video) into a project

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Importance of Multimedia

There are a no. of fields where multimedia could be of use. Examples are:-
→ Business
→ Education
→ Entertainment
→ Home
→ Public Places

Sound

→ Sound comprises the spoken word, voice, music & even noise.
→ It is ~~cc~~ a complex relationship involving a) vibrating object (sound source) b) transmission media or transmission medium (usually air), c) receiver (ear), d) preceptor (brain)

Unit to measure the sound - Decibel (Db)

Frequency of sound to be heard by human 20 Hz to 20k Hz

Pleasing sounds have regular waveform which is repeated over & over while noise has irregular patterns & they are non-repetitive in nature.

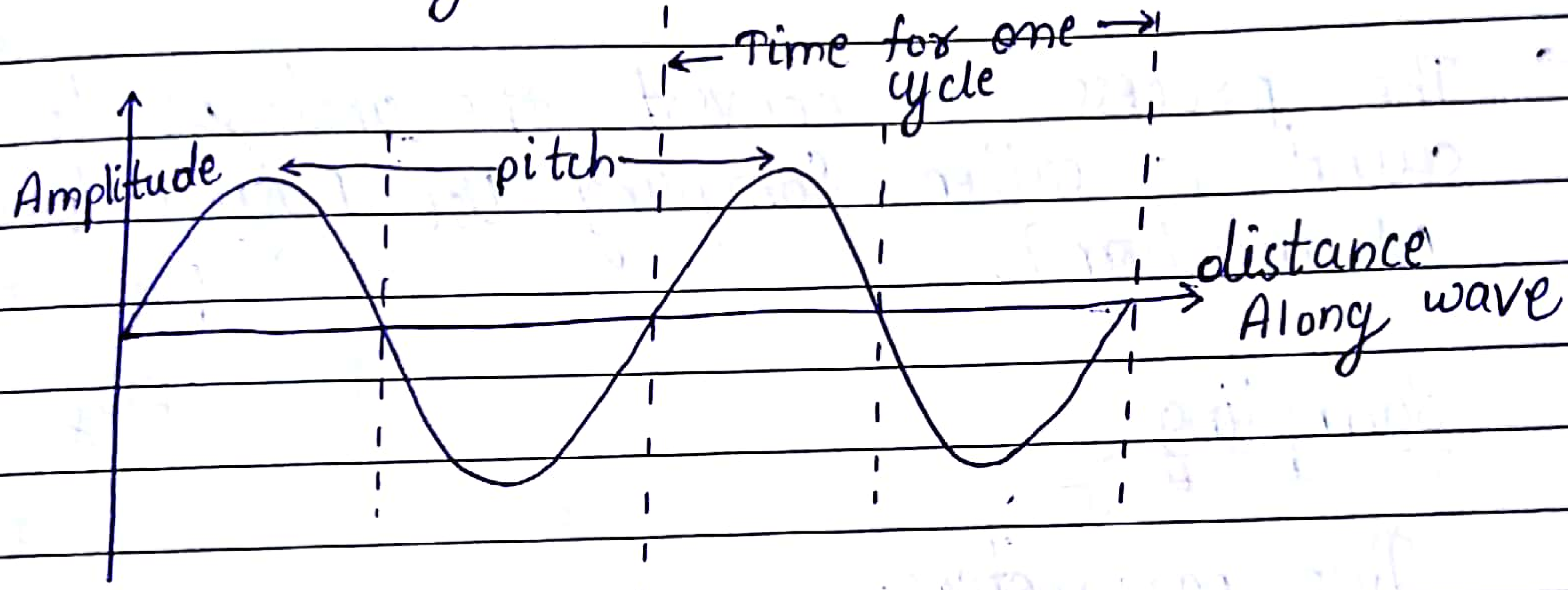
Frequency is the measure of how many vibration occurs in one second. This is measured in Hz & directly corresponds to the pitch of the sound. More frequent vibration more pitch, less frequent vibration corresponds to less pitch.

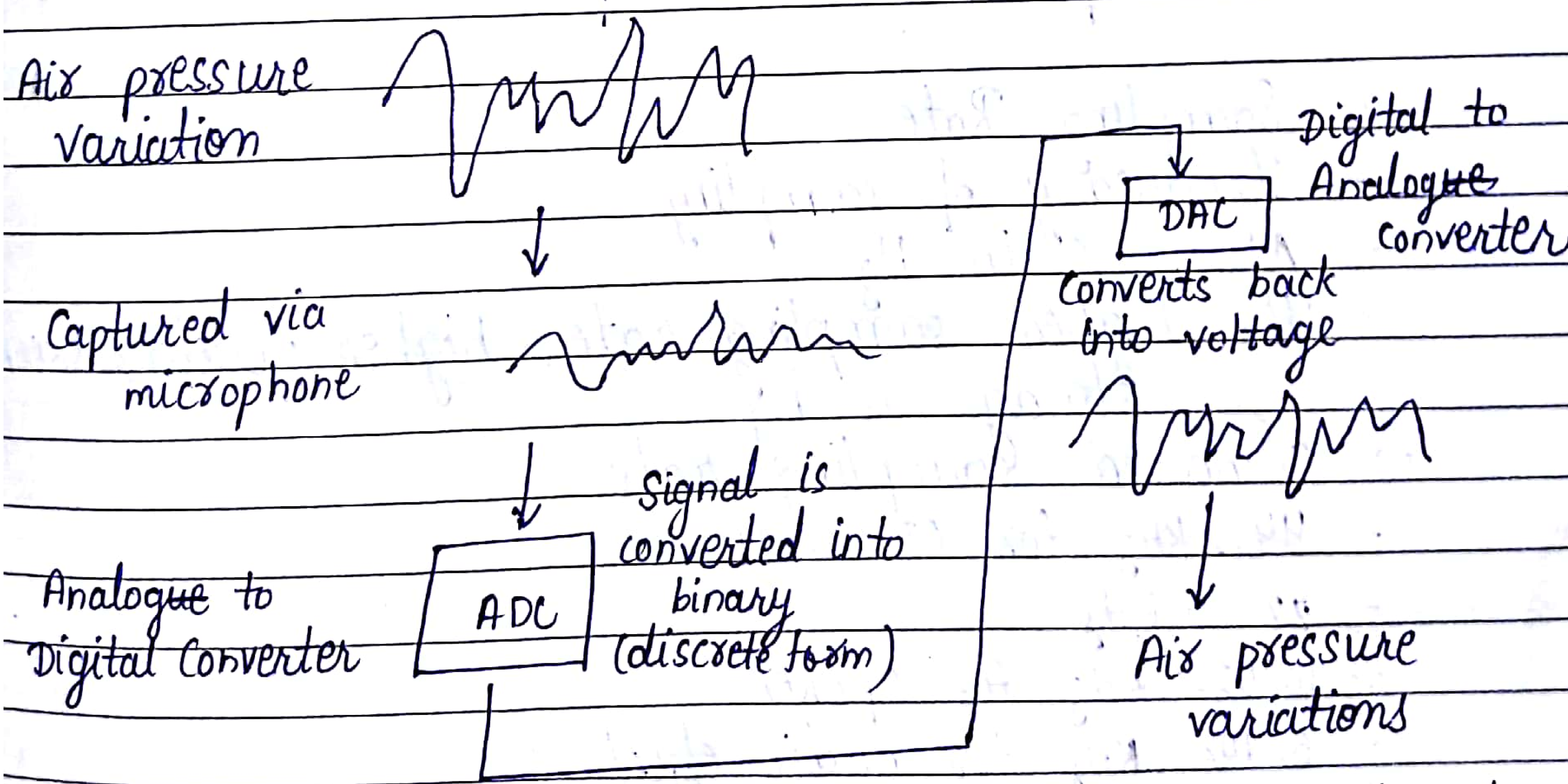
Sounds below 20 Hz - Infrasonic
Sounds above 20KHz - Ultrasonic

Frequency - No. of cycles per second or Hz

Amplitude

Sound's intensity or ~~loudness~~ loudness





An ADC is a device that converts analogue signals into digital signals.

→ Analogue signal is a continuous value
It can have any single value on an infinite scale

→ A digital signal is a discrete value
It has a finite value (usually an integer)

→ An ADC is synchronised to some clock.

→ It will monitor the continuous analogue signal at a set rate and convert what it sees into a discrete value at that specific moment in time.

→ The process to convert the analogue to digital sound is called Sampling. Use PCM (Pulse Code Modulation).

X No!

PCM = Phy Chem Math

Sampling

Two parameters:

i) Sampling Rate
→ Frequency of sampling
→ Measure in Hz
→ The higher sampling rate, higher quality sound but size storage is big.
→ Standard sampling rate:
- 44.1 KHz for CD audio
- 22.05 KHz
- 11.025 KHz for spoken
- 5.1025 KHz for audio effect

ii) Size sample
The resolution of a sample is the number of bits it uses to store a given amplitude value, e.g.
→ 8 bits (256 different values)
→ 16 bits (65536 different values)
→ A higher resolution will give higher quality but will require more memory (or disk storage)

Calculating the size of digital audio:

$$= \frac{\text{rate} \times \text{duration} \times \text{resolution} \times \text{no. of channels}}{8}$$

The ans will be in bytes
where
sampling rate - Hz
Duration / time is in seconds
resolution is in bits (1 for 8 bits, 2 for 16 bits)
no. of channels = 1 for mono, 2 for stereo, etc.

Q. Calculate the file size for 1 min., 44.1 KHz, 16 bits, stereo sound.

Sol^n - File size $= \cancel{60 \times}\ \frac{44100 \times 60 \times \cancel{16}^{4} \times \cancel{2}}{\cancel{8}\,\cancel{4}}$

$= 10584000$ bytes

Editing Digital Audio

→ Trimming
→ Slicing & Assembly
→ Volume adjustments
→ Format conversion
→ Resampling or downsampling
→ Fade ins and fade outs
→ Equalization
→ Time stretching
→ Digital Signal processing
→ Reversing Sound

MIDI - Musical Instrument Digital Interface

24/10/17

Differences b/w mp3 & midi files

1.) A MIDI file is a software for representing musical information in a digital format while in case of mp3 it is a patented encoding format for digital audio.

2.) Extension for MIDI file is .midi or .mid while for mp3 files it is .mp3.

3.) MIDI file - it is format type
Mp3 files - It follows lossy compression

4.) Computer based musical tools - MIDI files
Requires computers or ~~p~~ mobile phones - Mp3 files

5.) MIDI - less storage
Mp3 - More storage compared to MIDI files.

6.) MIDI files are narrow file format while Mp3 files are wide file format

7.) MIDI - Do not contain a recording of sound
Mp3 - while it contains recording of sound

8.) Application
Can compose in case of MIDI
while in Mp3 we can only record

9.) MIDI files are versatile
Mp3 - Less versatile

Protocol - Set of rules

Audio Engineering can be done - MIDI files

MIDI

MIDI is an industry standard protocol that enables electronic musical instruments and other equipment to communicate, control and synchronize with each other and to exchange system data.

MIDI does not transmit an audio signal or media.

The sounds are generated by the synthesizer, which receives the MIDI data.

Devices such as computers, synthesizers, keyboard controllers, sound cards and drum m/c's.

MIDI Ports
- → MIDI - In Port
- → MIDI - Out Port
- → MIDI - Thru Port is used for linking a no. of MIDI devices with single transmitter

Protocol

- → MIDI is a serial stream of data
- → Runs at 31250 bits per second baud rate
- → Describes event info.
- → Asynchronous transmission
- → A standard MIDI word consists of three bytes: first is Status byte, the second & third are Data bytes.

→ All status bytes have their MSB set to 1, whereas all data bytes have it set to 0.

To tune a MIDI device a standard specified 16 channels which identifies 128 instruments including noise effects with ~~u~~ unique no's. For eg. 0 is for piano, 40 is for violin, 73 is for flute.

The device must be set to one of the MIDI reception modes. Four modes are available: Mode 1, Mode 2, Mode 3, Mode 4

Mode 1 - OMNI ON / POLY
Mode 2 - OMNI ON / MONO
Mode 3 - OMNI off / Poly
Mode 4 - OMNI off / ~~Poly~~ Mono

- MIDI devices

MIDI synthesizers have following common components:

→ Sound generators
→ Microprocessors
→ Keyboard
→ Control Panel
→ Auxiliary controllers
→ Memory