30-04-17
1st (B) day

Data communication :-

Protocol (Rules)

IP → Internet protocol

http → hyper text transfer protocol

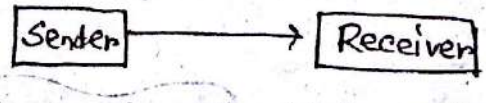
1. Senden
2. Reciever
3. Transmission medium
4. Message (যা পাঠাব অথবা, গ্রহণ করব)
5. Protocol (কিছু Rules)

→ 5 টার অন্তর্ভুক্ত Data communication

Transmission Mode :-

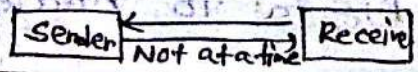
1. Simplex
2. Half Duplex
3. Full "

1. Simplex : One way communication



Example: keyboard and Monitor Relation
Scanner " file "

2. Half Duplex : Two way communication (Not at a time)

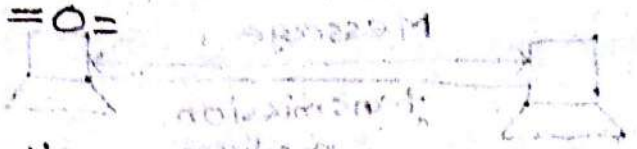


উদাহরণ (Example)

Scanned by CamScanner

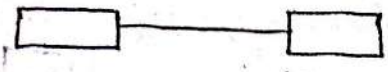
3. Full duplex: Two way communication (at a time Simulatanesly)

Example: Mobile phone

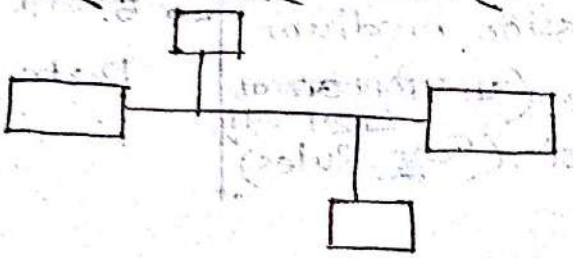


1. Point to point connection:
2. Multipoint connection:

1. Sender ও Reciever-এর মধ্যে আলাদা আলাদা connection থাকবে। One to one link.



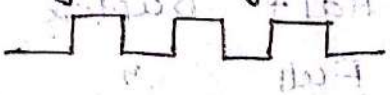
2. One to many link. Sender ও Reciever এর মধ্যে আরো link থাকতে পারে।



10101
Digital data

Digital to Digital

digital signal

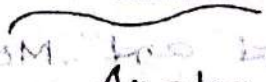


Analog signal

Analog to Digital

10101
Digital data

Analog



Analog

PSK, FSK, ASK → Digital to Analog techniques.

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দুইটা model আছে,

1. OSI model (Open Systems Interconnection)
2. TCP/IP

03-05-17
1st (D) day

Data communication :- Data communications are on the exchange of Data between two devices via some form of transmission medium such as a wire cable.

The effectiveness of Data communication:-

(i) Delivery
(ii) Accuracy
(iii) Timeliness
(iv) Jitter

→ 4 factors.

(i) The system must deliver data to the correct destination.

(ii) The system must deliver data accurately

(iii). The system must deliver data in a timely manner

(iv) Jitter refers to the variation in packet arrival time.

Physical Structure :-

Type of connection:

(i) Point to point

(ii) একটা link ও two or more device share করে multipoint connection

Scanned by CamScanner

Physical TOPOlogy: Refers to the way in which a network is laid out physically. Different way to make network design,

1) Mesh TOPOlogy
2) Star "
3) Bus "
4) Ring "
5) Hybrid "

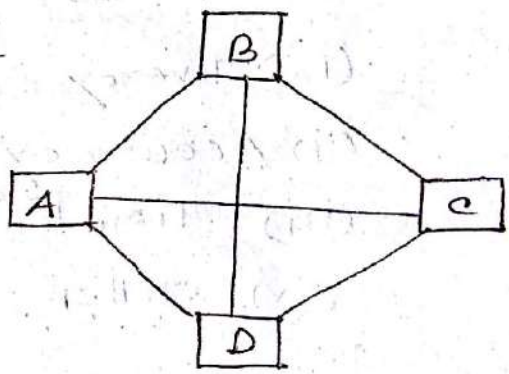
1) Mesh TOPOlogy:-

every device has poin. to point connection.

Here No. of link = $\frac{4(4-1)}{2}$

$= \frac{4 \cdot 3}{2}$

$= 6$



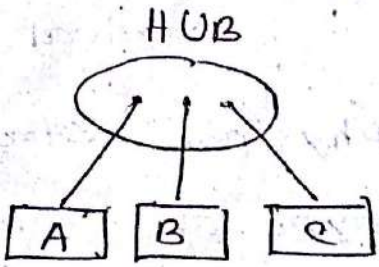
Mesh $\frac{n(n-1)}{2}$.

→ Storage connection
→ costly (because point to point)
→ একটা link নষ্ট হয়ে গেলে সমস্ত system টা কাজ করবে না
→ Data transmission fast হবে
→ যে link টা নষ্ট হয়, তা detect করা সহজ

2) Star TOPOlogy:-

Switch এর সাথে সবার connected

→ time বেশি লাগবে
→ link কম লাগছে (costly না)



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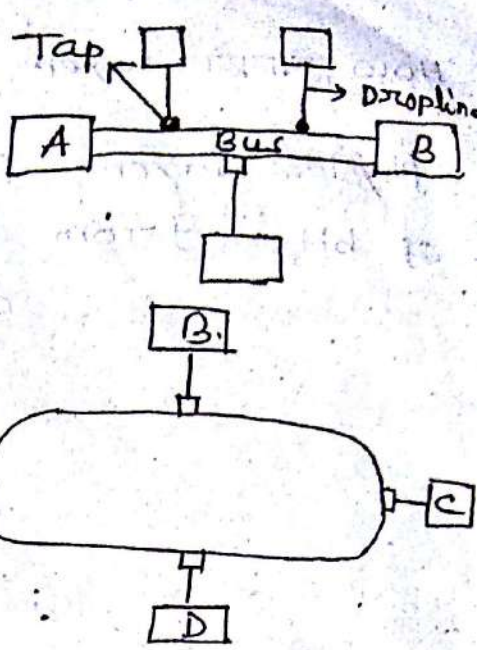
3) Bus Topology :-

Multipoint connection



4) Ring Topology :-

We connect here by link

⇒ একটা link নষ্ট হলে অন্যান্য system link নষ্ট হয় না।

⇒ যেই link টা নষ্ট হয়, তা detect করা যায়

= ০১

~~Hoo~~

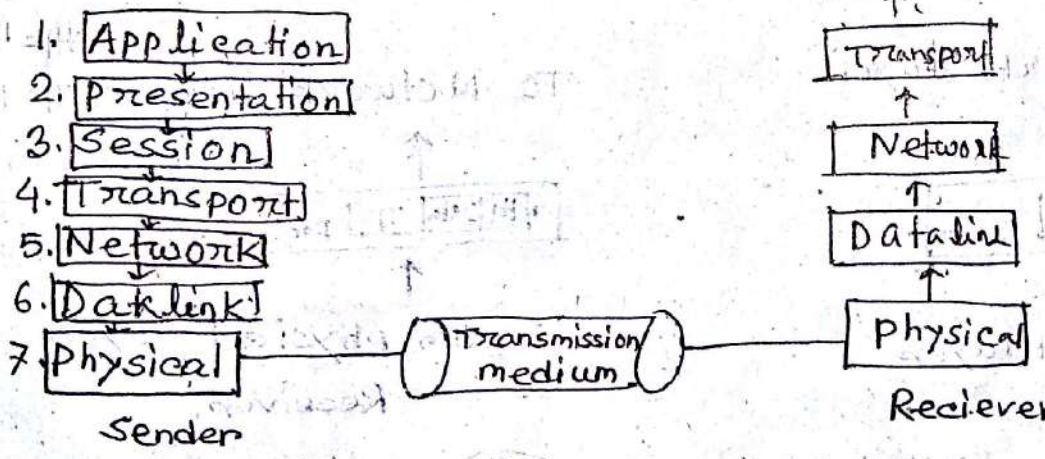
06-05-2017
1st (E)day

Network model :-

আমাদের basic model হল OSI model.

OSI → Open system Interconnection model

7 টা layer নিয়ে তৈরী,



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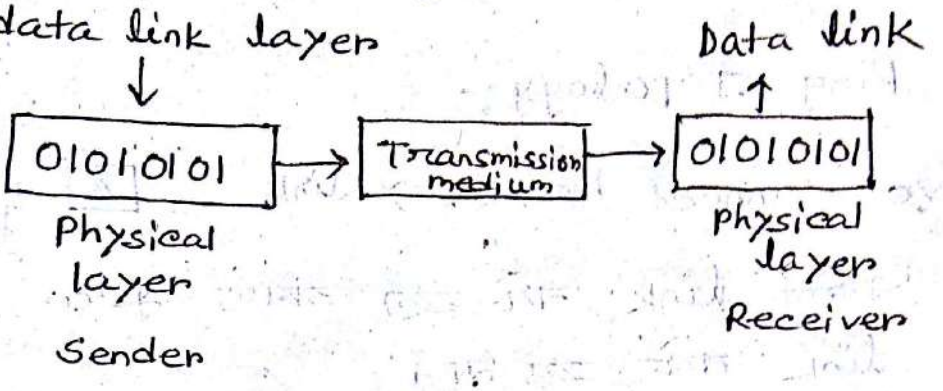
Now আমরা layer গুলোর কাজ দেখব,

Physical layer :- Physical layer is responsible for movements of bits from one hop (node) to the next.

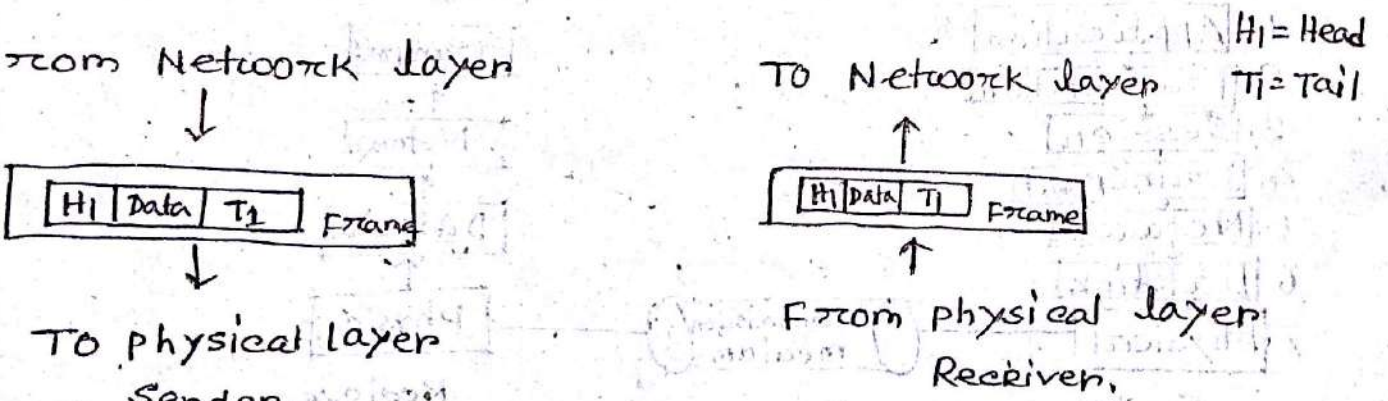


আরো কাজ :-

→ Representation of bit
→ Data Rate (No. of bit per second)
→ Sychronization of bits (Sender ও Reciever এ same bit থাকে)
→ Line configaration
→ Physical topology
→ Transmission mode (Simplex, half duplex, full duplex)
→ Hardware related

Data link layer :- Data link layer is responsible for moving frames from one hop (node) to the next.

H1 = Head
T1 = Tail



Other Responsibilities :-

→ Framing
→ physical Addressing (H1, T1 add করা)
→ Flow control (sender যেই rate এ send করবে, Receiver সেও-একই rate এ receive)
→ Error control
→ Access control (দুই বা তারচেয়ে বেশি PC একই সাথে Access চাচ্ছে same সিদ্ধান্ত, নাহলে decide করা)

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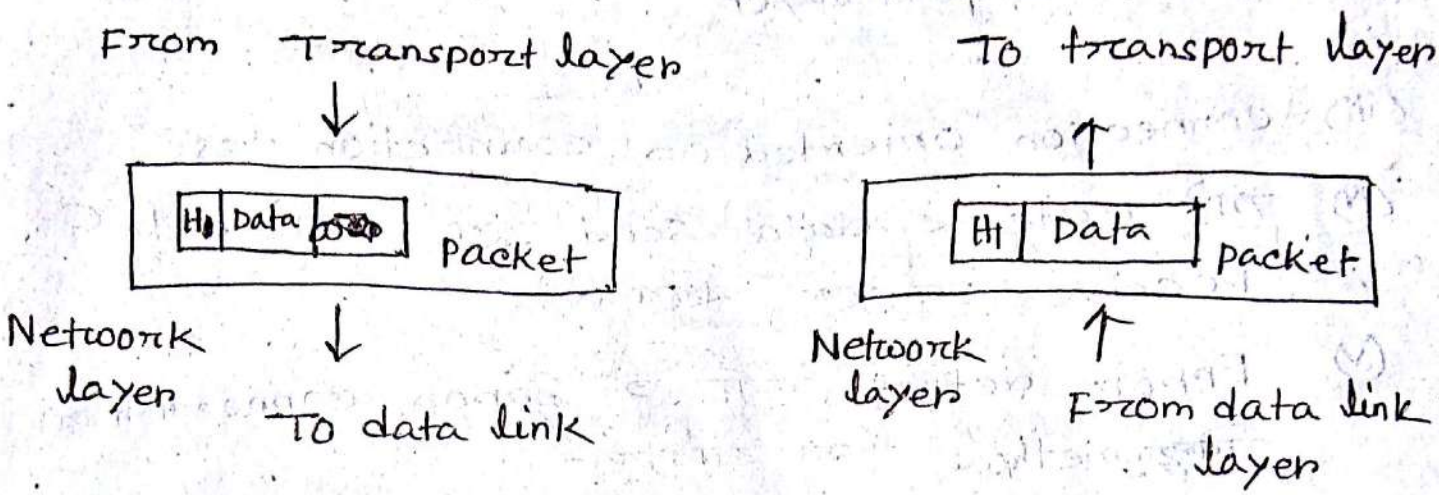
Error control: Error detect করা, Error correction.

Network layer:- Network layer is responsible for the delivary of individual packets from the source host to the destination host.



Other responsibilities:-

→ logical addressing (যেমন: IP Address)

→ Routing (কতগুলো network interconnection হয়ে একগন্তব্যে যুক্ত হয়)

packet
↓
farame
↓
bit stream

08-05-17
2nd (B) day

Transport layer:- Transport layer is responsible for the delivery of message from one process to Another.

Other responsibilities:-

(i) service point addressing
(ii) segmentation and reassemply (বড় message ছোট ছোট segment করে পাঠাবে এবং number দিবে, যাতে order চেঞ্জ না হয়)
(iii) connection control
(iv) Flow control
(v) Error control.

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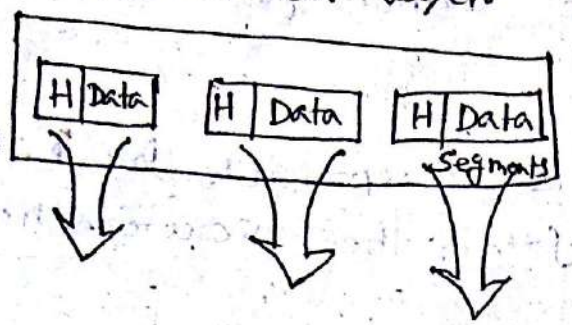
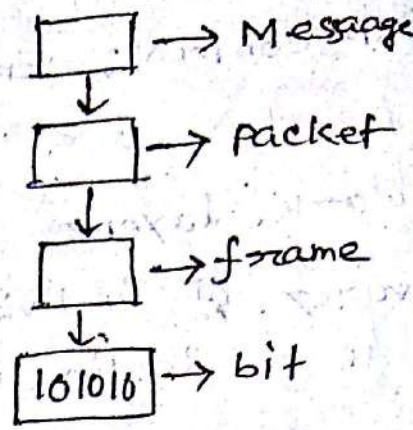
From session layer



TO Transport layer



(iii) connection oriented or connection less

(iv) যেই rate এ data send হবে, সেই rate এ receive করতে হবে

(v) Error detect করা ও Error correction করা কিছু method এর মাধ্যমে-

(i) address { logical → Network layer থেকে পাই
Physical → Data link " " "
Port → Transport " supply করে

message টাকে পড়া authentic করে যেন সেই Port address এর মাধ্যমে।

Session layer:- Session layer is responsible for dialog control and synchronization।

.Dialog control:- The session layer allows two system ~~two can~~ enter a dialog. It allows the communication between two processes to take place in either half duplex ⊕ mode or Full duplex mode.

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Synchronization: Message টাকে segmentation এ ভাগ করলাম 100 টা packet এ ভাগ করলাম। প্রথম 10 or 20 or 30 টা যাওয়ার পর বলবে বাকি গুলা বা বাকিগুলো পাঠানোর কথা বলা হবে। 30 টার পর যদি না যায় তবে বুঝব যে problem আছে। তখন যেখানেরটা আবার send করব।

Presentation layer: Presentation layer is responsible for (1) Translation (2) Compression & (3) Encription

(1) একেক device একেক operating system use করে। তখন একজন এক device থেকে আরেক device এ পাঠালে, compiler নিজের operating syetem অনুযায়ী translate করবে।

(2) Message ইচ্ছা করলে zip করে পাঠানো যায়।

(3) আমাদের message টাকে encript করি যাতে তা hack না হয়।

Application layer: Application layer is responsible for providing service to the user.

(i) File transfer, Access, Management
(ii) ~~Access~~ Mail service
(iii) Directory service

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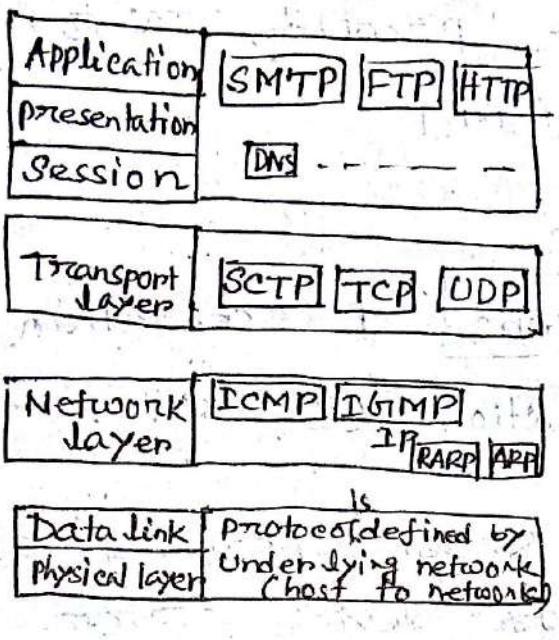
13-05-17
2nd (d) day

TCP/IP Model :- ~~কিছু কিছু~~ layer ও fixed protocol থাকে।



host to network

TCP → Transmission control protol

IP → Interenet protocol

protocol: protocol defined by underlying network (host to Network)

- At physical and data link layer, TCP/IP does not define any specific protocol.
- Network layer:

Internet protocol (IP):- (logical Address provide করবে)

Address Resolution protocol (ARP):-

- is used to associate a logical address with a physical address.

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Reverse Address Resulation protocol (RARP)

- Allow a host to discover it's internet address when it knows only its physical Address.

ICMP → Internet control Message protocol

IGMP → " group "

UDP → User datagram protocol.
Process to process transmisson control করবে।

TCP → Transmission control protocol
একটার পর transmission হবে, আগে যাতে কোন problem না হয়, provide full transport layer service to the Application layer.

SCTP → stream control transmission protocol
তখনই active হবে, যখন নতুন function or feature add হবে তখন কাজ করবে

FTP → File transfer protocol

DNS → Domain Name server

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14-05-17
2nd (E) day

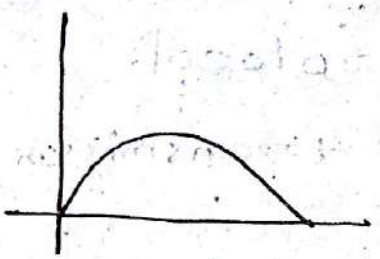
Chapter3: Data & Signal

Analog Data:- continuous time, continuous কিছু value নিয়ে Analog data

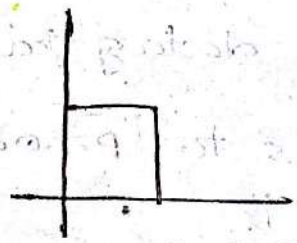
Digital " :- Discrete " , Discrete কিছু value নিয়ে Digital data

Analog Signal:- Analog Data গুলা নিয়ে যে signal

Digital " :- Digital " " " " " "



Analog data with signal

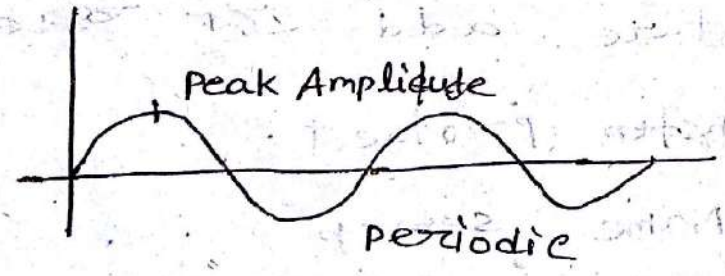


Digital data with signal

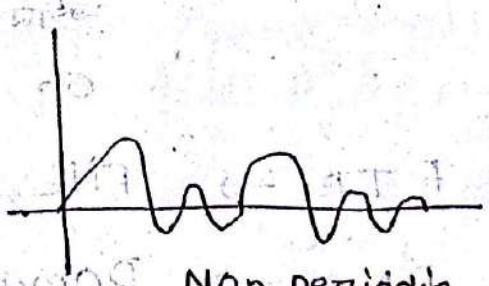
Periodic signal: নির্দিষ্ট time পর পর একি period ফিরে আসে

NOn " " : " " " " " period না আসে

একটা complete cycle তৈরী করতে যে সময় লাগে timeperiod এক থেকে যতগুলো ~~time~~ complete signal হয় তখন তাকে frequency বলে।



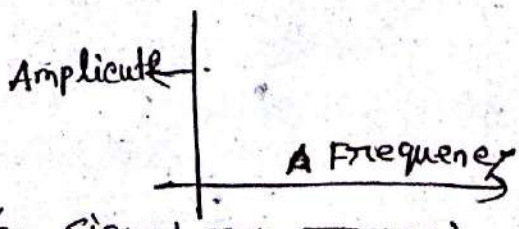
periodic



NOn periodic

Signal characteristics:-

1) Amplicute
2) Frequency
3) phase (যে কোন মুহূর্তে signal এর অবস্থা)



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Signal এর highest value কে বলা হয় peak Amplicuteএ

$100ms = 100 \times 10^{-3} s$

$100ms = 100 \times 10^{-3} \times 10^{6} \mu s$

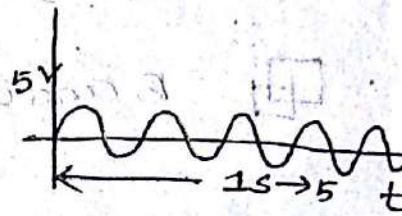
$f = \frac{1}{T} = \frac{1}{105}$

তরঙ্গদৈর্ঘ্য $(\lambda) \rightarrow \lambda = \frac{c\ m/s}{f\ Hz} = m$

V, V.I

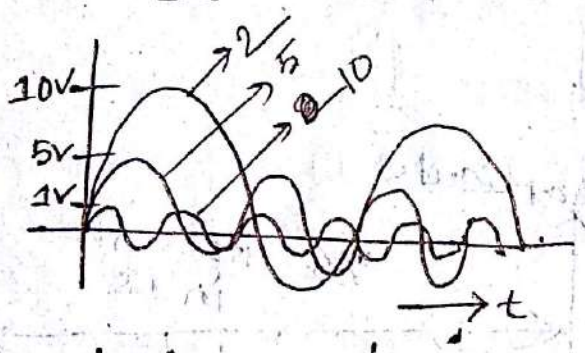
i) Time Domain & ii) frequency Domain কি? samefreq কি হবে।

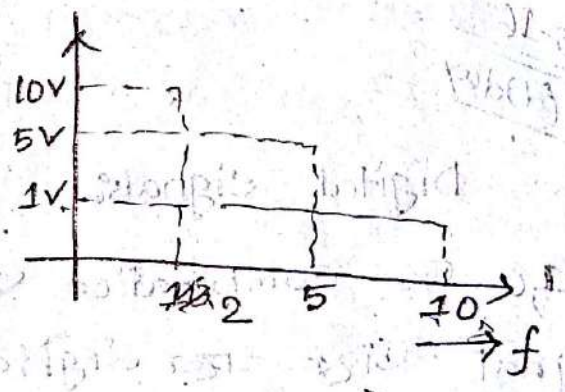
i) Time এর respect এ যে signal এখানে complex দেখা যায়।



ii) Frequency " " " " 5

এখানে অচ্ছ কোন দেখায় Time domain এর তুলনায়।





একেবে same frequency হবে দুই ক্ষেত্রে

অনেক গুলা signal Add করে যে signal পাওয়া যায় তাকে composite signal বলে।

Bandwidth:- The bandwidth of a composite signal is refered to as the difference between the highest frequences and lowest frequencies contained in that signal.

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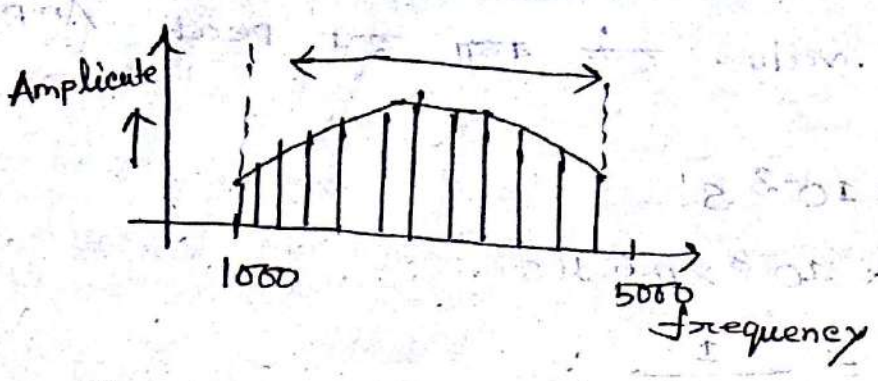


Bandwidth = (5000 - 1000) Hz = 4000 Hz

- frequency 100, 300, 500, 700, 900 Hz

  Bandwidth = (900 - 100) Hz = 800 Hz

- Bandwith 20 Hz, highest = 60 Hz, lowest = ?

  $20 = 60 - l_w$

  $\Rightarrow l_w = 40$ Hz

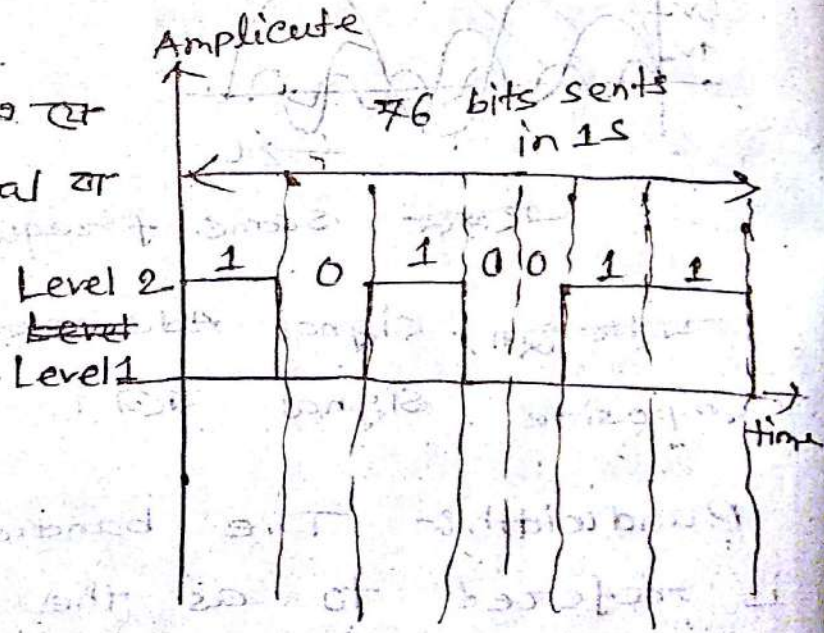
20-05-16
3rd (d) day

Digital signals:-

1,0 এর combination থাকে signal কাকে বলে digital বা Discreat signals.

info থাকলে → 1

" না " → 0



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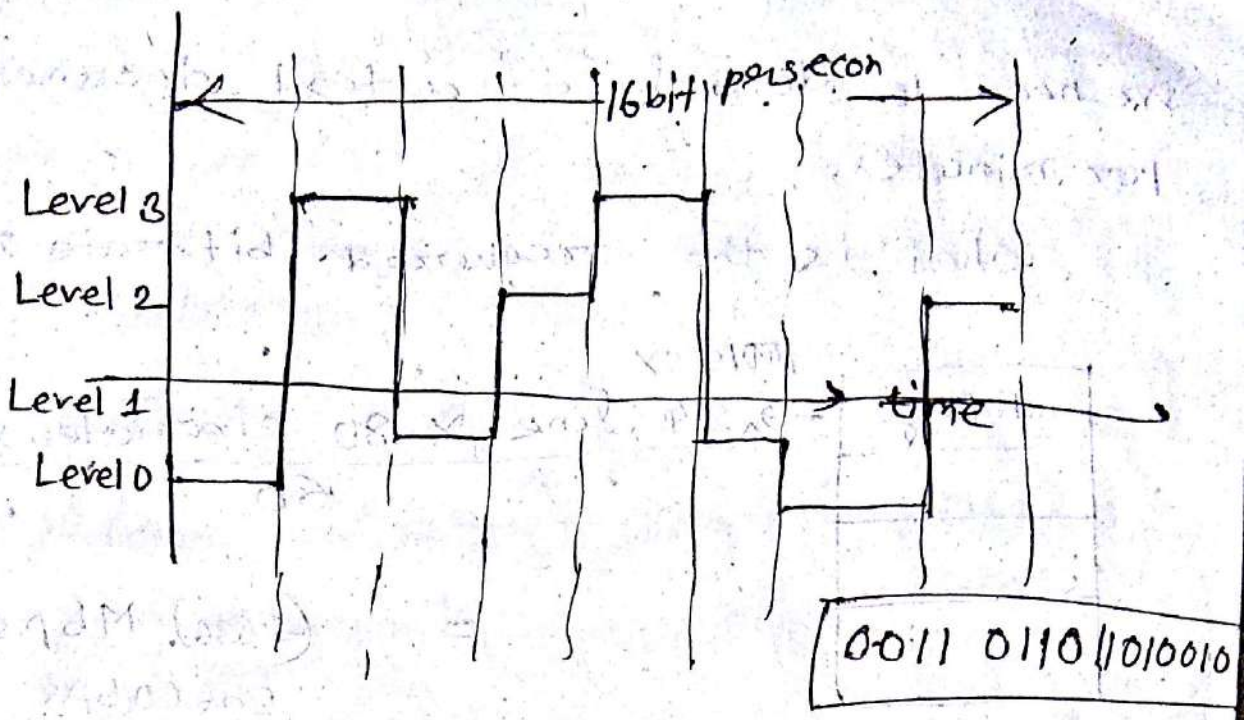


$2^r = 4 \rightarrow 00 \rightarrow 0$
$01 \rightarrow 1$
$10 \rightarrow 2$
$11 \rightarrow 3$

at a time 3 bit send করতে চাই তাহলে $\log_2 L$

যখন, level, $L = 8$ $= \log_2 3$

$= 3$

8 টা level হলে at a time 3 bit send করব

অবশ্যই level টা integer হবে, যে bit পাওয়া যাবে

সেটাও integer হবে।

$\log_2 9$ হলে $= 3.2$, তখন consider করব 4 bit

$= 0 =$

000 → 0
001 → 1
010 → 2

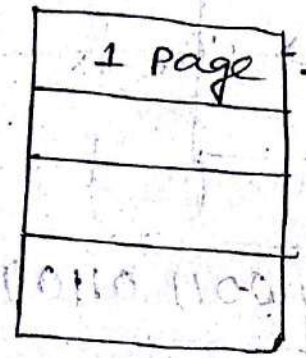
তখন 4 bit করে নিয়ে

0000 → 0
00

Scanned by CamScanner

We need to download a text document 100 page per minutes,

What is the required bit rate of the channel?



100 page ×

$$\rightarrow \frac{24 \text{ line} \times 80 \text{ character} \times 8 \text{ bit} \times 100}{60}$$

$$= \frac{(1.636)\ \text{Mbps}}{256\,00\ \text{bps}}$$

Bit rate → No of bit per second

Bit length → propagation speed × bit duration

→ ms-1 × s

→ [8m – উত্তর]

Transmission Impairment :- (যখন কিছু ঘটনা যার জন্যে signal টা perfectly Receive না পৌঁছায়)

i) Attenuation (loss of energy)

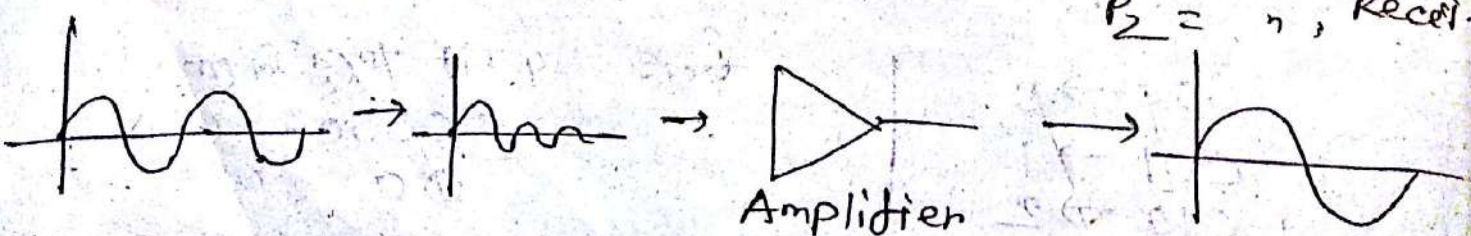
ii) Distortion

iii) Noise

energy টা change হয়ে গেল হয় signal টার

P_1 = Power of sender

P_2 = ", Receiver



decibel, $dB = 10 \log_{10} \frac{P_1}{P_2}$

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Example

$$dB = 10 \log_{10} \frac{P_1}{0.5 P_1}$$

$$= 10 \log_{10} \left(\frac{1}{0.5}\right)$$

$$= 3.01 \text{ dB}$$

$P_1 = P_1$

$P_2 = \frac{1}{2} P_1$

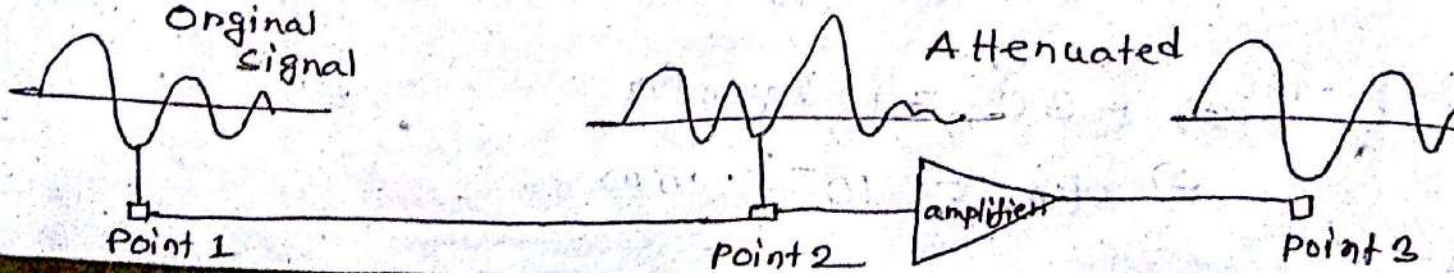
$= 0.5 P_1$

Positive আছে, তার মানে loss positive, loss থাকে loss negative আসলে loss কমে।

21-05-2017
3rd (E) day

Transmission Impairment:- Signals travel through transmission media, which are not perfect. The perfection causes signal impairment. This means that the signal at the begining of the medium is not the same as the signal at the end of the media. What is sent is not what is received. Three causes of impairment are attenuation, distortion and noise.

Attenuation: Attenuation means a loss of energy when a signal, simple or composite, travels through a medium, it losses some of its energy in overcoming the resistance of the medi



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$$dB = 10 \log_{10} \frac{P_2}{P_1}$$

Variables P_1 and P_2 are the powers of signal at point 1 & point 2 respectively.

Example

$$dB = 10 \log_{10} \frac{P_2}{P_1}$$

$$= 10 \log_{10} \frac{0.5 P_1}{P_1}$$

$$= -3 dB$$

এখানে loss হচ্ছে

$P_1 = P_1$

$P_2 = \frac{1}{2} P_1$

Another example

loss of energy $dB = 10 \log_{10} \frac{10}{1}$

$= 10 \times 1$

$= 10 dB$

এখানে gain হচ্ছে, loss হচ্ছে না (+) আছে

$P_2 = 10 P_1$

$P_1 = P_1$

Another example

Power in miliwatt, $P_m = \frac{P_2}{P_1}$

$dBm = 10 \log_{10} \frac{P_2}{P_1}$

$= 10 \log_{10} P_m$

$\Rightarrow -30 = 10 \log_{10} P_m$

$\Rightarrow P_m = 10^{-3}$ mw

$dBm = -30$

$P_m = \frac{P_2}{P_1} = ?$

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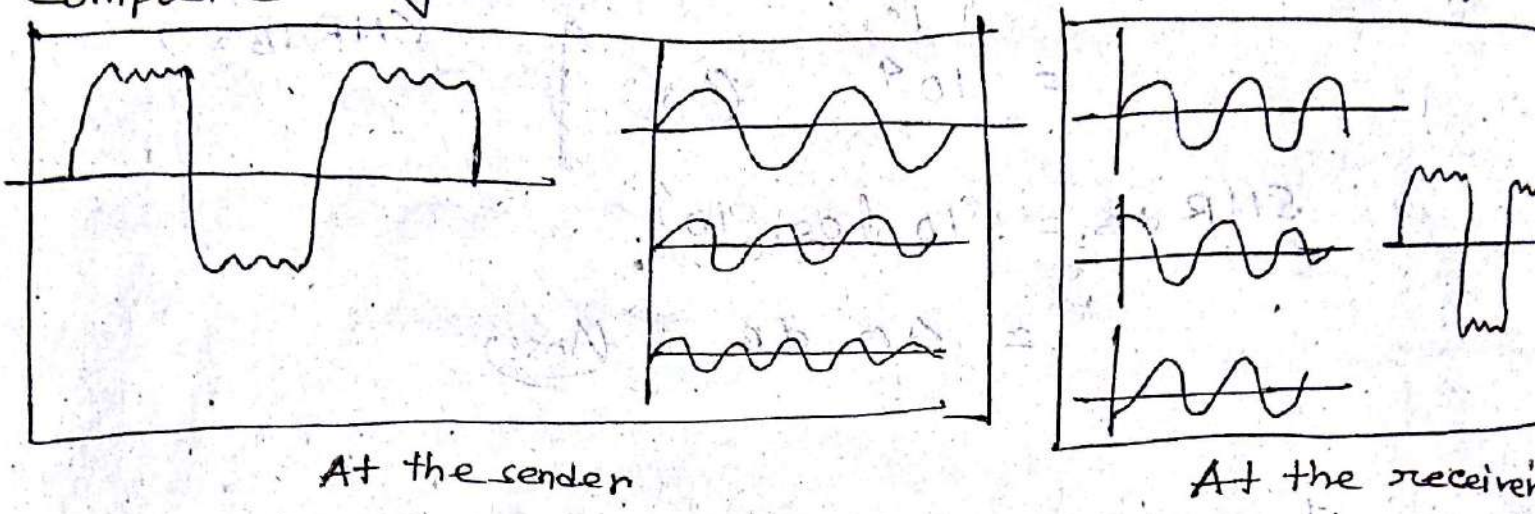
~~Ans~~ :

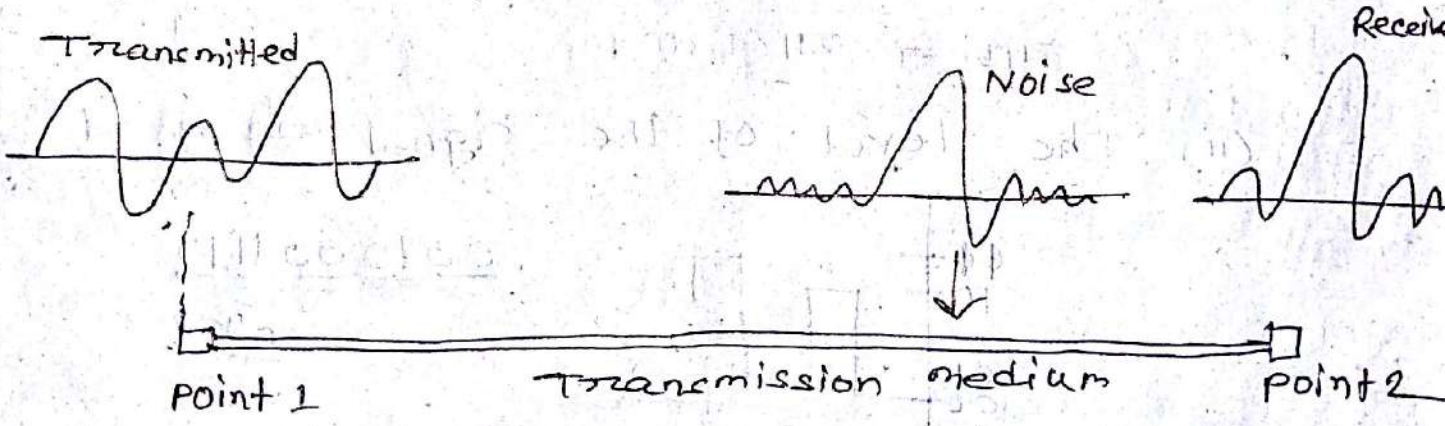
Distortion : Distortion means that the signal changes its form or shape. Distortion can occur in a composite signal made of different frequency.



At the sender

At the receiver

Noise: Noise is another cause of impairment. Several types of noise such as thermal noise, induced noise, cross talk noise and impulse noise, may corrupt the signal.



The signal to noise relation is defined as,

$$SNR = \frac{\text{Avg. signal power}}{\text{Average Noisse power}}$$

$$= 10 \log_{10} SNR$$

SNR খুব High হলে noise খুব কম, SNR > 1 হলে

" " less " বেশি SNR < 1 "

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Example

Signal power, $P_1 = 10\,mW = 10^4\,\mu W$

Noise ; , $P_2 = 1\,\mu W$

SNR = ?

SNR_{dB} = ?

$$SNR = \frac{P_1}{P_2} = \frac{10^4}{1} = 10^4 \quad \text{(Ans:)}$$

$$SNR_{dB} = 10 \log_{10} 10^4 = 40\ dB \quad \text{(Ans:)}$$

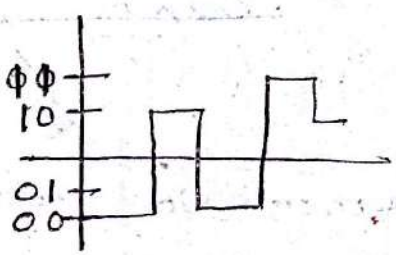
03-07-17
4th (B) day

Data rate Limit :- 3 factor needs :-

(i) Bandwidth of the channel :

Bandwith কম থাকলে data rate বাড়ানো যাবে না।

(ii) The level of the signal we used



00 10 00 11 10

2^2

(iii) The Quality of the channel signal : (the level of noise)

noise বেশি হলে quality খারাপ

" কম " " ভালো

Bit rate :-

No. of Bit per second.

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Noiseless channel :- Nyquest Bit Rate

Maximum Bitrate,

$$\text{Bitrate} = 2 \times \text{Bandwidth} \times \log_2 L$$

[Level যে power of 2 হবে]

Noisy channel :- Shannon capacity

Theoritical highest data Rate formula,

$$\text{Capacity} = \text{Bandwidth} \times \log_2 (1+SNR)$$

↳ Signal noise Ratio

$$SNR = \frac{\text{Avg signal power}}{\text{noise}}$$

দেওয়া আছে,

$BW = 3000\ Hz$

$L = 8$

Bitrate = ?

$$\text{Bitrate} = 2 \times BW \times \log_2 L$$

$$= 2 \times 3000 \times \log_2 8$$

$$= 18000\ bps$$

Ans.

দেওয়া আছে,

Bit rate = 265 Kbps = 265000 bps

BW = 20 KHz = 20000 Hz

L = ?

$$265000 = 2 \times 20000 \times \log_2 L$$

$$\Rightarrow L = 2^{6.625}$$

$$\Rightarrow \log_2 L = 6.625$$

$$\Rightarrow L = 2^{6.625} = 98.7 \text{ level}$$

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এখন level কে 128 তে নিয়ে যাব,

Now, Bit rate = $2 \times 20000 \times \log_2 128$

$= 2,80,000$ bps

$= 280$ Kbps

এখন level কে 64 তে নিয়ে যাব,

Bit rate = $2 \times 20,000 \times \log_2 64$

$= 2,4900$ bps

$= 240$ Kbps

level কখনো floating value হবে না।

$= 0 =$

যদি SNR = 0 হয়

capacity = $BW \times \log_2 (1+SNR)$

$= BW \times \log_2 (1+0)$

$= BW \times \log_2 1$

$= 0$

অর্থাৎ কোন Noise থাকবে না। data transmit হবে না। Noise কিছু থাকতে হবে।

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We know,

$$\text{Capacity} = 2 \times BW \times \log_2(1+SNR)$$

$$= 2 \times 2 \times 10^6 \times \log_2(1+10^{3.6})$$

$$= 2 \times 10^6 \times \log_2(1+3981)$$

$$= 24 \text{ Mbps}$$

(Ans:)

দেওয়া আছে,

$$SNR_{dB} = 10 \log_{10} SNR$$

$$= 36$$

$$36 = 10 \log_{10} SNR$$

$$\Rightarrow \log_{10} SNR = 3.6$$

$$\Rightarrow SNR = 10^{3.6}$$

$$= 3981$$

$BW = 2 \text{ MHz}$

Capacity = ?

=0=

Throughput:- Throughput is a measure of how fast we actually send data through a network. ধরি, একটা network এর Bit rate = 10 Mbps. It can send 12000 frame per minute, each frame can carry 10,000 bit. Throughput = ?

$$\text{Throughput} = \frac{12000 \times 10000}{60}$$

$$= 2 \text{ Mbps}$$

Propagation time: 1 টা bit source থেকে destination পৌঁছাতে যে সময় নেয়।

$$\text{Propagation time} = \frac{\text{Distance}}{\text{propagation speed}}$$

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Propagation time = $\frac{12000 \times 1000\,m}{2.4 \times 10^8\,m/s}$

= 50 ms.

distance = 12000 km

propagation speed = 2.4×10^8 m/s

propagation time = ?

Transmission time: ~~Whole~~ সমস্ত message টা sender থেকে destn পৌঁছাতে যে সময় লাগবে।

$$\text{Transmission time} = \frac{\text{Message size}}{\text{Bandwidth}}$$

exam এ যদি আগে propagation time ও Transmission time বের করতে দিতে পারে,

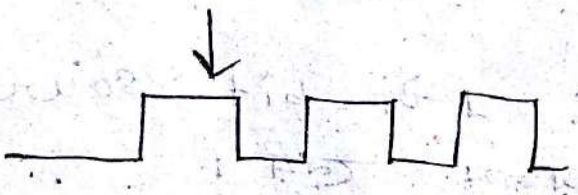
= 0 =

05-07-2017
4th(D)day

Digital Transmission

Digital to Digital conversion:-

10101100 1010 ——→ Digital data



→ Signal

• Digital data থেকে Digital signal করাকে বলা হয় D. to D. conversion.

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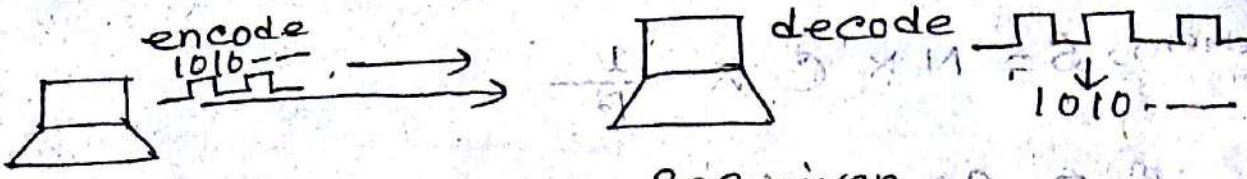
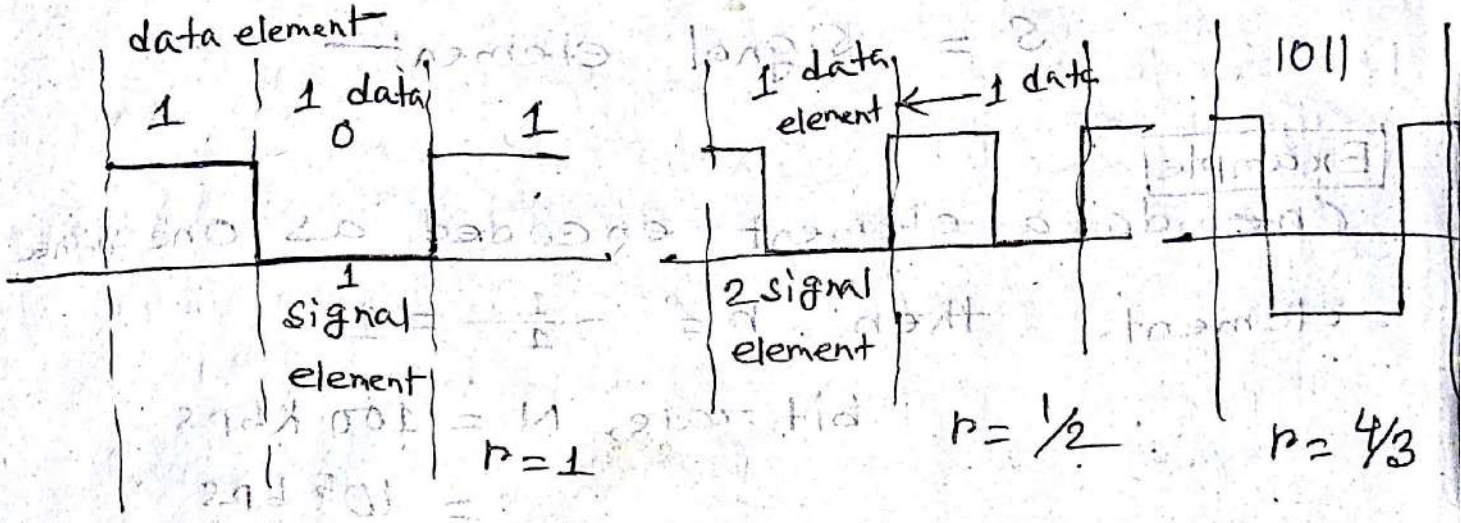


Line coding technique: one kind of technique where we can do D. to D. conversion.

Data element vs signal element :-



1 signal element : 1 টা data থাকেও হয়।

2 " " : 2 " "

Data element = bps
(what we need to send)

Signal element = baund rate / pulse rate / modulation rate

(1 sec. Second এ কতগুলো ~~data~~ pulse sent হয়)

(carrier, যার মাধ্যমে send করা হয়)

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Signal element, $S = N \times C \times \frac{1}{r}$

C = case factor

N = Number of bits per second

r = 4 bit থাকলে 3 টা signal বহন করে

then $r = 4/3 = \frac{\text{bit}}{\text{number of signal}}$

→ 1 second এ কতগুলো bit যাবে

S = Signal element

Example

One data element encoded as one signal element, then $r = \frac{1}{1} = 1$

bit rate, N = 100 Kbps

$= 10^5$ bps

case factor between 0 & 1

Now, C = 0.5

Avg. Signal rate, S = ?

$S = N * C * \frac{1}{r}$

$= 10^5 \times 0.5 \times 1$

$= 50\,000$ baud

C = 0 হলে worst case

C = 1 হলে Best case

Avg case

$C = \frac{0+1}{2}$

$= 0.5$

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Minimum Bit rate: Band width

$$B_{min} = C \times N \times \frac{1}{n}$$

$= 0 =$

D. to D. conversion problem:-

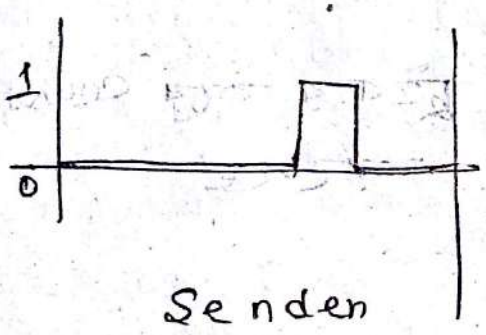
i) Baseline wondering
ii) DC component
iii) self synchronigation

} Factor of Digital to Digital conversion

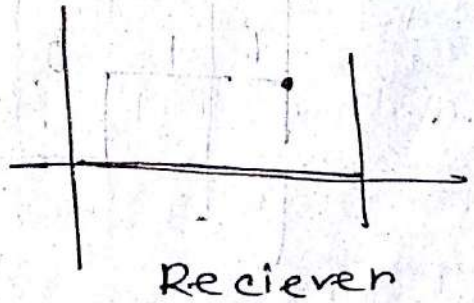
(i) (i) ও (ii) এর অনেক মিল আছে।

000000 1 00000

String এর bit sequence টা যদি অনেকগুলা 0 এর পর 1 বা অনেক 1 এর পর একটা 0 থাকে avg value count করে, তখন 1 কে 0 বুঝে নেয় Reciever। তখন signal টাকে আর 0 হয়।



Senden



Reciever

এটা Baseline wondering problem.

(ii) ~~conse~~ 1111110 1111111

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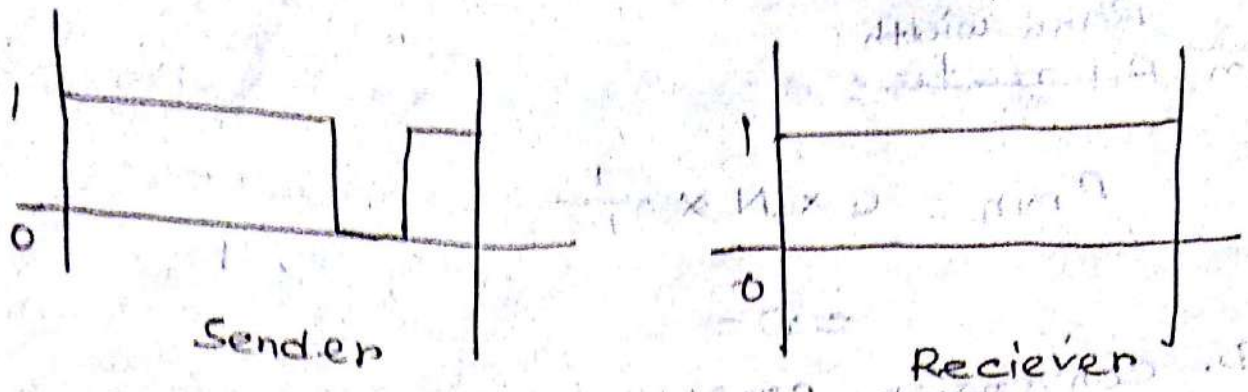
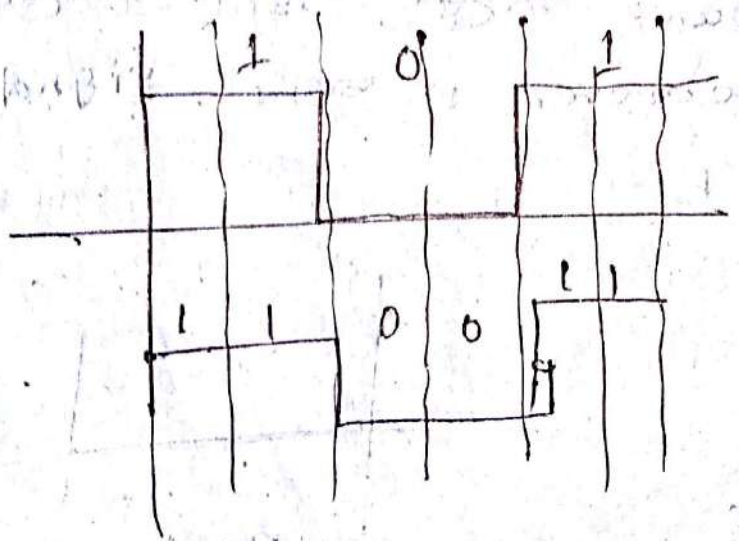


অবস্থাকে ⓒ 1 হিসেবে count করে।
এটাই DC component problem.

(iii) Sender যে সময়ের মধ্যে send করছে Receiver যে সময়ের মধ্যে Recieve করতে না পারে, যদি synchronization না থাকে তবে তাকে (iii) বলে। এক্ষেত্রে delay হয়, পর পর দুইটা 1 or পর পর দুইটা 0 Receive করবে।



দুইবার করে count করতেছে

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08-07-17
~~5th (A) day~~
4th (E) day

Line coding scheme :- (disadvantage, advantage সহকারে যেকোনো ২টা)

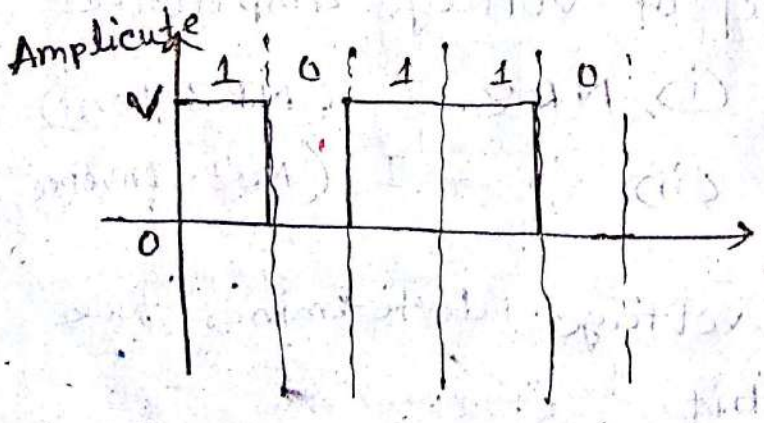
1. Unipolar → NRZ (Non return to Zero)
2. Polar → NRZ, RZ, and biphase (Manchaster, Differential Manchaster)
3. Bipolar → AMI and pseudoternary
4. Multilevel → 2B/1Q, 8B/6T and 4D-PAM
5. Multitransition → MLT-3

① Unipolar scheme :-

All the signal levels are on one side of the time axis either above or below.

Non return to zero (NRZ)

- Positive voltage define bit 1 & Zero voltage define bit 0
- It is called NRZ because the signal does not return to zero at the middle of the bit.



~~Positive দিক নেবে এখানে consider করা হয়~~। যে কোন একদিকে থাকবে signal যে either (+) or (-) দিকে থাকবে। তাই unipolar scheme এখানে signal এর bit এর মাঝে transition হয় না। এজন্য বলা হয় NRZ

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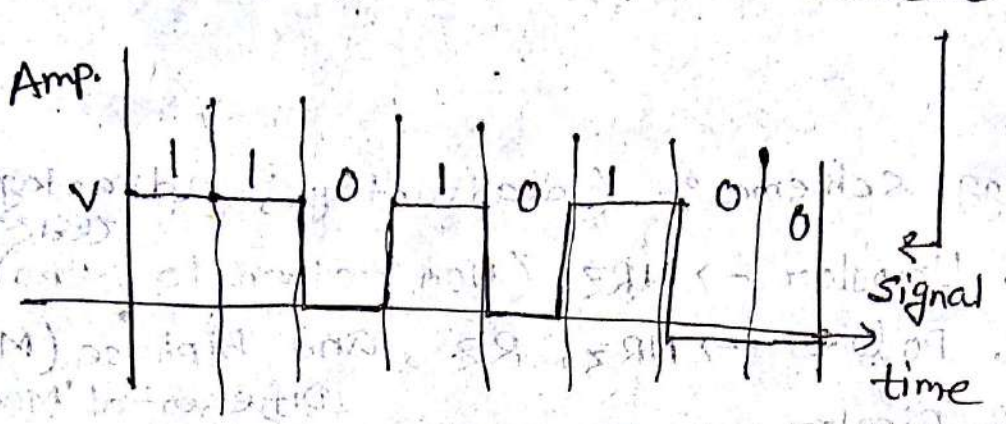
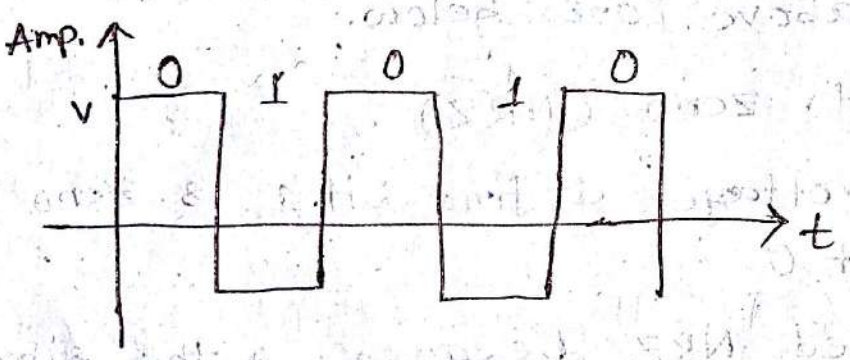
(2) 11 01 0100 → unipolar scheme



(2) Polar scheme:-

— the voltages are on the both sides of the time axis. For example, the voltage level for 0 can be positive & the voltage level for 1 can be negative



যেখানে bit 0 সেখানে positive
1 হলে negative
(ঠিক বিপরীত)

Polar NRZ:-

We use two level of voltage amplicute.

দুইটা version:- (i) NRZ-L (NRZ-Level)
(ii) " - I (NRZ-Inverse)

(i) the level of the voltage determines the value of the bit.

(ii) If there is no change the bit is 0
" " a " " " 1

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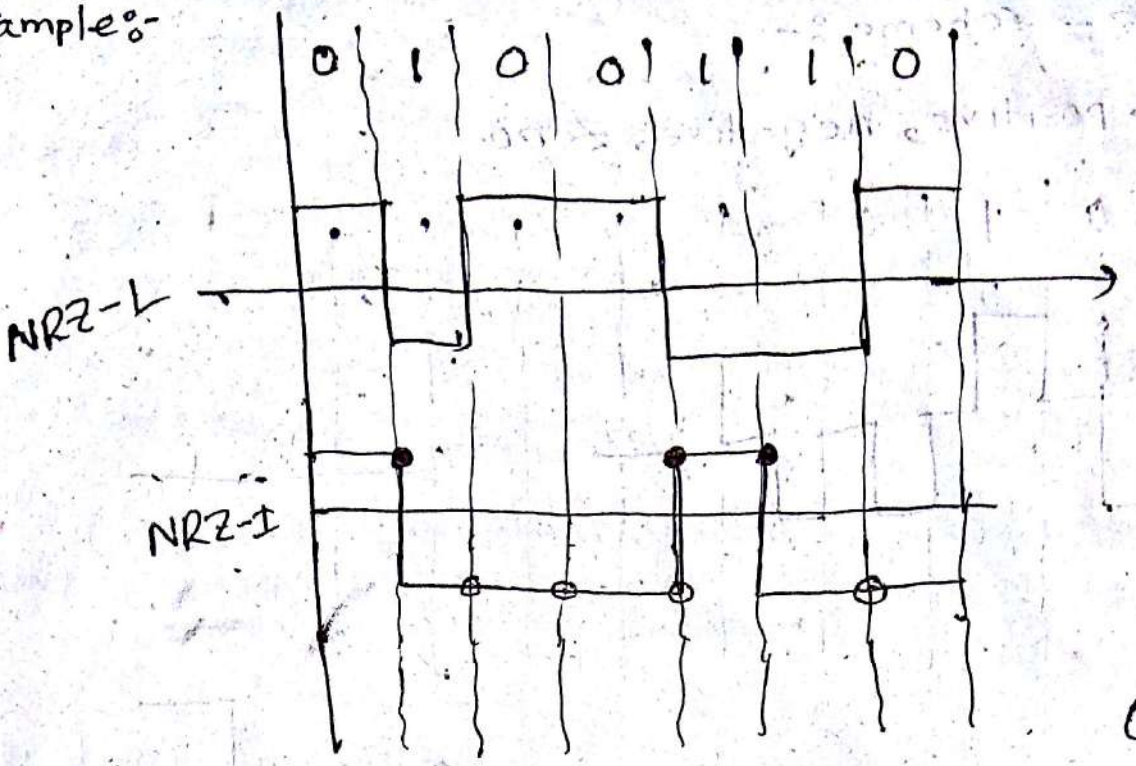
Example:-



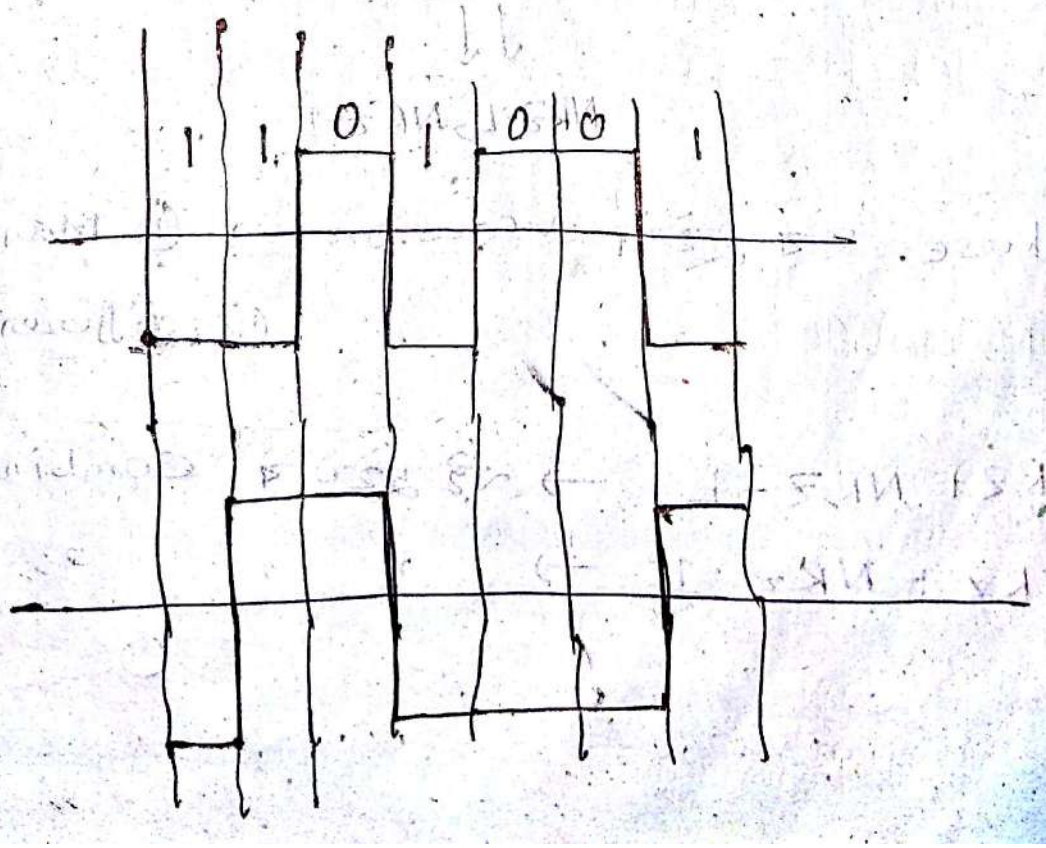
NRZ-L এ polar scheme এর মতো

0 → No inversi

● → next bit inversio

NRZ-I → Next bit 1 হলে তবে transition হবে positive পিরিয়ডে start হবে

Another example: 1 1 0 1 0 0 1



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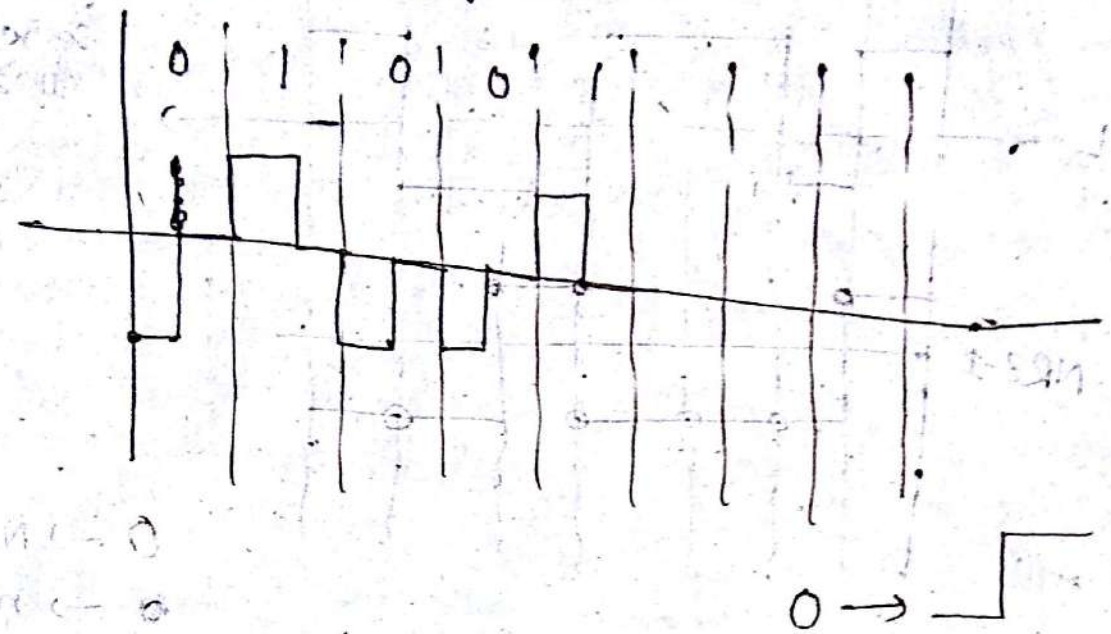
Polar RZ - scheme :-

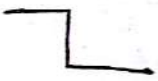
→ positive, negative, zero.



0 →

0 পাইলে negative থেকে 0 level ↘

1 » positive » 0 » »

1 → 

Polar biphase (NRZ + RZ)

↓↓

NRZ-L, NRZ-I

Biphase এর দুইটা version → (i) Manchaster

(ii) differential »

(i) RZ + NRZ - L → এই দুইটার combination

(ii) RZ + NRZ - I → » » »

0

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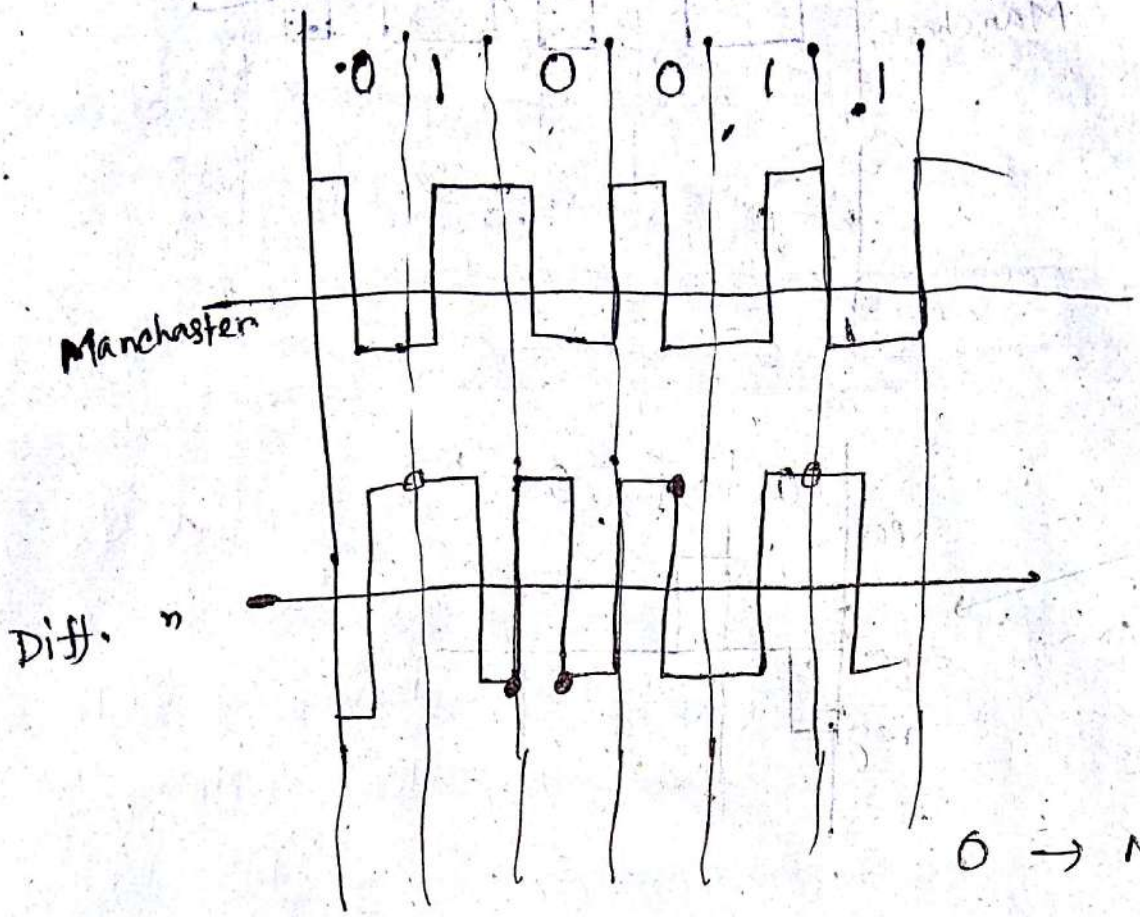
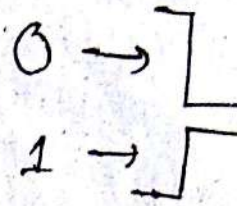
RZ এর level গুলোর নাম → positive
zero
Negative





0 → Non inversion next bit 1

1 → inversion next bit 0.

10-07-17
5th (B) day

Biphase: Manchaster and differential Manches

Manchaster:- ⇒ The idea of RZ (Transion at the middle of the bit) and the idea of NRZ-L are combined into the manchesten schene

⇒ The voltage remains at one level during the first half and moves to other level in the second half.

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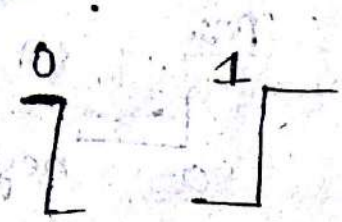
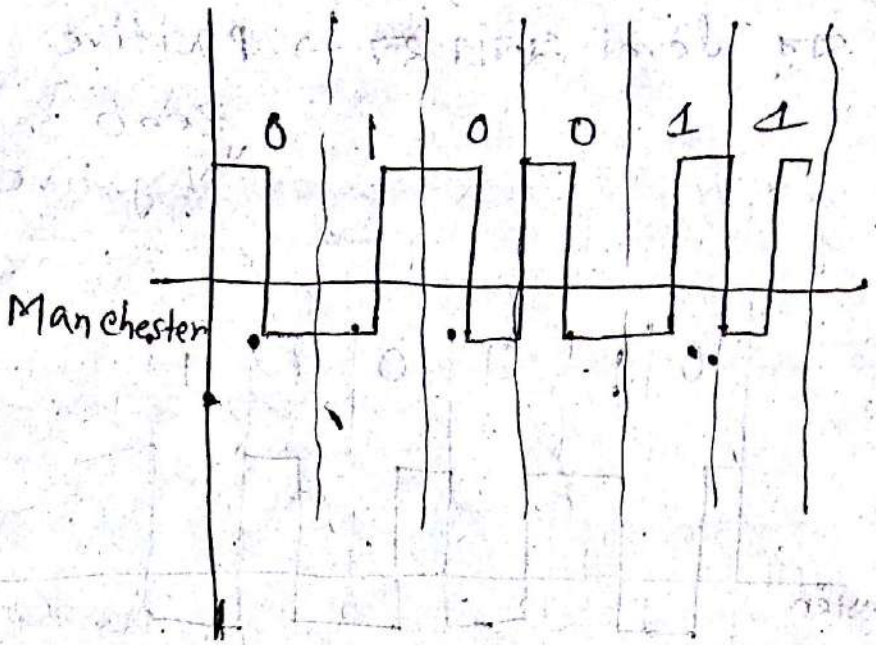
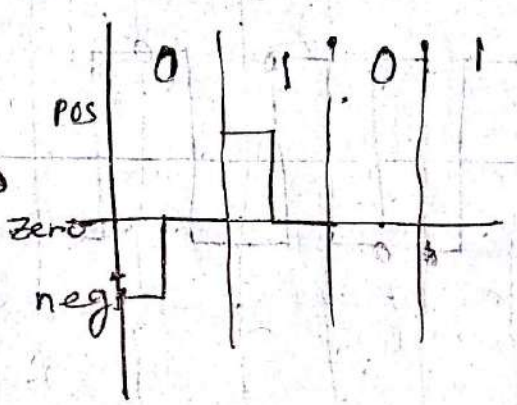


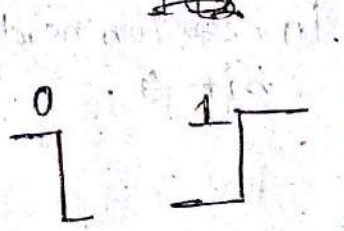


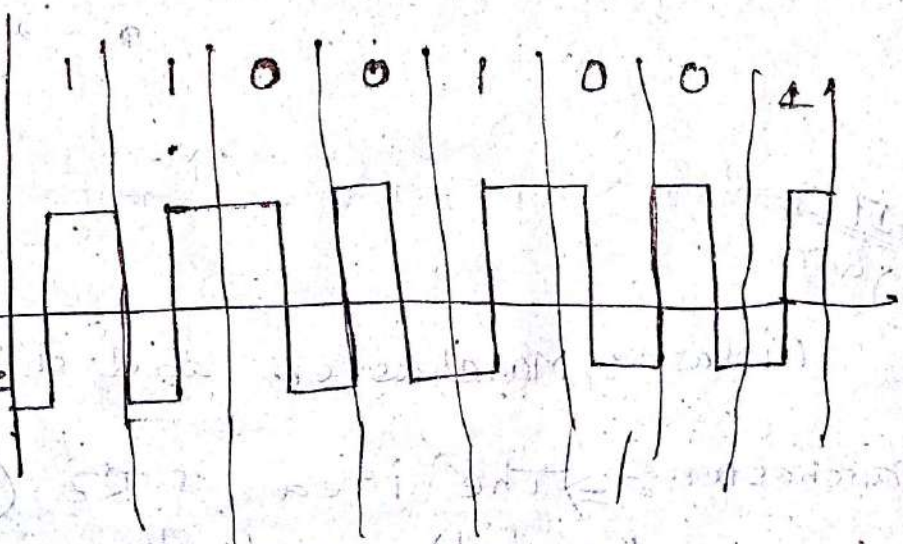
RZ

positive
zero
Negative



~~1 0~~





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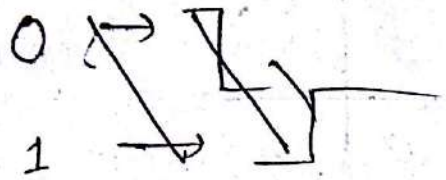
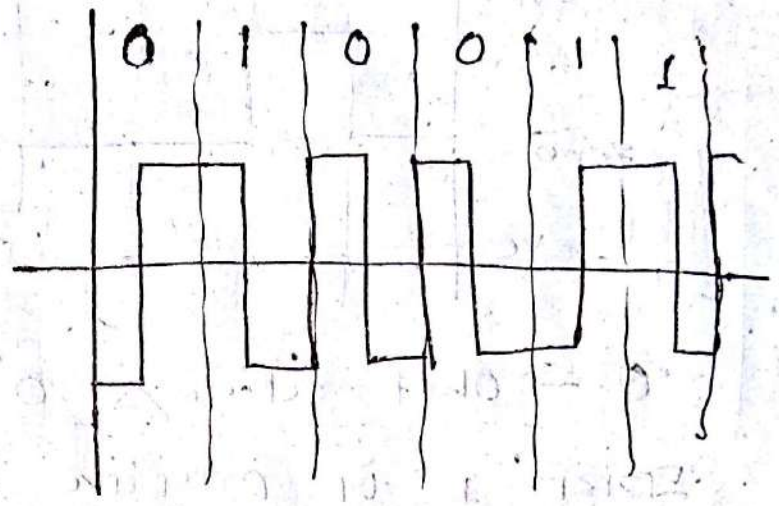
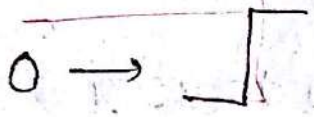
Differential Manchester:- Diff. Man. combines the ideas of RZ and NRZ-I. There is always a transition at the middle of the bit, but the bit values are determined at the begining of the bit. If the next bit is zero, there is a transitio

I " " " " 1 " " no "

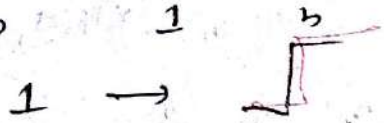




প্রথমে 0 থাকলে



" 1 "

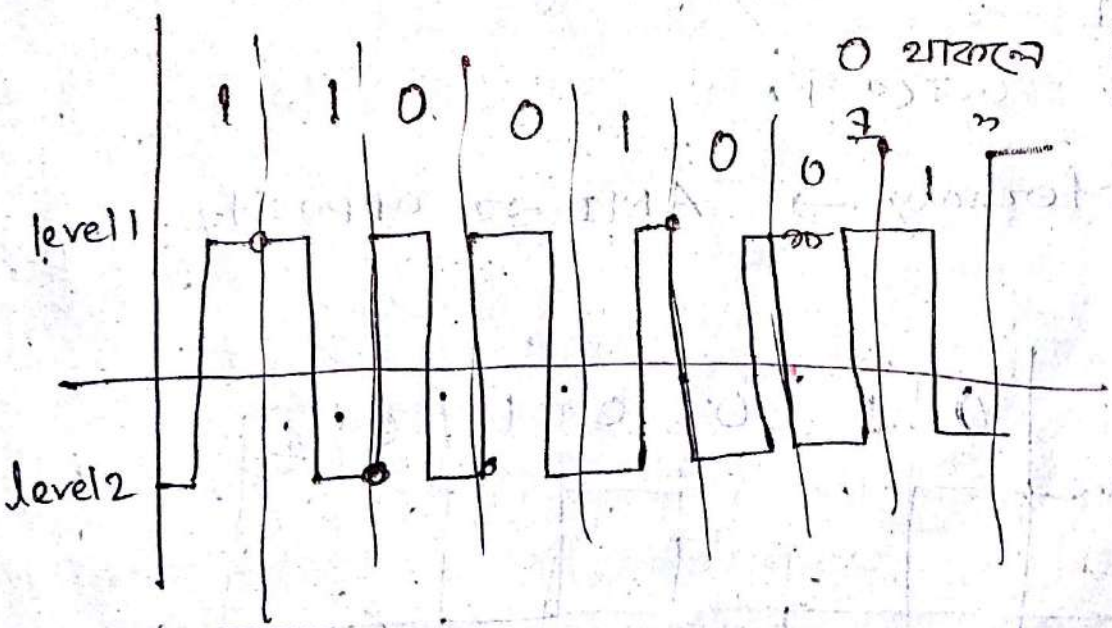


0 → no inversion, next bit → 1

1 → change, next bit → 0

0 থাকলে inversion হবে,

" " না



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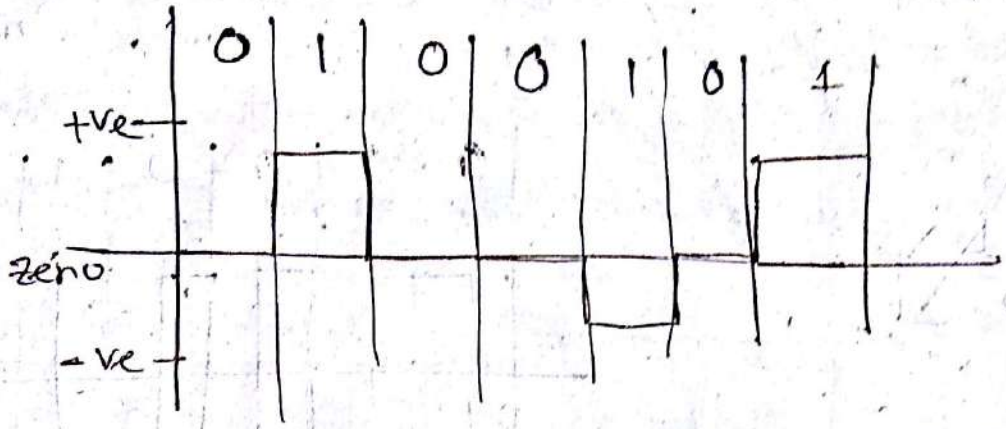
Bipolar schemes:-

- There are three voltage level - positive, negative, zero

AMI (Alternate Mark Inversion)



0 → 0bit always 0

প্রথমে 1 টা positive level এ দিয়ে গেলে

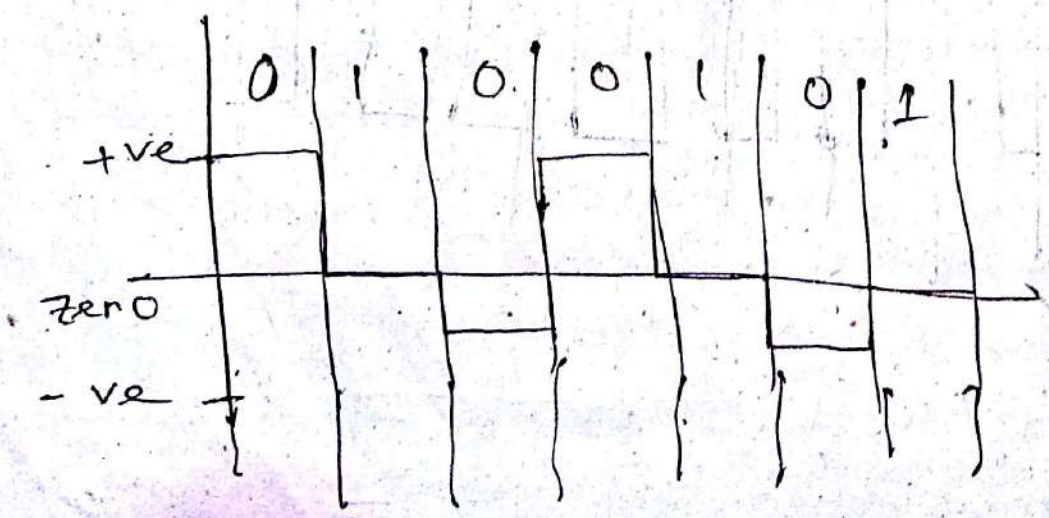
পরের 1 negative যাবে

পরে 1 আবার positive

পরের 1 negative

এভাবে চলবে।

Pseudoternary → AMI এর opposite



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1 ⇒ always 0 level

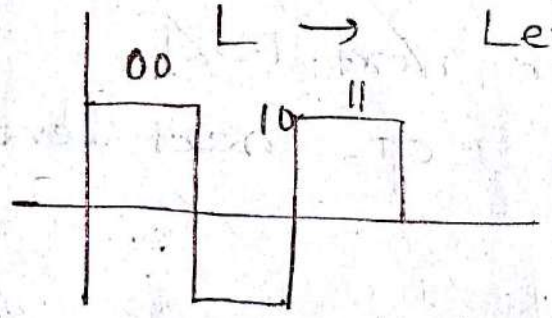
0 তে change হবে অর্থাৎ AMI এর 1 এর ক্ষেত্রে

12-07-17
5th (d) day

Multilevel scheme:- 0, 1 নিয়ে একাধিক ডাটা পাঠানো হয়
at a time: 2 বিট করে send করলে 4 টা combinat
অসম্ভব।

mBnL scheme:- A pattern of m data elements
encoded as a pattern of n signal elements in
which $2^m < L^n$

m → data element
n → signal
L → Level



→ এক্ষেত্রে m = 2
n = 1
2 বিট বিশ্লেষণের signal

2 বিট করে পাঠালে → 00, 01, 10, 11 } Possible level 4 টা
L = 4

$2^m = 2^2 = 4$

$L^n = 4^1 = 4$

Scanned by CamScanner

m b n L
↓ ↓ ↓ ↓
2B1Q → এখানে m = 2, n = 1

Bit → data element

Q → Quartenary (Level)

Level = 4

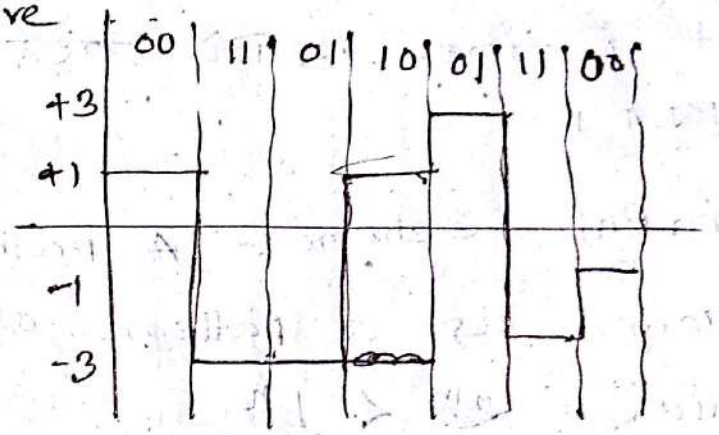
এটাই হল 2B1Q scheme.

এখন এটার কিভাবে এটা perform করে,

Previous level positive — Previous level negative

Next bit	Next level	Next Level
00	+1	-1
01	+3	-3
10	-1	+1
11	-3	+3

Transition table.



প্রথমে 00 এর পর 11, Next ~~level~~ bit 11 এটা 3 next bit 01 then next level.

দুইটা কিভাবে এটা হবে, next level ও Previous level.

প্রথমটা positive দিয়ে start করব।

Multiline Transmission → (MLT-3) এর 3 levels, (i) + volt

(ii) − volt

(iii) 0 volt

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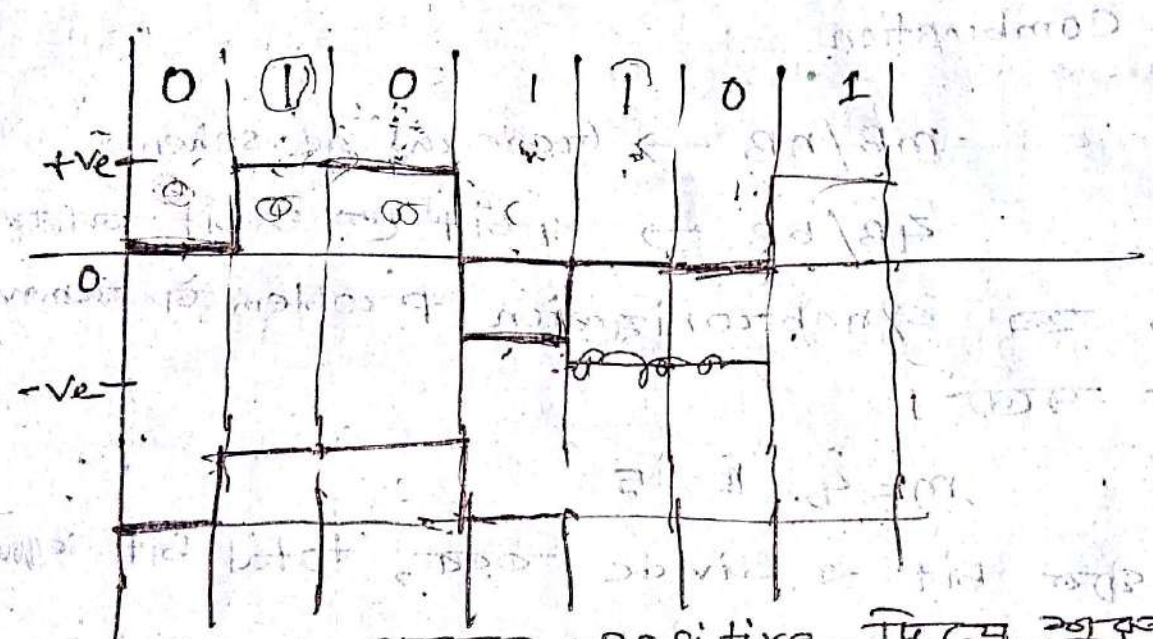
3 condition:-

1. If ~~there is~~ the next bit is 0, there is no transition.
2. If the next bit is 1 and the current level is not 0, the next level is 0
3. If the next bit is 1, and the current level is 0, the next level is the opposite of the last non zero level



যখন bit 1 থাকলে positive দিয়ে শুরু করব।

" " 0 " 0 " " "

17-07-17
6th (B) day

Block coding: Digital to Digital conversion that means Digital data to Digital signal

4B/5B → Bit sequence 1010|1000|1---

4 bit করে ভাগ করবে।

Step গুলান হল:-

1. Division
2. Substitution
3. Combination

mB/nB → Generalize scheme

4B/5B → 4 bit কে 5 bit রূপান্তর

উদ্দেশ্য হল synchronization problem টা remove করার জন্যে।

$m = 4,\ n = 5$

m সংখ্যক bit এ divide করব, total bit sequence কে 4 bit এ ভাগ করব,

তারপর substitute করব, substitue m bit to n bit, 4 bit কে 5 bit এ রূপান্তর।

পরে 5 bit এর sequence কে combined করে network এ দিব।

4 bit করে পাঠালে possible 16 টা combination আসবে। 4 bit কে 5 bit এ রূপান্তরের নিয়ম:

(i) পরপর 3 টা 1 পাশাপাশি থাকলে পরে 0 দেওয়া যায়। যেমন: 1111, লেখা যায় 11101

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(ii) পরপর 3 টা 0 থাকলে 1 দেয়া যায়। যেমন:-

0001 লেখা যায় 0001

বইয়ের table টা দেখতে হবে।

Combined sequence টাকে NRZ-I Apply করে digital signal তৈরী করবে। এরপর signal টাকে bit এ রূপান্তরিত হবে। 5 bit এর sequence টাকে 4 bit এ রূপান্তরিত করে মূল bit পাওয়া যায়।

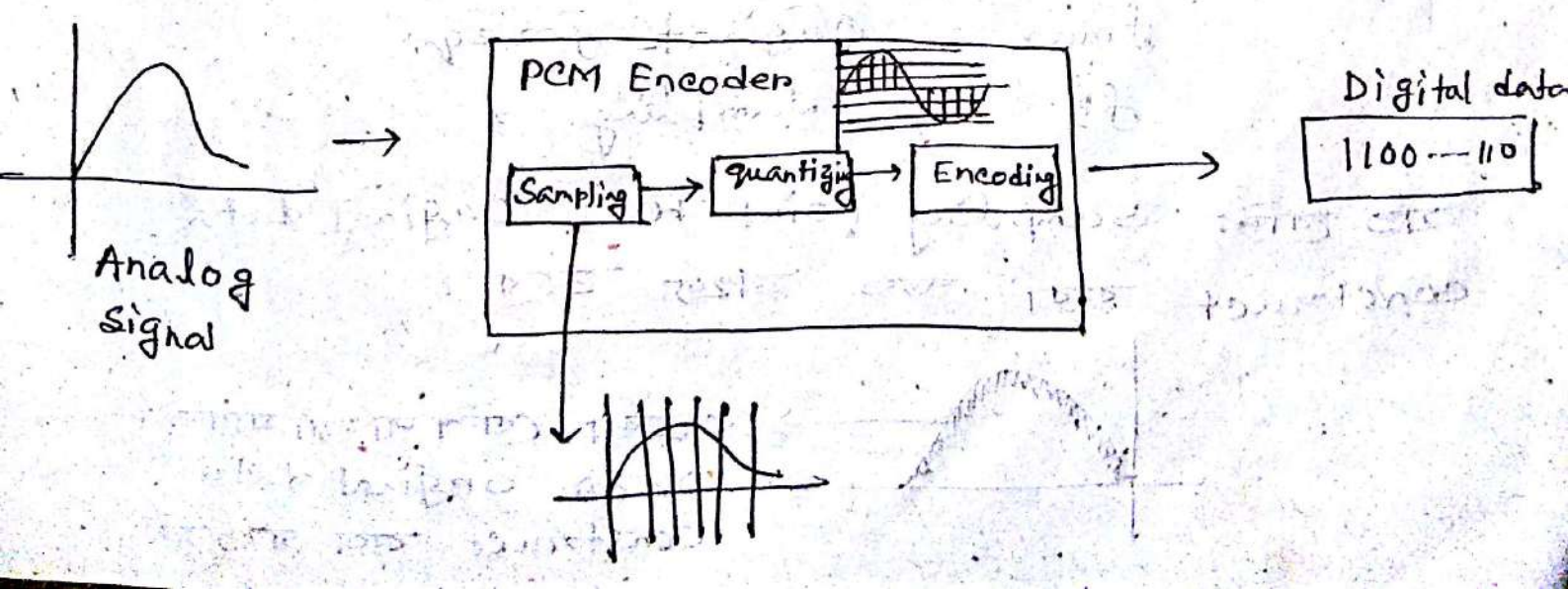
Scrambling → বই থেকে দেখতে হবে
→ এটাও একটা line coding scheme

Line coding এর scheme এর advantage ও disadva
দেখতে হবে

এও এর scheme এর disadvantage আছে, এটাকে scheme দিয়ে remove করা যাবে?

Analog to Digital conversion:-

Pulse code Modulation (PCM):-



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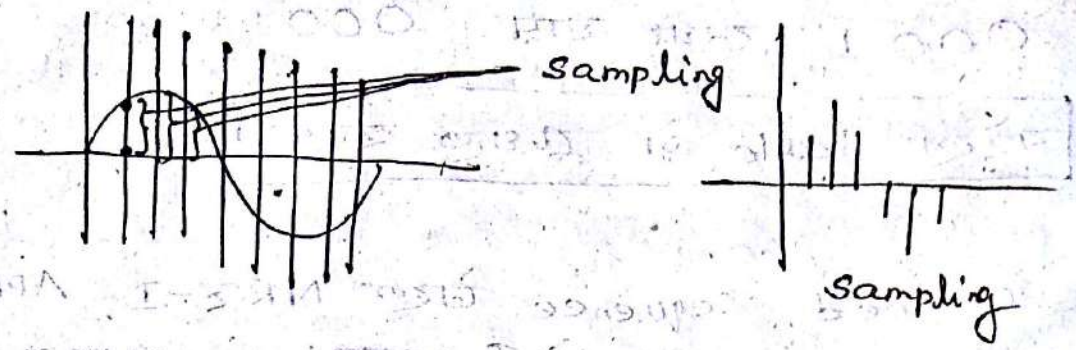
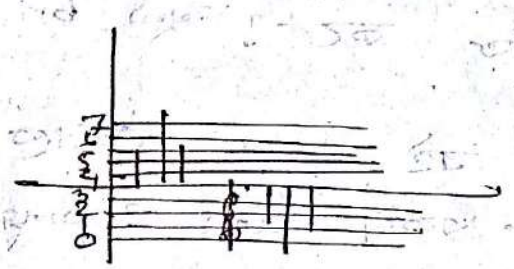
Sampling: No of collection sample.

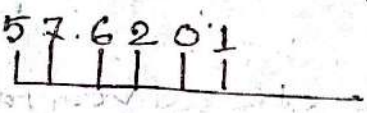


Quantizing: ~~See~~ sampling কে horizontally leveling করে। একেকটা level কে zone বলা হয়।



7 টা level এবার করলাম যেহেতু 7 টা level এবার করলে 3 bit represent

Encoding:-
এখানে আছে sample গুলা আছে,



প্রত্যেকটার bit representation করে দাই এটাই Encoding

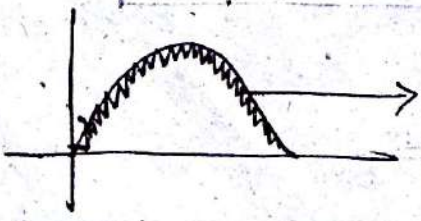
Sampling rate টা কেমন হবে তার জন্য Nyquist theorm:- এই theorm অনুযায়ী

"Sampling Rate $f_s \geq 2f_{max}$

f_{max} = orginate freq.

f_s = sampling "

যত বেশি sampling point নিব, Orginal data construct করা তত সহজ হবে।



এগুলা বেশি পাওয়া যায় যদি Orginal data construct করা সহজ

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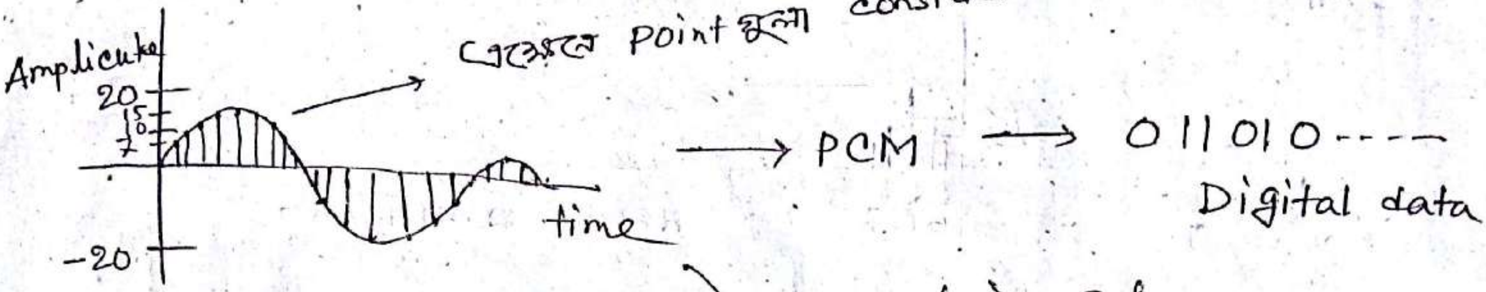
19-07-17
6th (d) day

Sampling

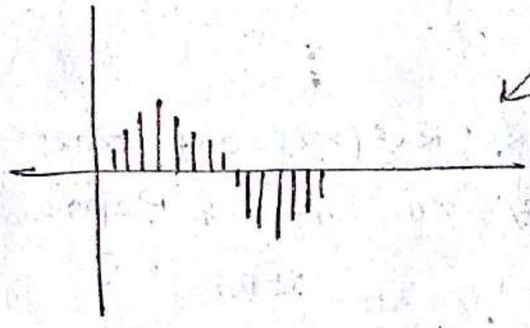
Steps of PCM :-

1. The Analog signal is sampled.
2. The sample signal is quantized
3. The quatized values are encoded as stream of bits.



Sampling rate, $f_s \geq 2f_{max}$

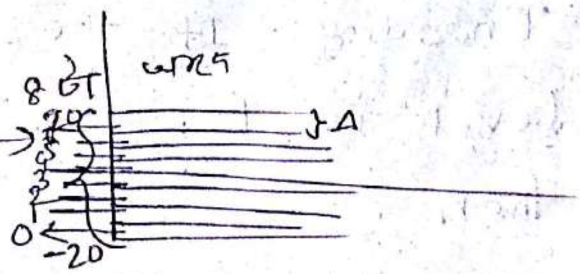
Now the output,



Steps of Quantization:-

L → division

L = 8



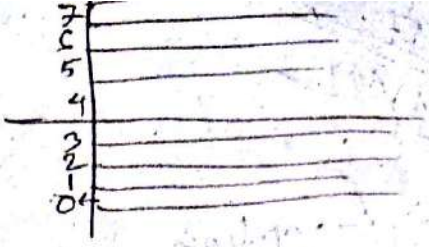
$$\Delta = \frac{V_{max} - V_{min}}{L}$$

$$= \frac{20-(-20)}{8}$$

$$= 5V$$

0 - L-1 পর্যন্ত marking করব,

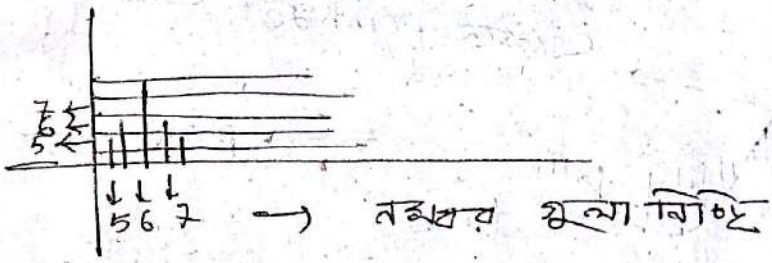
0 - 7 পাওয়া যাবে।



$$\text{Normalization} = \frac{\text{amplicate}}{A} = \frac{20}{5}$$

$$= 4$$

⇒ Quantazation ~~port~~ code গুলা কত নম্বরে থাকে সেটা বের করতে হবে



$$n_b = \log_2 L$$

$$= \log_2 2^3$$

$$= 3$$

Now 5, 6, 7 কে bit এ Represent করব — 5 কে bit, 6 কে bit, 7 কে bit এ Represent করাকে Encoding বলে পাওয়া যায়।

Encoding:- If the number of quantization level is L, the number of bit is $n_b = \log_2 L$, then

Bit rate = Sampling rate x number of bits per sample

$$= f_s \times n_b$$

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We want to digitize human voice? What is the bit rate

মানুষের voice Analog, একে digital করব,

Ans:

Assume that 8 bits per sample.

$f_s = 2 \times f_{max}$

$= 2 \times 4000 = 8000$

now, bit rate $= f_s \times n_b$

$= 8000 \times 8$

$= 64000$ bps

$= 64$ kbps

$f_{max} = 4000$ Hz

$f_s = ?$

$= 0 =$

Minimum Bit, $B_{min} = C \times N \times \frac{1}{n}$

$= C \times n_b \times f_s \times \frac{1}{n}$

$= C \times n_b \times 2B_{analog} \times \frac{1}{n}$

$= @\frac{1}{2} \times n_b \times 2B_{analog} \times 1$

$= n_b \times B_{analog}$

C = Case

= average case

= 0.5

$\frac{1}{n} = \frac{1}{2} = 1$

1 ও bit 1 signal দিলে লাগলে

$f_s = 2 \times f_{max}$

$= 2 \times B_{analog}$

PCM এর Minimum Band width, $B_{min} = n_b \times B_{analog}$

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আগের অংকটার যদি $B_{analog} = 4000$ Hz

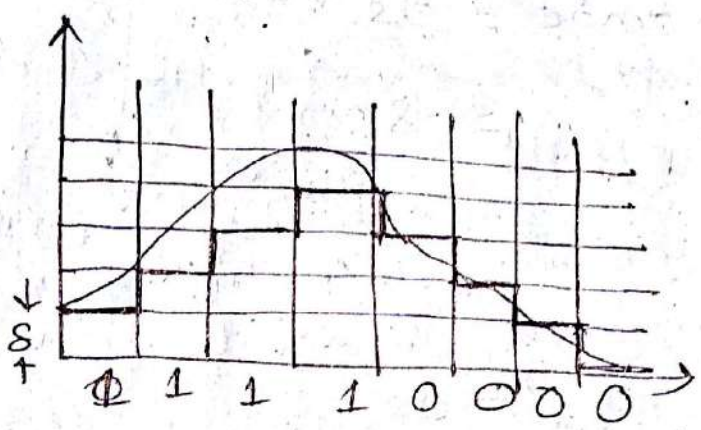
$n_b = 8$

Minmum BW $= n_b \times B_{analog}$

$= 32000$

Mimmum 32000 Hz BW থাকা দরকার তা না হলে PCM ও pass হবে না।

Delta Modulation (DM)



increase কে 1 দ্বারা denote decrease কে 0 দ্বারা denote

Analog টার digital version = 1 1110000

PCM = analog → digital data

DM → analog → digital data

PCM টা খুব complex way তে analog থেকে digital এ পরিবর্তন করে।

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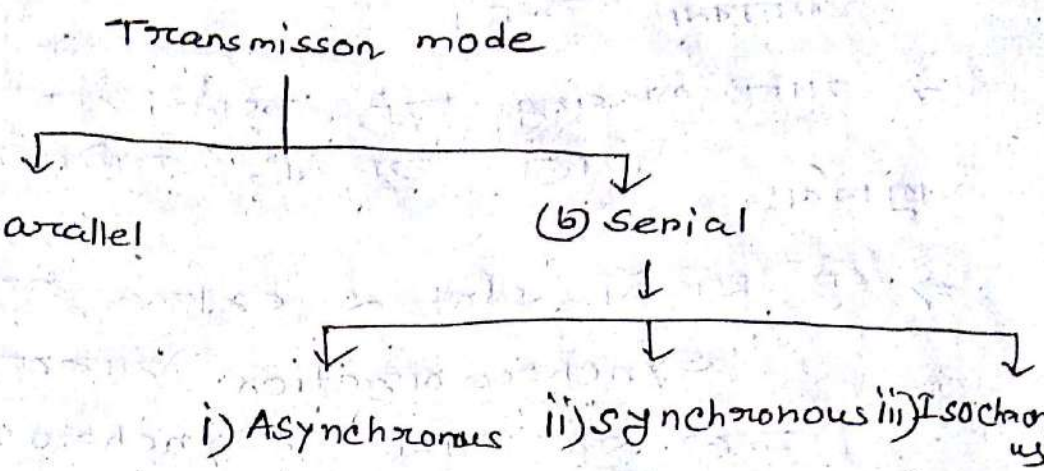
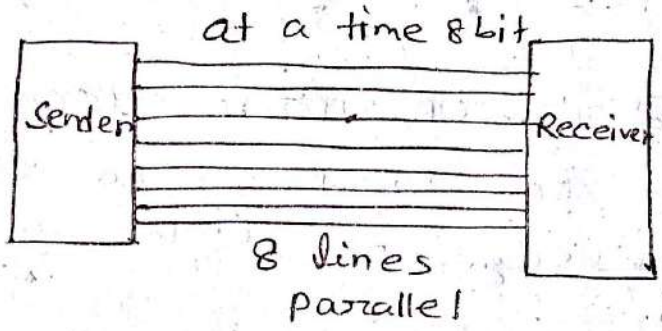
29-07-17
6th (F)day

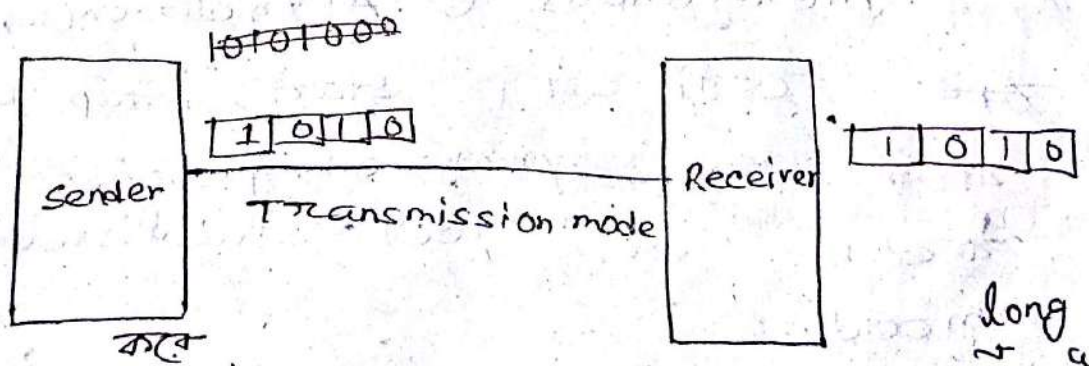


(a) Sender থেকে Reciever ও at a time 8 bit করে পাঠাতে হলে, তখন parallel 8 টা line দরকার, ফলে cost বেশি কিন্তু data transmission fast

Short ~~long~~ distance ~ use হয় parallel



(b)



Long distance ~ use হয়

কবে একটা একটা bit যায় serially

(i) প্রথমে start bit 1 then 8 bit send করে, then একটা stop bit পাঠাবে, then একটা gap থাকবে then আবার আরেকটা 8 bit - এভাবে পাঠানো হয়

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⇒ data sender থেকে Receiver missing হওয়ার সম্ভাবনা কম।

⇒ যদিও missing হয়, তখন আর message টা আবার পাঠানো হয় না, সেটা missing হয়ে যায়।

অসুবিধা:-

⇒ (i) প্রতিটা slot এ extra করে bit add থাকে synchronization থাকছে না বলেই। ফলে এর নাম Asynchronus.

(ii) start bit, stop bit, gap থাকবে না, একটা একটা করে bit পাঠানো হয়। synchronization সমস্যা দূর করা হয় এর মাধ্যমে।

⇒ bit গুলো না থাকার কারণে পুরো message টা আবার send করতে হবে, যদি message এ কোন missing থাকে

(iii) synchronous ও Asynchronous এর সমন্বয়ে এটা তৈরী হয়। start, stop bit ও gap থাকে এবং synchronization ও maintain করে। এটা well stablished transmission mood.

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~~Di~~ ~~Analog~~

~~Dig~~ **Analog transmission:-**

data → Signal → 1010001 ⟶

Digital to Analog conversion:- data

- line coding → digital to digital signal
- PCM → Analog to digital data

3 methods for digital data to analog signal:-

(i) Amplitude shift keying (ASK)

(ii) Frequency shift keying (FSK)

(iii) Phase shift keying (PSK)

(iv) Quadrature Amplicate Modulation (QAM)

Carrier Signal:- In analog transmission, the sending device produces a high frequency signal that act as a base for the information signal this base signal is called carrier signal Or carrier frequency.

(i) Amplicute
(ii) frequency
(iii) Phase

→ यसको signal मा तिनको basic feature.

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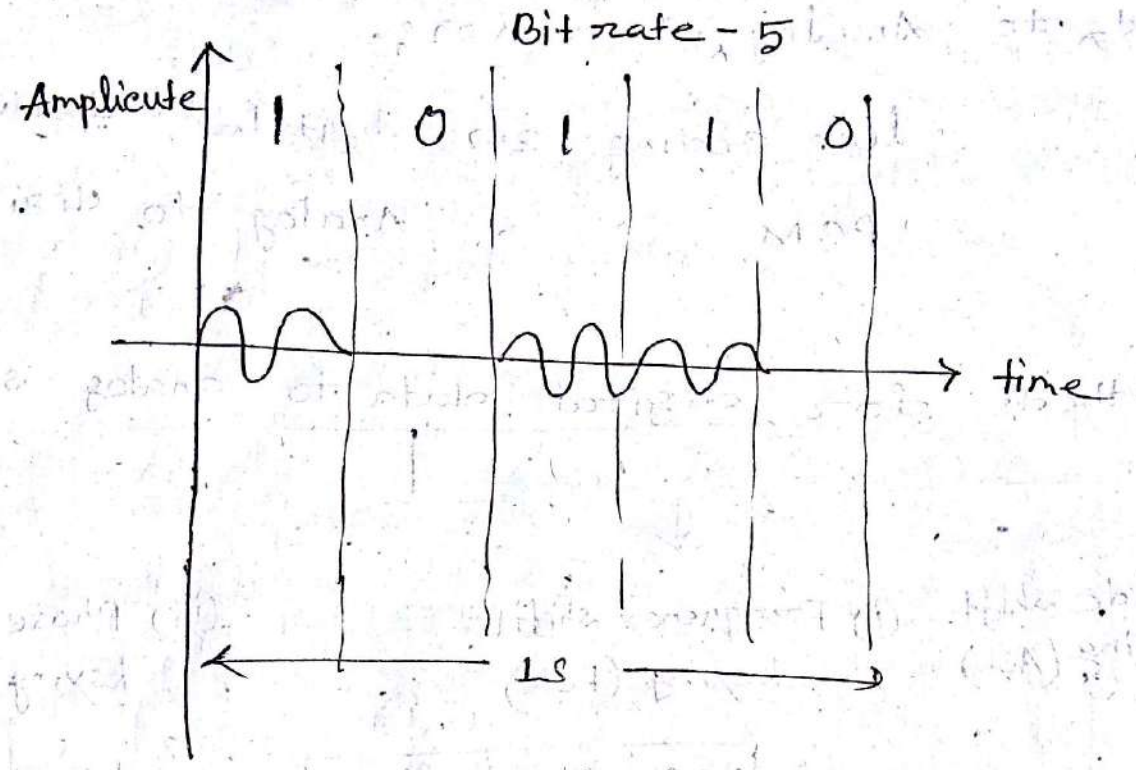
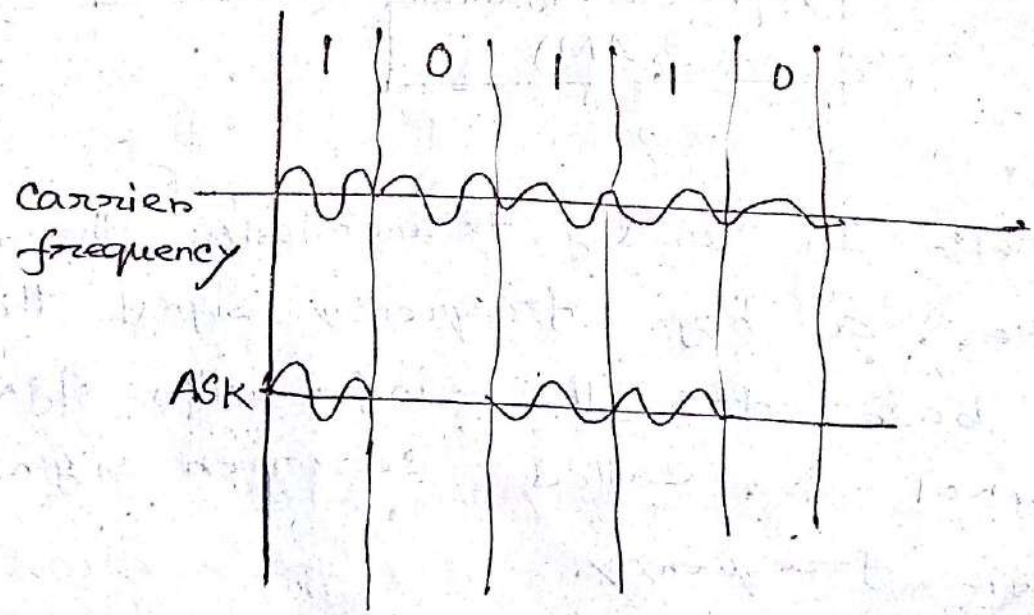
(i) শুধু Amplicute change হবে, frequency এবং Phase constant থাকবে। এখানে Amplicute এর base.

Now example:-



আরো ভালো example:-



1 BASK
2 Quartanry

এখানে এইটা হল Binary ASK. At a time 1bit করে send করি তাই। At a time 2 bit করে send করলে Quartanary.

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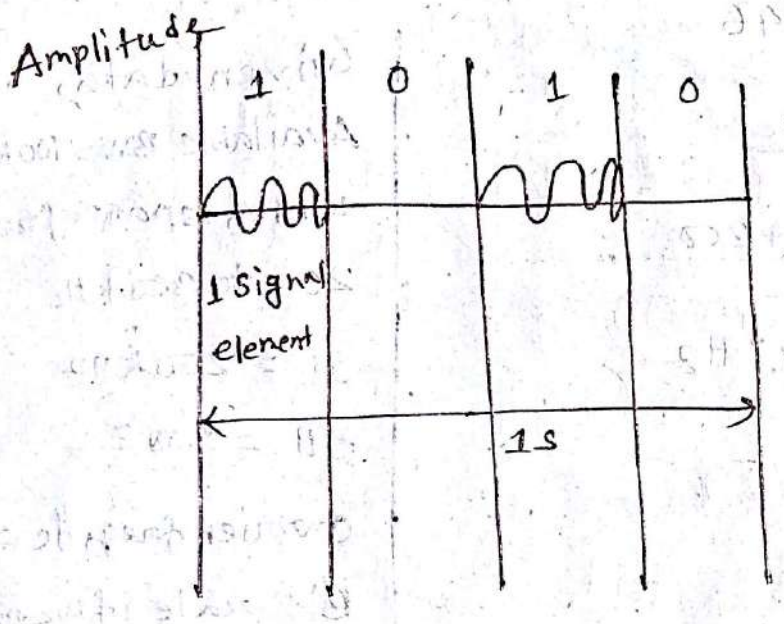
31-07-2017
7th (B) day

ASK

Binary ASK: Bindry ASK is normaly implemented using only two levels. This is ~~refffered~~ to as binary Amplicude shift keying (BASK) or on-off keying (OKK)

- The peak amplitude of one signal level is 0; the other is the same as the amplitude of the carrier frequency.



দুইটা level আছে binary ASK

Signal rate আর bit rate এর relationship

$S = N \times 1/r$

r = 1 bit পাঠাতে কতটা signal pass হয় (ratio)

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$S = N \times 1/n$

$B = (1+d)S$

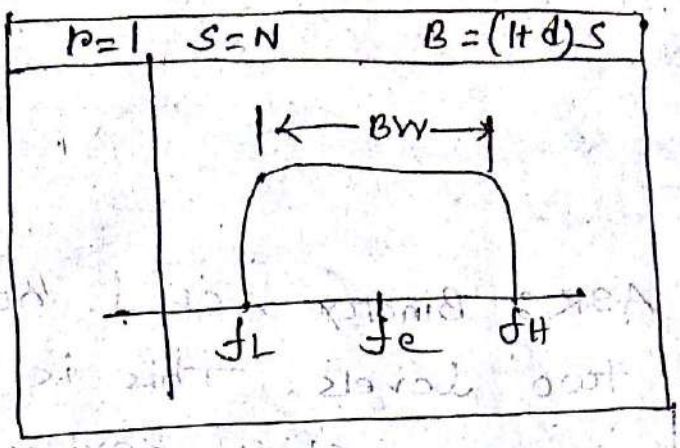
$d = 0$ to 1

Worst signal @
$d = 0$

Best signal @
$d = 1$

Avg. case @ $d = 0.5$

nomally $d = 1$ धरते काम करता है।



Example:- page-146

$$f_c = \frac{f_L + f_H}{2}$$

$$= \frac{200+300}{2}$$

$$= 250 \text{ Hz}$$

$$S = N \times \frac{1}{n}$$

Here,

$$B = (1+d)S$$

$$= (1+1)S$$

$$= 2S$$

$$= 2 \times N \times \frac{1}{n}$$

$$1000 = 2 \times N \times \frac{1}{1}$$

$$\therefore N = 500 \text{ kbps}$$

Given data,
Available BW = 100 KHz
which spans from
200 to 300 KHz
$f_L = 200$ KHz
$f_H = 300$ Hz.
Carrier freq, $f_c = ?$
Bit rate if we modulates our data by ASK (with $d = 1$ and $n = 1$)
bit rate, $N = ?$

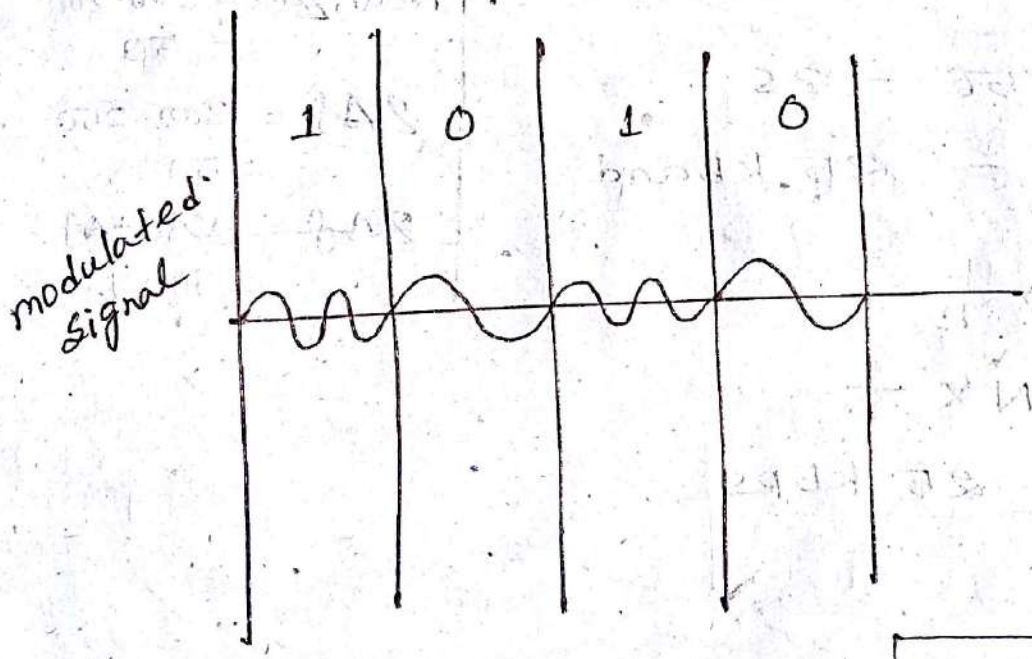
Scanned by CamScanner

Frequency shift keying (FSK) :-

In FSK, the frequency of the carried signal is varied to represent data.

Binary FSK (BFSK) :-

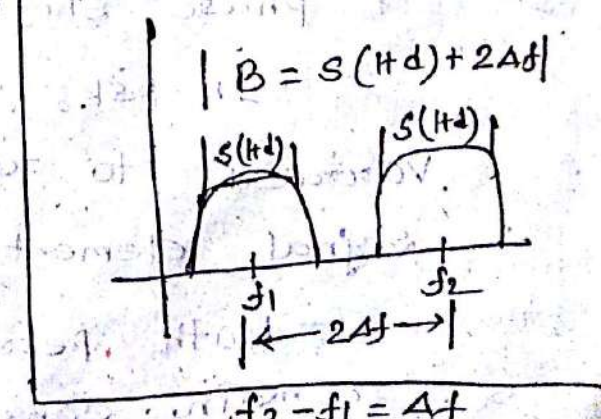
- Consider two carrier frequency f_1 and f_2
- We use the 1st carrier if the data element is zero (0)
  We use the 2nd ---- is one (1)



$N \times \frac{1}{n}$

100

$n=1 \quad S=N \quad B=(1+d)S+2\Delta f$



Scanned by CamScanner

Example

$B = (1+d)S + 2\Delta f$

$S = N \times \frac{1}{r}$

$B = (1+1)S + 2\Delta f$

$= 2S + 2\Delta f$

$100 = 2S + 2\Delta f$

$\Rightarrow 100 = 2S + 50$

$\Rightarrow 100 - 50 = 2S$

$\therefore S = 25$ Kband

$S = N \times \frac{1}{r}$

$\Rightarrow S = N \times \frac{1}{r}$

$\therefore N = 25$ Kbps

BW = 100 KHz

Spans 200-300KHz

What should be the carrier frequency, f_c = ?

Bit rate = ?

If we modulated our data by FSK with $d = 1, r = 1$

$f_c = \frac{200+300}{2}$

$= 250$

Now, $2\Delta f = 250 - 200$

$= 50$

$2\Delta f = 300 - 250$

$= 50$

~~$2\Delta f = 2\Delta f + \Delta f$~~

~~$= 100$ Hz~~

02-08-17

7th (D)day

Phase, shifting keying (PSK):-

- In psk, the phase of the carrier signal varried to represent two or more different signal element.

- Both peak amplitude and frequency remain constant as two phase changes.

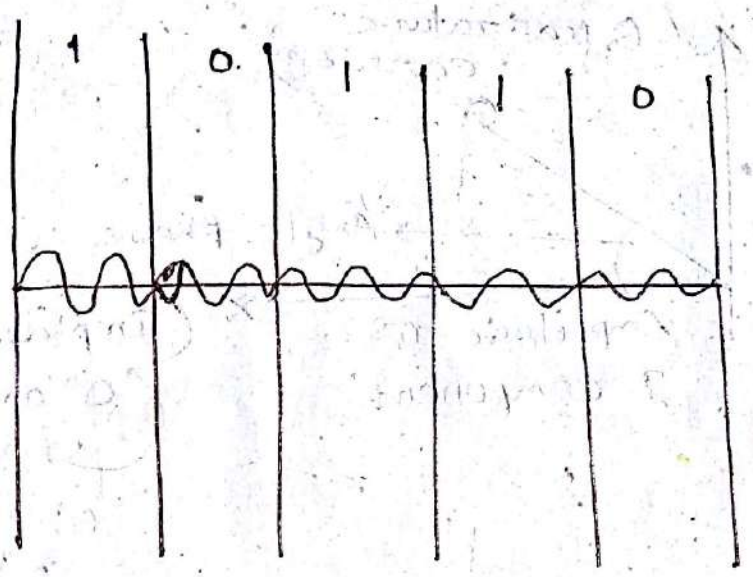
Scanned by CamScanner

Binary PSK (BPSK):-

- we have only two signal elements, one with a phase 0° and the other with a phase 180°

*** PSK টা FSK ও অন্যান্য গুলার থেকে তুলনামূলক ভালো Amplitude ও Frequency change করা অহণ কিন্তু phase change করা কঠিন। ফলে PSK টা best. Phase টা define করা থাকে, Noise দ্বারা কম প্রভাবিত হয়, তাই less succitable (সংবেদনশীল)

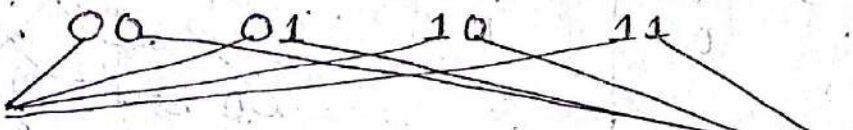
QPSK (Quadrature phase shift keying):-

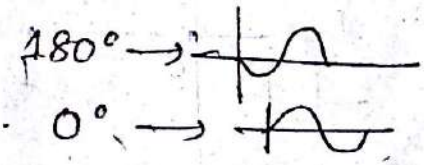


দুই ধরনের phase ও আছে তাই একে BPSK 0° & 180°

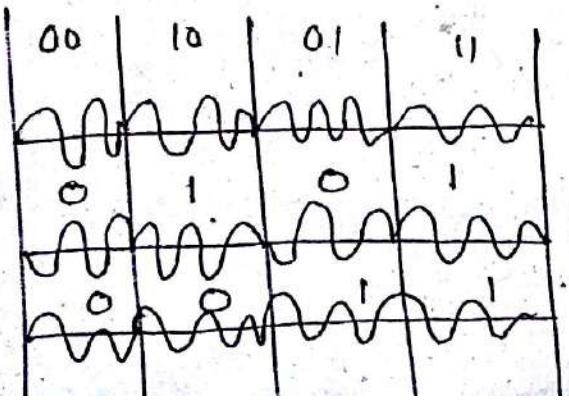
1 → 0° phase
0 → 180° phase

QPSK:





এগুলো প্রথমে BPSK দিয়ে যায়, পরে এগুলো BPSK দিয়ে যায় পরে Combined করা হয়।



1 → 0 phase
0 → 180° phase

> পরে এই দুইটা Combined হবে।

Scanned by CamScanner

তাহলে 4 টা phase থাকবে → 45°, 135°, -45°, -135°

00 → -135°

10 → -45°

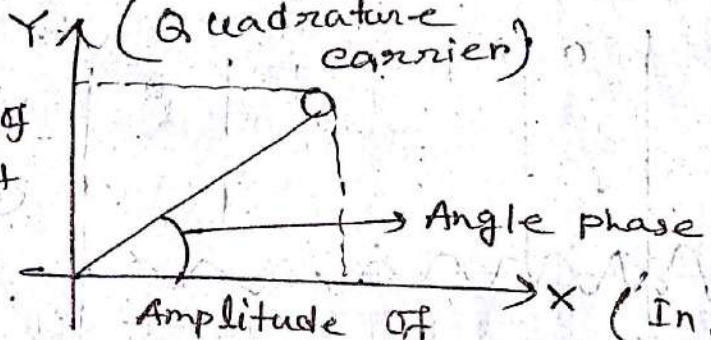
01 → 135°

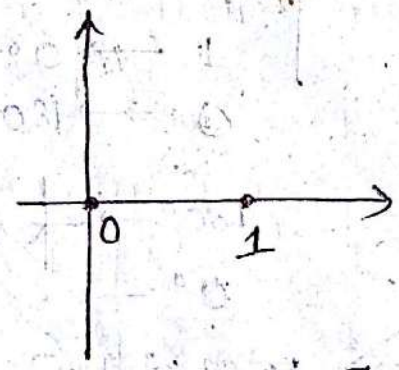
11 → 45°

এটাকে represent করার জন্য আছে একটা diagram.

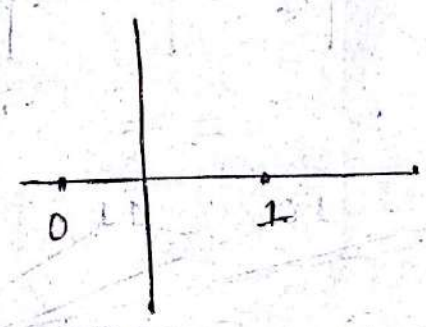
*Constellation Diagram:

—helps us to define the Amplitude and phase of a signal element.

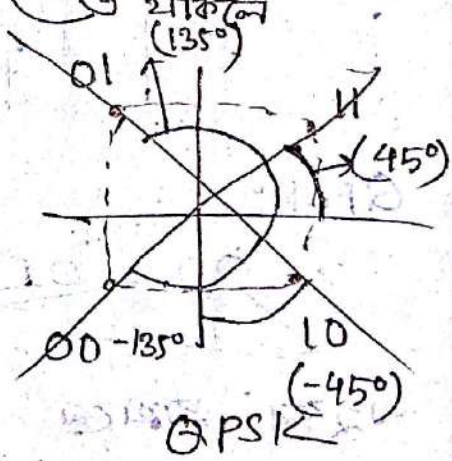




ASK (OOK)



BPSK



QPSK

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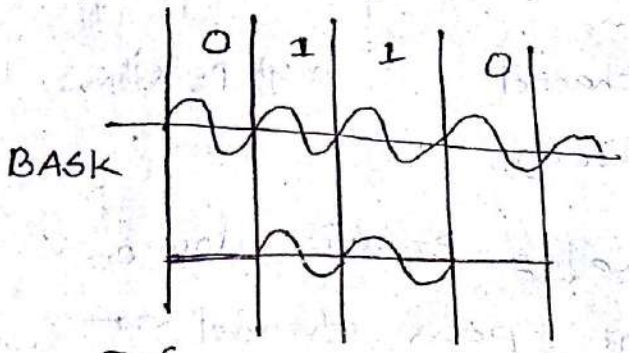
05-08-2017
7th (E) day

QAM → Quadrature Amplitude Modulation

→ Combination of ASK & PSK

Amplitude ও Frequency দুইটাই change হবে।



সুবিধা:-

i) efficiant বেশি

ii) Noise দ্বারা প্রভাবিত হয় কম

iii) যেই signal টা পাবো সেটা বেশি strong

iv) information টা loss হওয়ার possibility কম

অসুবিধা:-

i) এইটা complex, নতুন pattern ও device বেশিমাণে current, voltage বেশি লাগে।

Analog to Analog conversion:-

i) Amplitude Modulation (AM)
Amplitude vary করবে বাকি ২ টা ঠিক থাকবে

ii) Frequency Modulation (FM)
Frequency vary করবে বাকি দুইটা ঠিক থাকবে

iii) Phase Modulation (PM)
Phase vary করবে বাকি দুইটা ঠিক থাকবে

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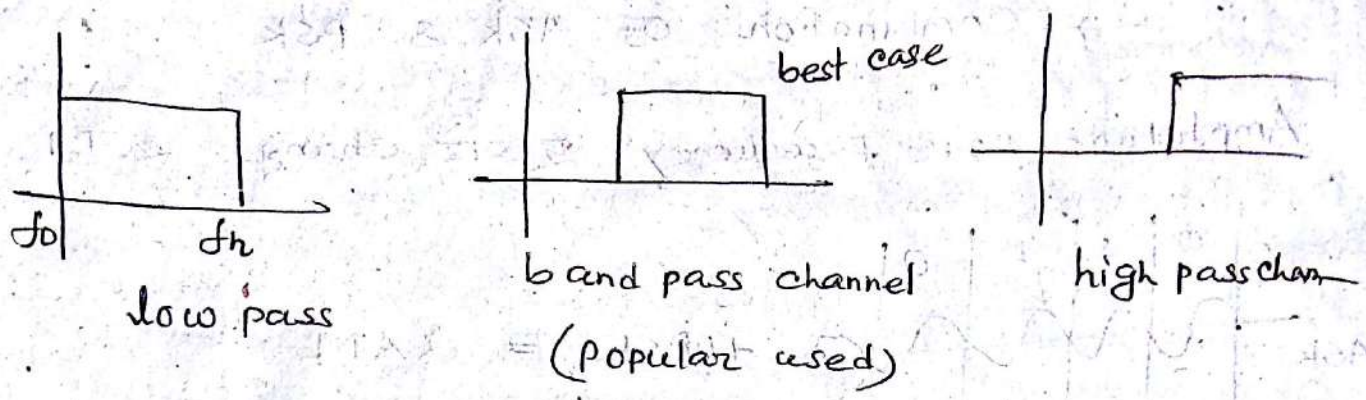
Modulation কেন দরকার?

Channel এর bandwidth এর সাথে related, যেমন কর, band pass channel



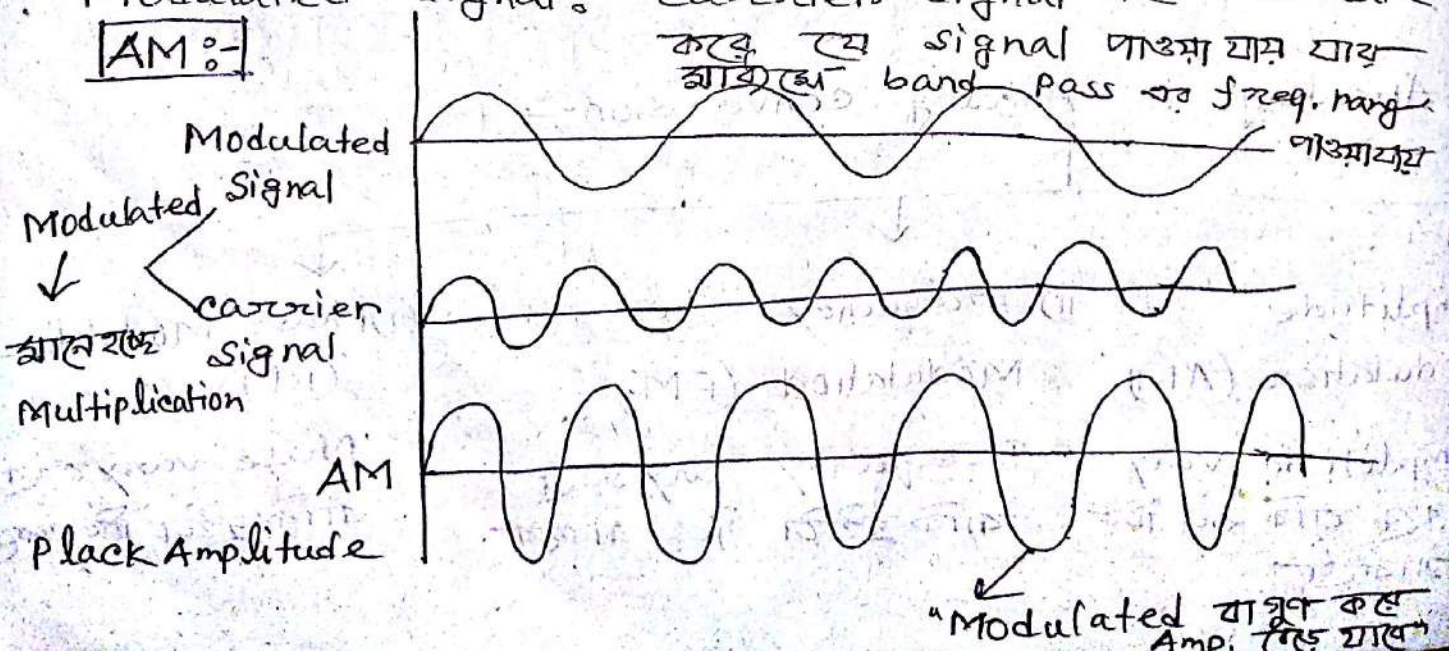
Modulation করার পর Analog টা যদি low or high pass হয়, যখন band pass channel এর মধ্যে pass করলে low ও high এর মধ্যে range এর মধ্যে যায়।

**Analog signal টাকে modulation করা হয় যেন band pass channel এর range এর মধ্যে নিয়ে আসা যায়, তার ফলে best case পাওয়া যায়।

=0=

Modulated signal: carrier signal টাকে Modulate করে যে signal পাওয়া যায় যার মাধ্যমে band pass এর freq. range পাওয়া যায়

AM :-



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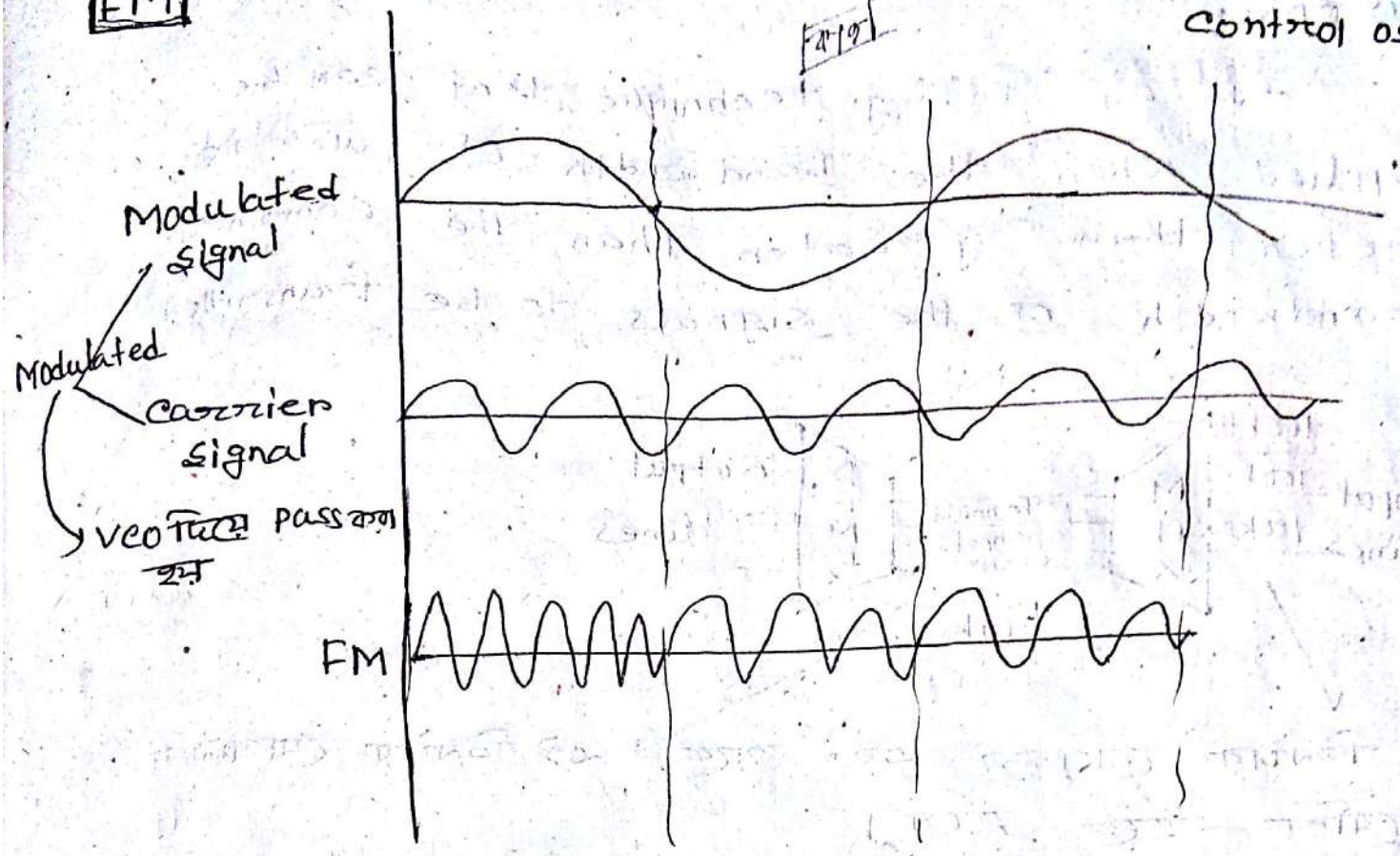
FM

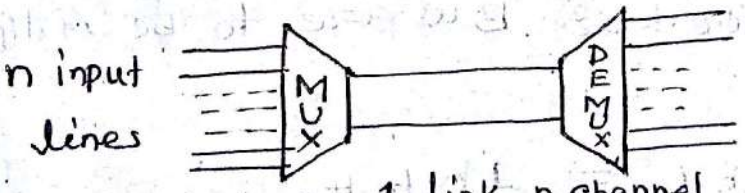
VCO → voltage controll oscillator



07-08-2017
8th (B) day

MULTIPLEXING :-

— Multiplexing is a set of techniques that allows the simultaneous transmission of multiple signals across a single data link.



তিন ধরনের multiplexing techniques আছে;

(i) Frequency division Multiplexing (FDM) (analog)
(ii) wavelength division Multiplexing (WDM)
(iii) Time division Multiplexing (TDM) → Digital

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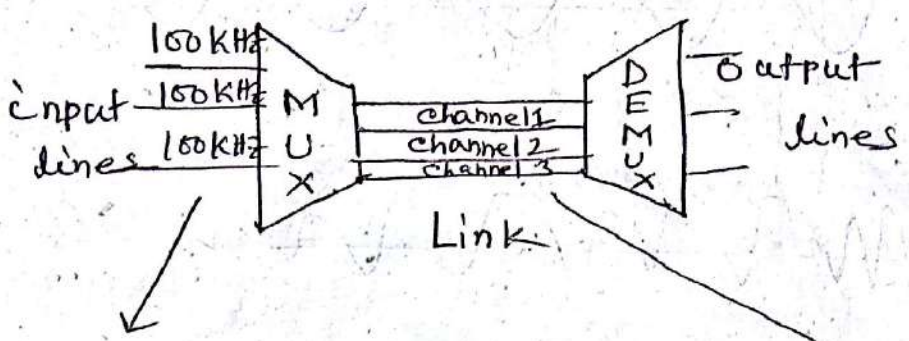
(i) FDM :-

- is an analog technique that can be applied when the bandwidth of a link is ~~better than~~ greater than the combined bandwidth of the signals to be transmitted.



ডিমাটার যোগফল এক থেকে এই ডিমাটার যোগফল বেশি হতে হবে।

Guard band → দুইটা interface overlap না হওয়ার কারণে channel এর ফাঁকে ফাঁকে Guard band use করা হয়। Guard band এক ধরনের band width.

যদি channel হয় n, তবে Guard band n-1

Example :- page → ~~164~~ 159

5 channel →

each with 100 kHz BW are to be multiplexed together

guard band = 10 kHz

Minimum band with = ?

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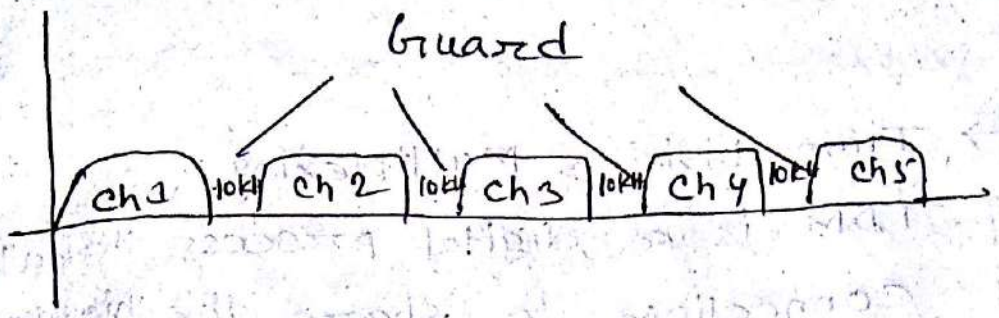
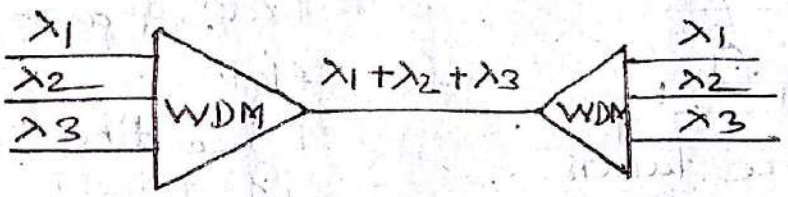


Minimum bandwith = $5 \times 100 + 4 \times 10$

$= 540$ kHz

WDM:

- WDM is designed to use high data rate capabilities of fiber optic cable. The optic fiber cable data rate is higher than the data rate of metalic transmission cable.



prism এর technique follow করে।

** efficiency than FDM

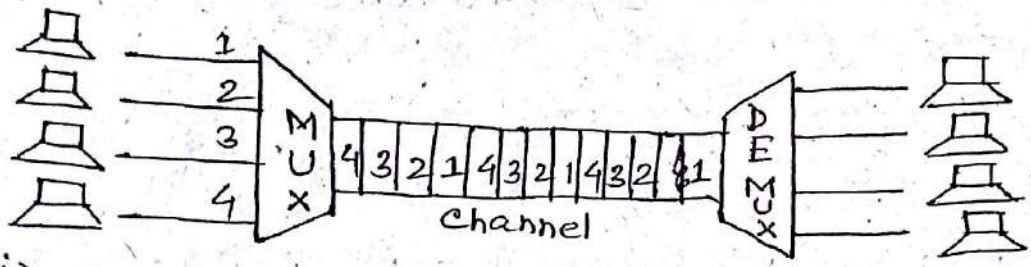
(n-1)

Scanned by CamScanner

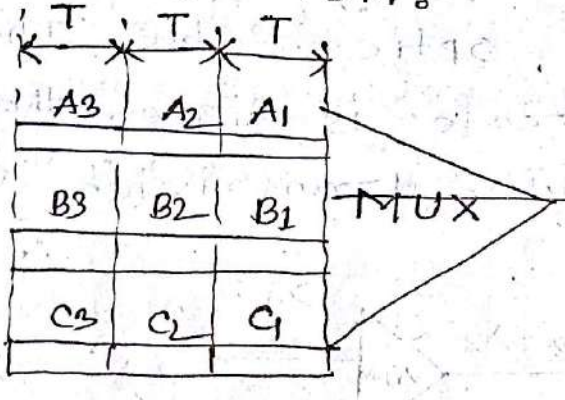
12-08-2014
8th (E) day

TDM → Time Division Multiplexing

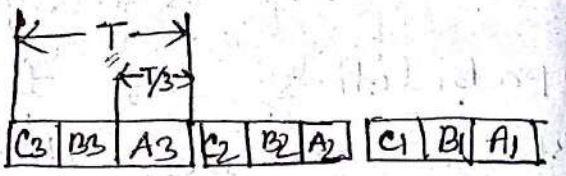
– TDM is a digital process that allows several connections to share the high bandwidth of a link.



(i) Synchronous TDM :-



Data are taken from each line every Ts



Each frame is 3 time slots

Each time slot duration is T/3s

TDM → এখানে share the high bandwidth, digital process

FDM → " " " " " নাই, Analog,

Data Rate = Bit rate WDM ও " "

BW বাড়লে Bit rate বেড়ে যায়, এজন্য এখানে time slot ও ভাগ করা হয়। এজন্য একে TDM বলা হয়।

TDM → i) Synchronous TDM
ii) Statistical TDM

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(i) n সংখ্যক device থাকলে n সংখ্যক time slot এ ভাগ করব। ২য় চিত্রে 3 টি device তাই 3 টি time slot এ ভাগ হবে।

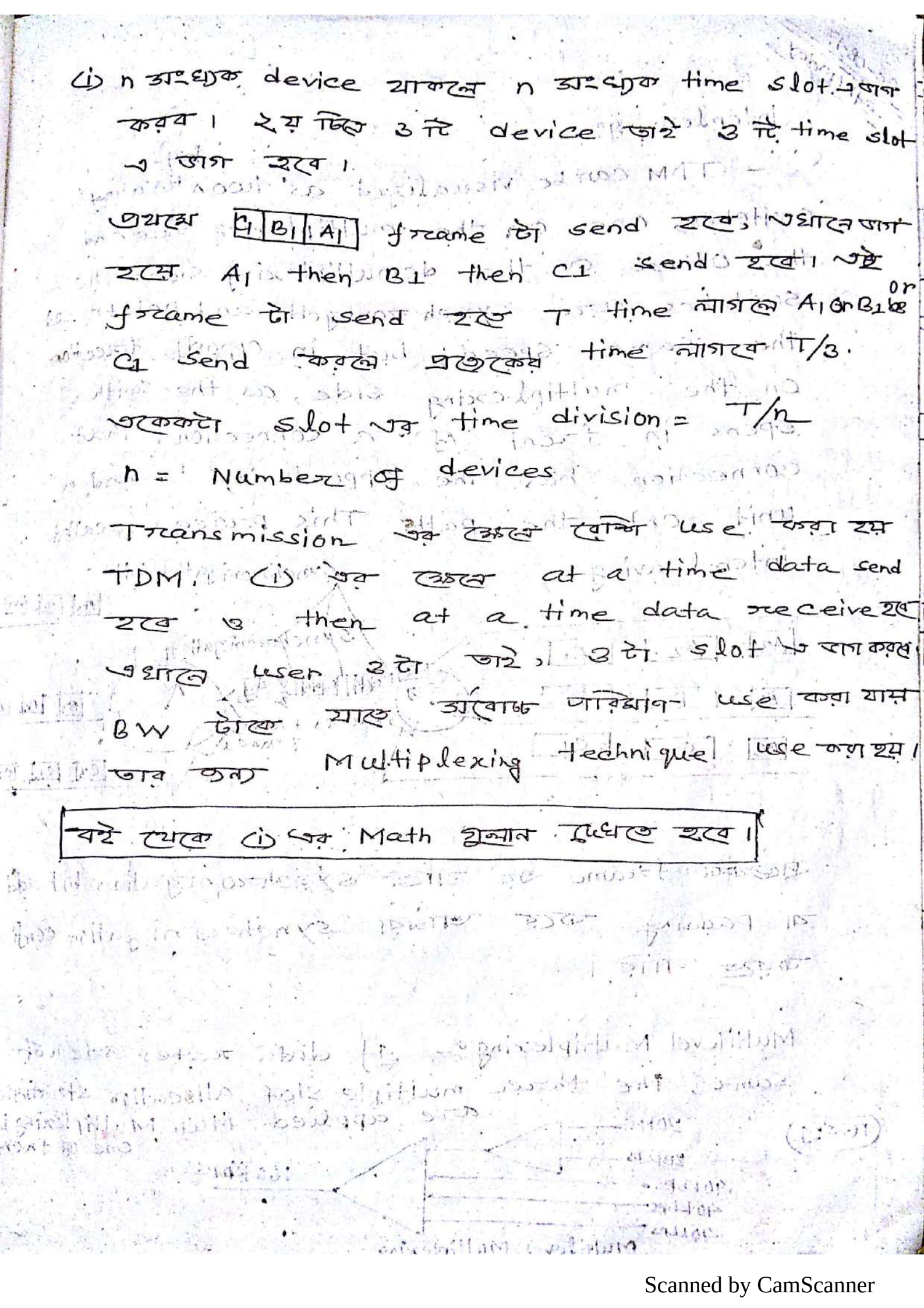
প্রথমে | C | B1 | A1 | frame টা send হবে, এখানে ভাগ হয়ে A1 then B1 then C1 send হবে। এই frame টা send হতে T time লাগলে A1 or B1 or C1 send করতে প্রত্যেকের time লাগবে T/3.

একেকটা slot এর time division = T/n

n = Number of devices

Transmission এর ক্ষেত্রে যেটি use করা হয় TDM. (i) এর ক্ষেত্রে at a time data send হবে & then at a time data receive হবে এখানে user 3 টা তাই, 3 টা slot এ ভাগ করে BW টাকে যাতে সর্বোচ্চ পরিমাণ use করা যায় তার জন্য Multiplexing technique use করা হয়।

বই থেকে (i) এর Math বুঝান বুঝতে হবে।

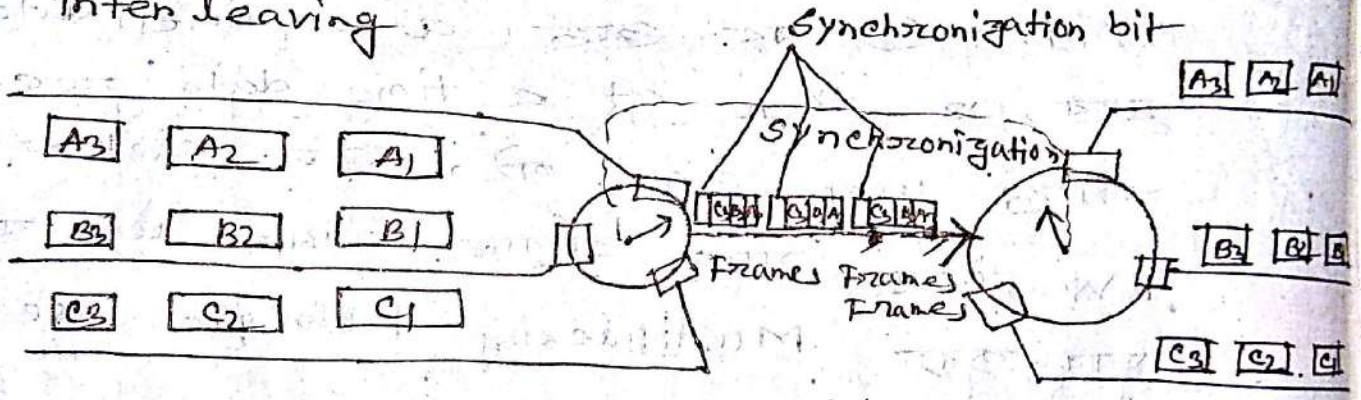


Scanned by CamScanner

20-08-17
9th (D) day

interleaving :-

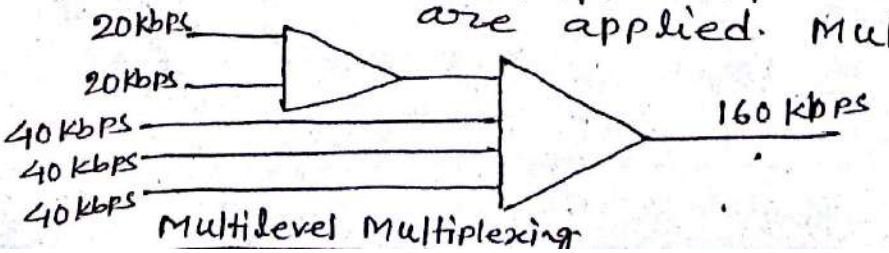
- TDM can be visualized as two fast-rotating switches, one on the multiplexing side and the other on the demultiplexing side. The switches are synchronized and rotate at the same speed, but in opposite direction. On the multiplexing side, as the switch opens in front of a connection, that connection has the opportunity to send a unit onto the path. This process is called interleaving.



প্রত্যেকটা frame এর আগে synchronization bit add বা padding করে আমরা synchronization confirm করতে পারি।

Multilevel Multiplexing :- If data rates are not same, the three multiple slot allocation strategies are applied. Mul. Multiplexing is one of them.

(Fig: 1)



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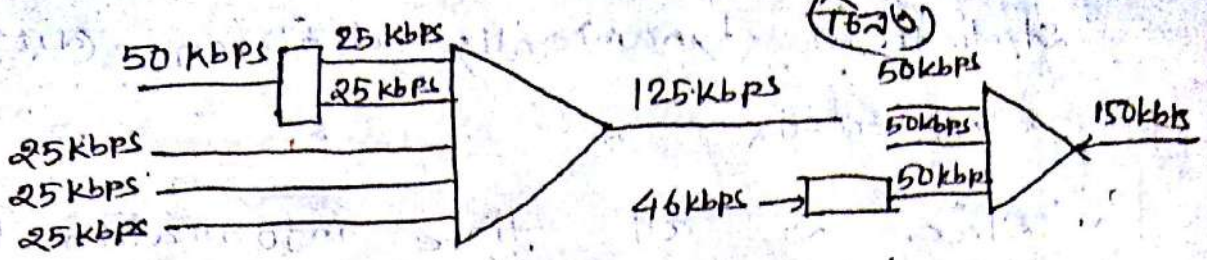
চিত্র 2)



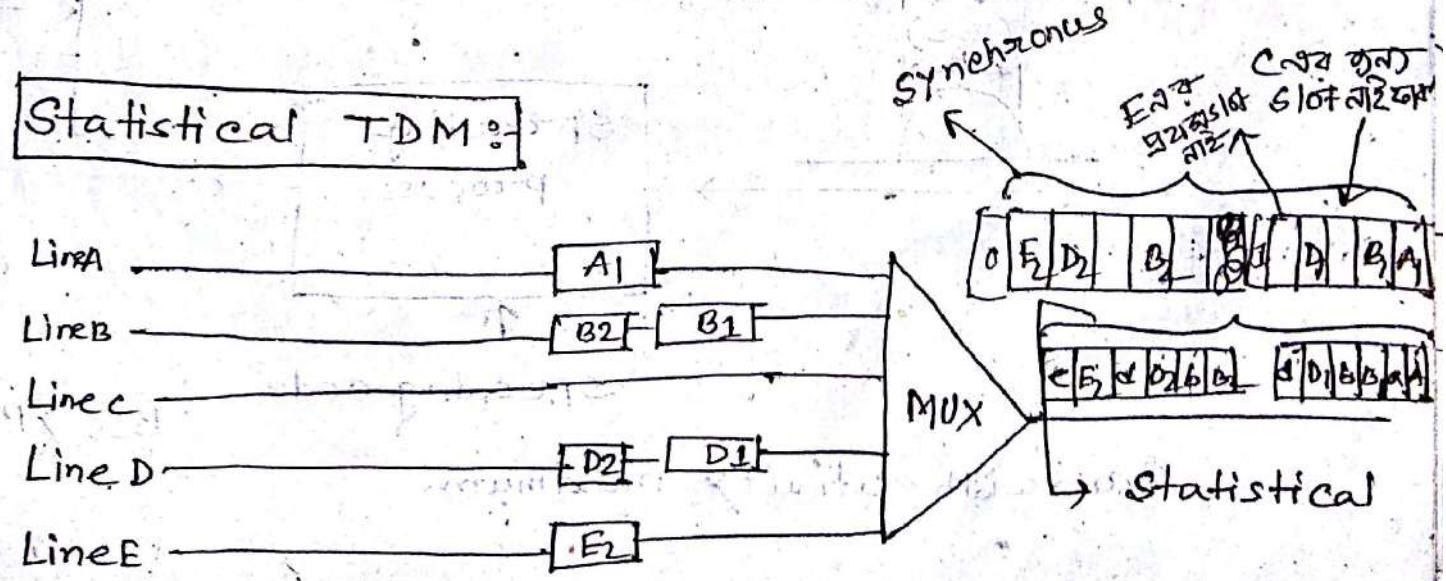
(চিত্র 3)

pulse stuffing / bit / bit Padding

যতগুলো user আছে তাদের bit rate আছে তখন transmission এর জন্য এটা।

প্রথম চিত্রে 20 kbps + 20 kbps = 40 kbps করে করা হয়েছে
দ্বিতীয় চিত্রে 50 kbps কে demultiplexing করে
25 kbps + 25 kbps করে transmit করা হচ্ছে
তৃতীয় চিত্রে, merge করলেও সমান করা যায় না + divide করলেও সমান হয় না, তখন extra bit add করা হয়, যেমন: 46 কে অন্য গুলোর সমান করার জন্য 4 add করেছি তখন একে pulse stuffing/ bit stuffing / bit padding.

Statistical TDM:



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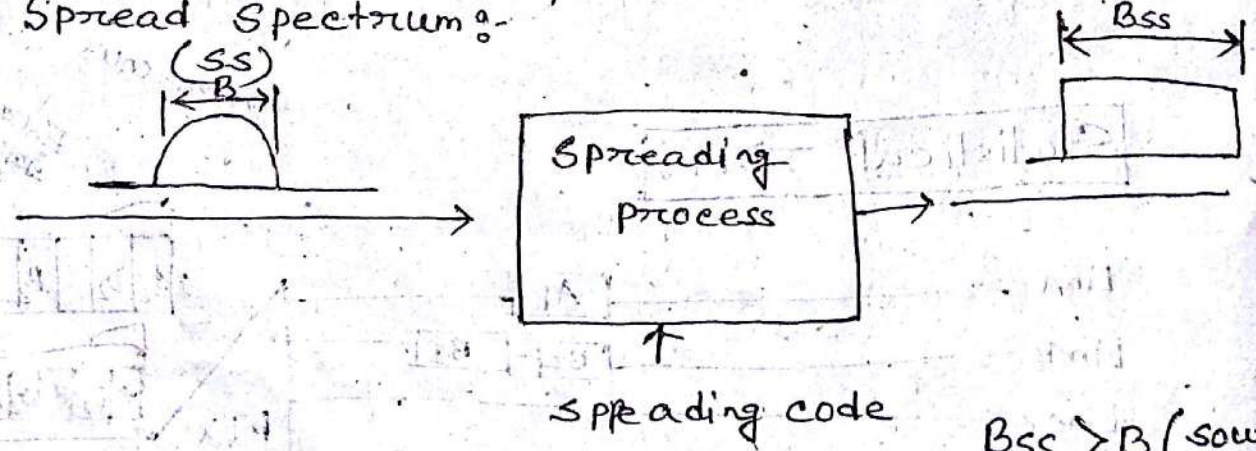
Statistical dynamically diesion নেয়
Synchronus " " না

Stas. এ all time information নিবে corresponding data এর add. থাকবে। কোন ফাকা থাকবে না, Receiver Receive করার সময় add. দেখে সহজে Receive করতে পারবে। Round Robin scheduling. এখানে এটা বেশিরভাগ apply করা হয়।

" " " এখানেও frame bit add করা যায় synchronization এর জন্য। ফলে synchronization এর ঝামেলা নাই। ~~syn~~ statistical এ frame size fixed না। syn. এ frame size fixed. Synchronus উপরের সব এর বিপরীত।

21-08-2017
9th (E) day

Spread Spectrum:-



Bss > B (source BW)

Bandwidth utility maximum

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SS achieves its goal through two principales:-

1) The bandwidth allocated to each station needs to be larger than what is needed. This allows redundancy.

2) The expanding of the orginal Bandwidth B to the Bandwith Bss must done by a process that is independent of the orginal signal

Two types:-

1) Frequency Hoping spread spectrum (FHSS)
2) Direct Sequence Spread Spectrum (DSSS)

Spread spectrum:- যখন medium হল wireless, তখন এর Receiver access পায়, তখন Bandwith টা high করতে হবে। যাতে কোন interfrance না ঘটে। তখন এই যে spread spectrum এর এই goal টা achieve করার দুইটা principal কেবলে দেয়া হল। এটা secure techniq কারণ এখানে Orginal code এর আগে একটা code add যেটা শুধু sender ও receiver জানতে পারবে। Carrier Now two types নিয়ে আলোচনা:- frequency টা mapping করে হিসেবে কাজ করছে ফলে hacker hack করতে পারবে না।

1) FHSS:- FDM এর আগে মিল আছে, এরা Carrier frequency use করে।

K = Spereading code

$M = 2^K$ = Carrier frequency

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K bit pattern

K = 3 এর জন্য

101	111	001	000	010	110	011	100

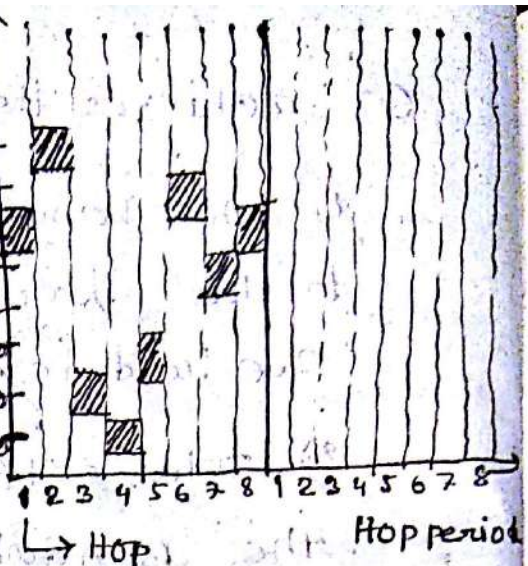
First Hop Selection

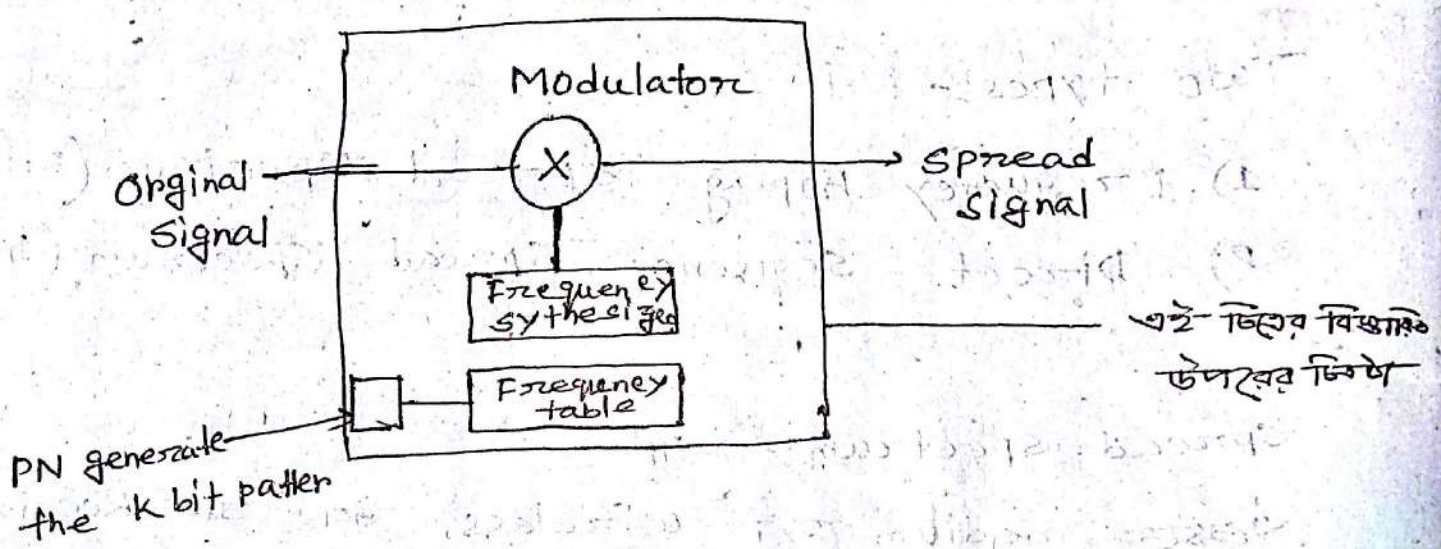
K = 3

M = 8

K bit	Frequency
000	200 kHz
001	300 »
010	400 »
011	500 »
100	600 »
101	700 »
110	800 »
111	900 »

Frequency table





Pseducode random code generator (PN), creates k bit patter for every hopping period.

এখানে randomly bit গুলোকে নেওয়া হচ্ছে, ফলে তার corresponding carrier freq. পাওয়া যাচ্ছে, এই carrier fequency orginal freq. এর সাথে mapping হিসেবে কাজ করে। ফলে hacker সহজে hack করতে পারেনা, ফলে এখানে safety generate হয় user এর।

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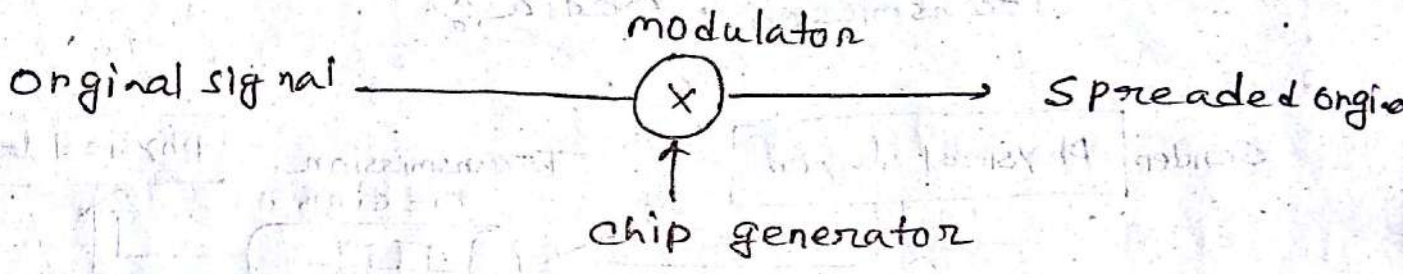
2) DSSS :-

- DSSS techniques also expands the bandwidth of the orginal signal, but the process is different

- In DSSS, we replace each data bit with n bits using a speading code

- In other words, each bit is assigned a code of n bits called chips, where the chip rate is n times that of the data bit.

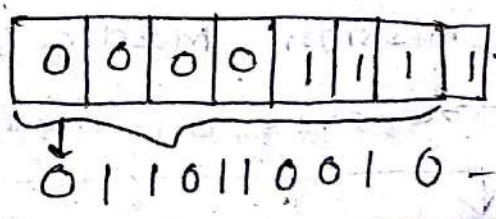


spreading code থাকবে, যেকোনো code-এর সাথে add হয় → সে spreading code হয়।

ধরে কাই, spreading code = 8 bit

orginal code = 32 bit

total = 8 × 32 bit



0 1 1 0 1 1 0 0 1 0 ——— → O. C.

0 0 0 0 0 1 1 1 1 0 0 0 0 1 1 1 1 ——— → Spreaded orginal

হয় modulator-এর

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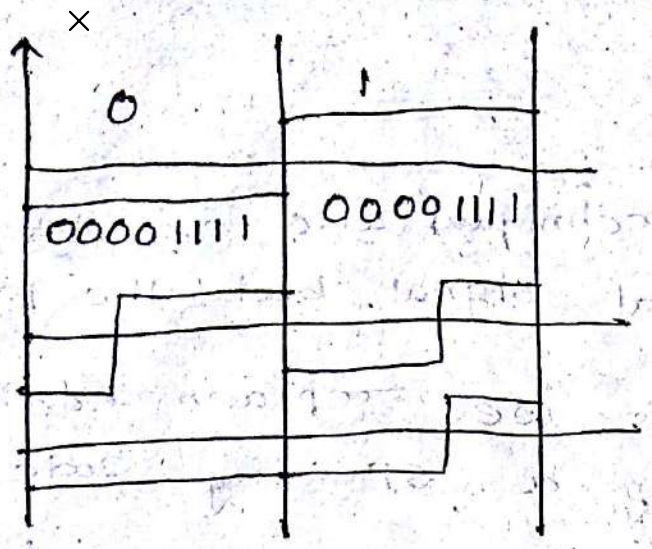


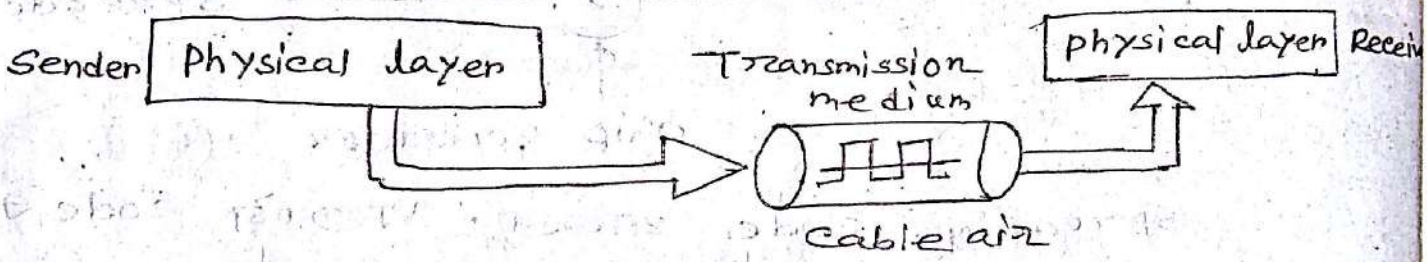
0 ↔ negative
1 → positive

← আগের কথামুলার graph representation

23-08-2017
10th(B)day

Chapter 7

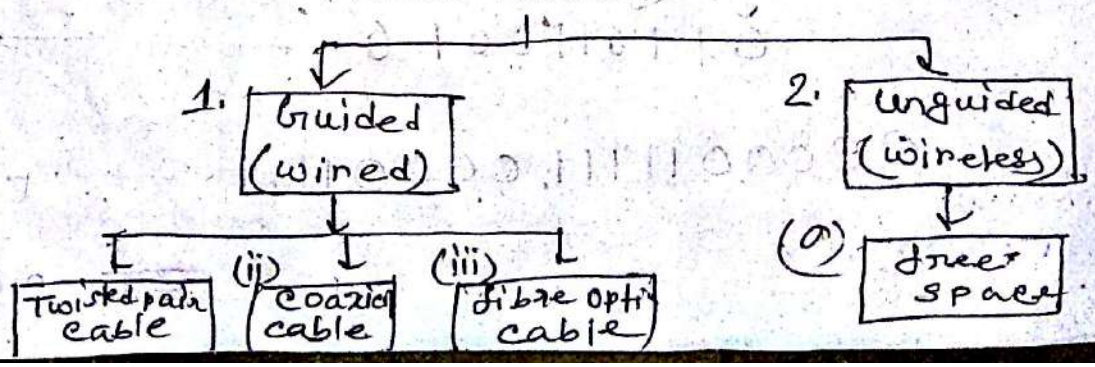
Transmission media :-



- Transmission medium can be broadly defined as anything that carry information from source to destination.

- physical layer এই কাজ করে।

Classes of transmission Media :-



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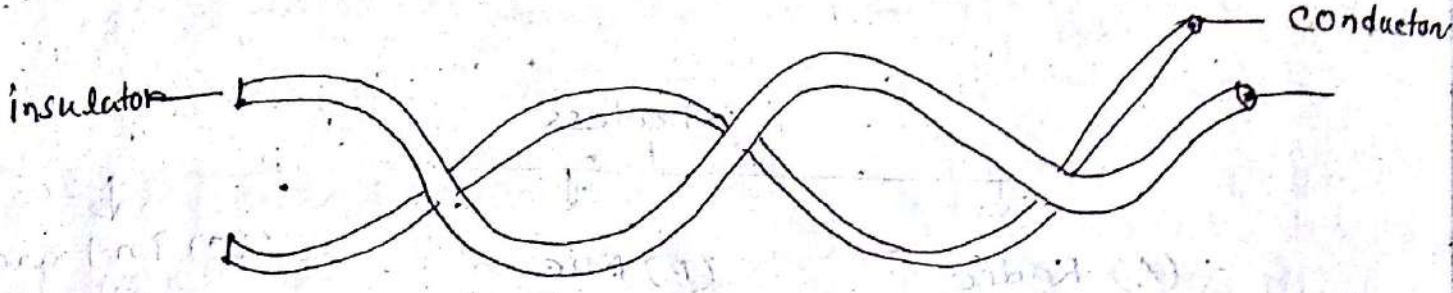
(i) Twisted pair cable:-

- A twisted pair cable consists of two conductors (normally copper), each with its own plastic insulation, twisted together



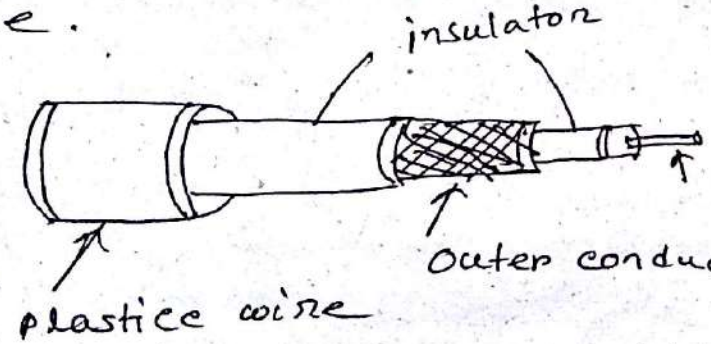
- One of the wires is used to carry signals to the receiver, and the other is used only as a ground reference.

Application:-

Twisted pair cables are used in telephone lines to provide voice and data channels.

(ii) Coaxial cable:- (Dish line)

- Coaxial cable carries signals of higher frequency ranges than those in Twisted pair cable.



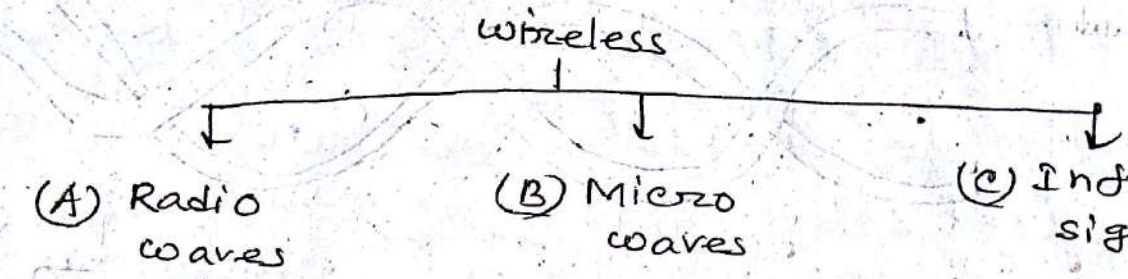
→ এর দ্বারা 160Mbs pass করা সম্ভব।

Application: Coaxial cable was widely used in analog networks where a single coaxial network could carry 10000 voice signals.

Scanned by CamScanner

- Cable T.V network also wed coaxial cables.
- Ethernet LAN

(iii) Fibre Optic cable → যেখে নিতে হবে

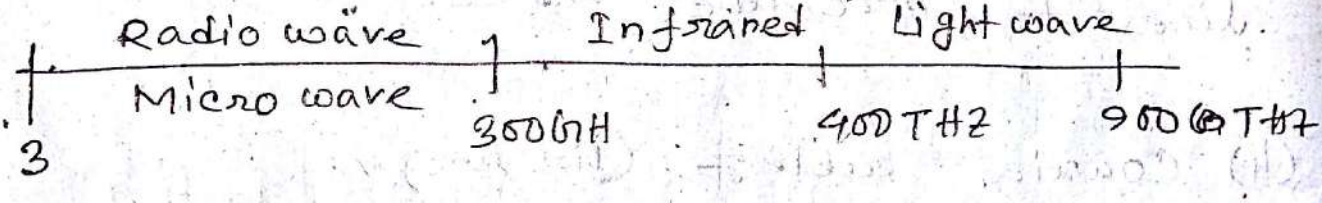


প্রত্যেকের Application, কত Mbps pass হয়, properties যেখতে হবে

(A) Broadcasting ও use হয়।

(B) Unicasting " " "

(C) অবশ্যে যেকি frequency



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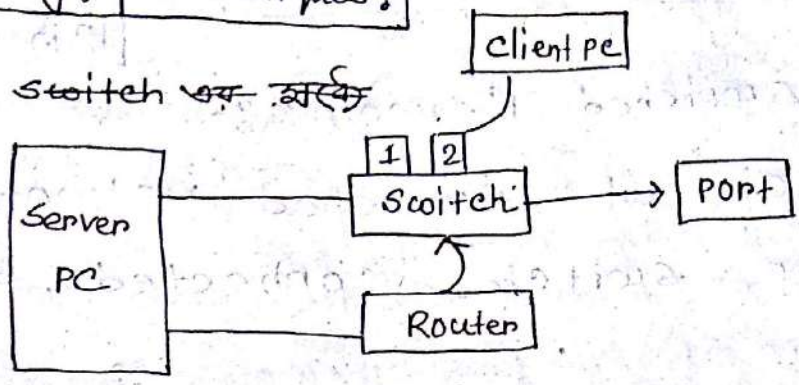
28-08-2017
10th (E) day

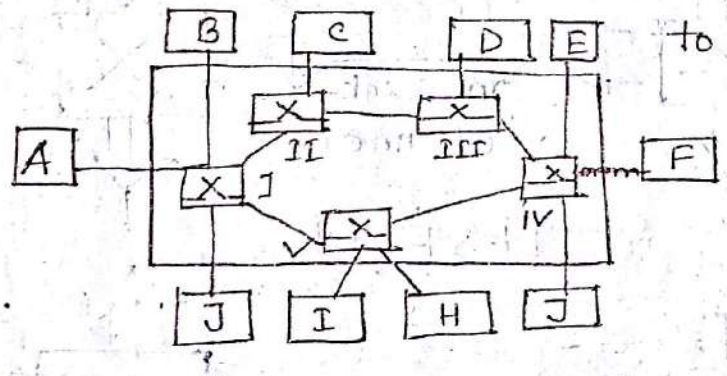
Switching :- techniques :-

একটা switch এর মধ্যে

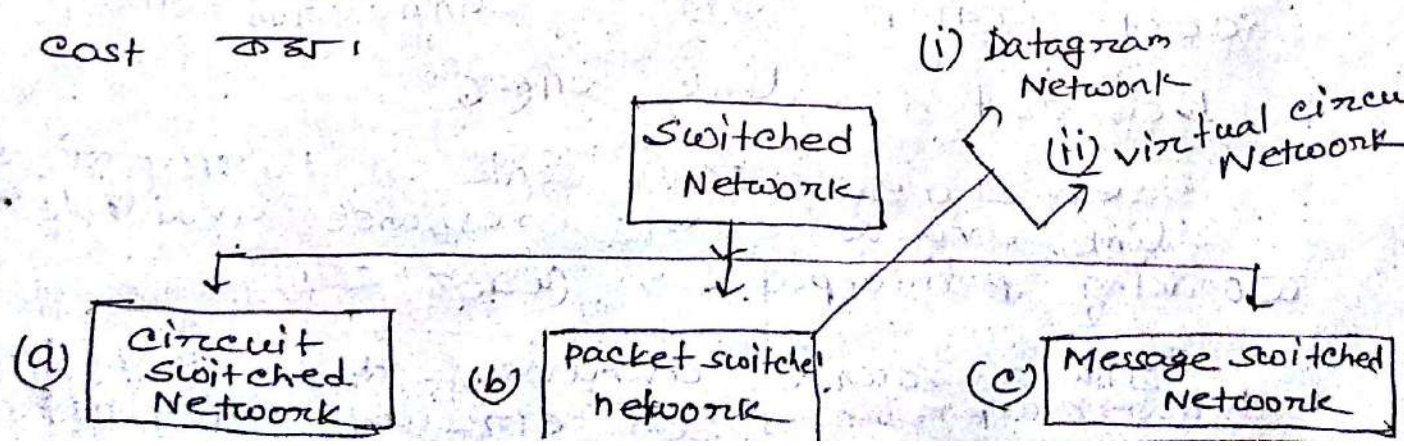


এর topology থেকে switching technique টা better. topology তে প্রত্যেকের আছে dedicated line আছে, একটা device idle থাকলে এর idle থাকে

NOW, switched Network, transmission হয় না properly, এই অবস্থাটা দূর করা হয় switch দিয়ে দূর করা হয়, Point to point connection না. dynamically decision নেয়।



A থেকে E তে data পাঠাতে চাচ্ছি, logical & physical address এর মাধ্যমে, switch এর সাহায্যে নিয়ে A থেকে E তে যায়। এক সাথে অনেকগুলোন switch একসাথে access চাচ্ছে সেক্ষেত্রে priority কাজ করবে। switching এ cost কম।



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09-09-17
~~9th~~ 11th (B) day

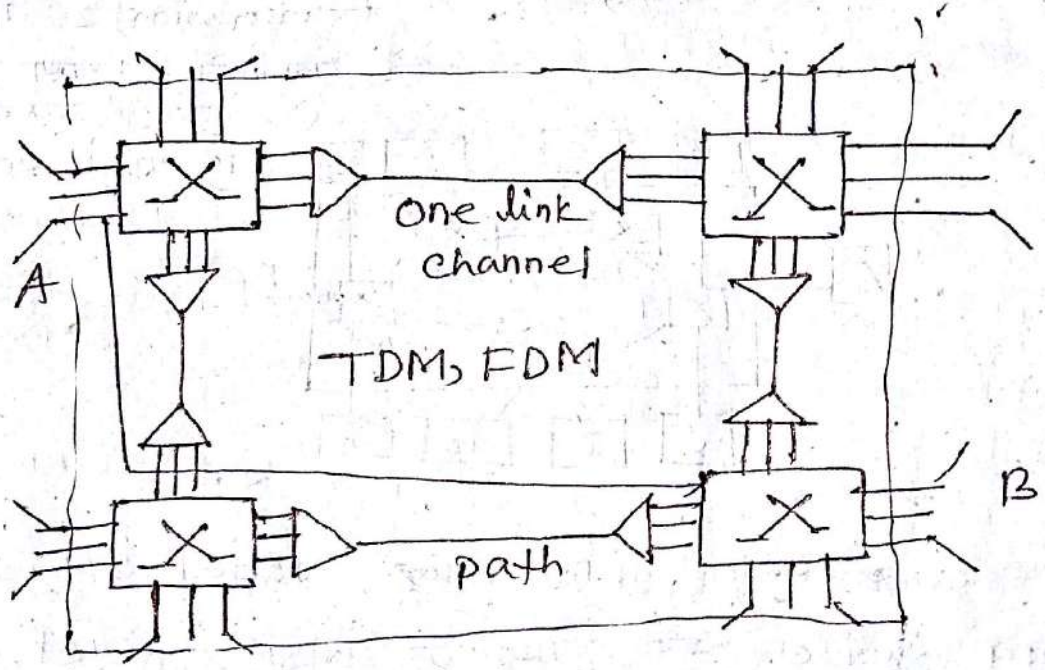
Chapter 1, 3, 4, 5, 7 → Quiz (25 marks)

12th (E) day

Circuit switched Networks :-

- A circuit switched network consists of a set of switches connected by physical links.

- It is made of a set of switches connected by physical links in which each link is divided into n channels.



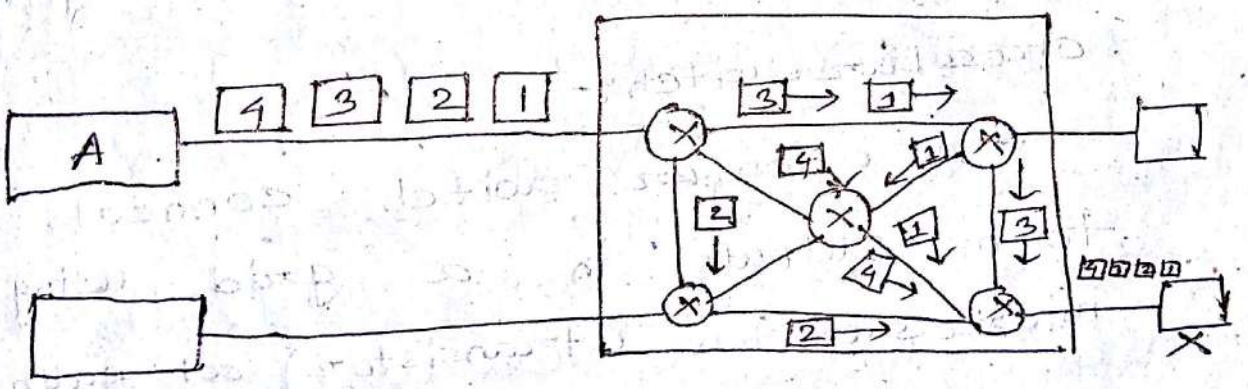
TDM, FDM এর মাধ্যমে Establised করা হয়।
cost বেশি কারণ Connection বেশি।
Dedicated link থাকবে
User 10 জন হলে link টা 10 ভাগে ভাগ হবে
link available তাই resource available হবে
working principal → বুঝতে হবে।

যদি resource available না হয় তাহলে dynamic
dynamic process হলে circuit switch network

fail করে। Datagram network থেকে এই disadvantage দূর করা হয়।

Datagram Network:-

- In packet switched network, there is no ~~procedure~~ resource reservation. resources are allocated on demand.
- In a datagram network, each packet is treated independently of ~~the~~ all others. Even if a packet is part of a multipacket transmission, the network treats it as though it existed alone. Packets in this approach are referred to as datagram.



→ এই packet গুলো আসা যাওয়ার ক্রমে আগে যাবে sequentially receive হবে order ঠিক থাকবে

→ যখন যে link টা access হবে, তখন সেটা use করা যাবে।

→ এখানে dedicated কোন link থাকবে না

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Virtual circuit Network: dedicated link dynamic হবে, কিন্তু আগের দুইটার combination

11-09-2017
11th (D) day

Virtual circuit Network:-

- circuit switch Network ও Datagram network কে combined করে পাওয়া যায়।

Characteristic গুলোন বই থেকে।

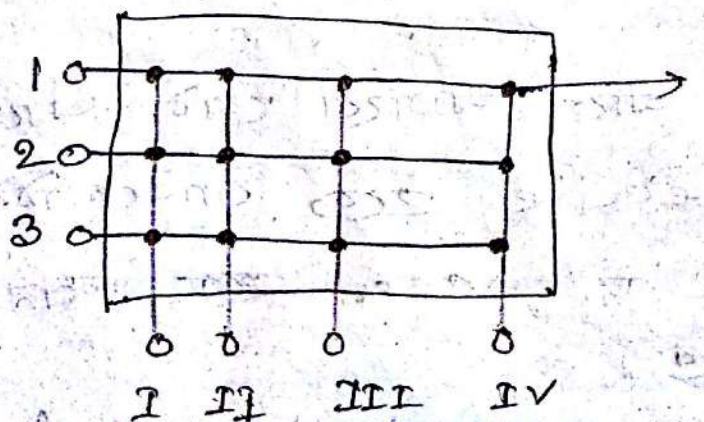
Structure of a switch:-

(i) space division switch
(ii) Time " "

(i) এর প্রথমে যেমন cross bar switch

crossbar switch:-

- A crossbar switch connects n inputs to m outputs in a grid, using electronic microswitches (transistor) at each crosspoint.



Crosspoint লাগবে = n x m

1000 জন user এর আগে connect থাকলে পাচ্ছি then crosspoint = 1000 x 10

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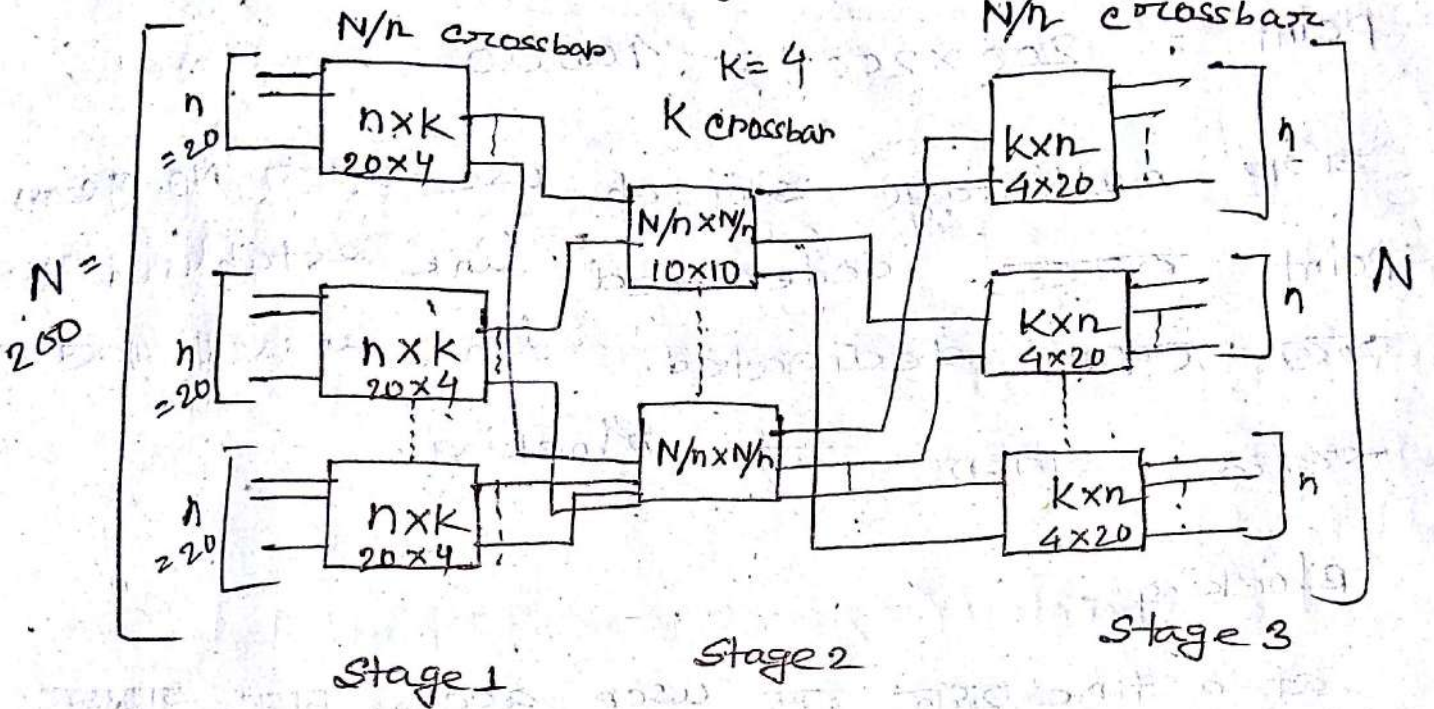
Disadvantage :-

No of cross point বেড়ে যাবে dedicated link established হয় যেকোন ১ সময়ে 75% dedicated link ব্যবহার না at a time.

এগুলো overcome করার জন্য,

Multistage switch :-



200/20 = 10 টা cross bar

10x(20x4) + 4(10x10) + 10(4x20) =

1. We divide the N input lines into groups, each of n lines For each group, we use one cross of size nxk, k is the number of crossbar in middle stage.

2. We use k cross bars, each of size (N/n) x (N/n) in the middle.

3. We use N/n cross bars, each of size kxn at the third stage.

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$$N/n\ (n \times k) + k\ (N/n \times N/n) + N/n\ (k \times n) = 2kN \times k(N$$

$$= 10(20 \times 4) + 4\ (10 \times 10) + 10\ (4 \times 20)$$

$$= 2000$$

কিন্তু cross bar switch use করলে total cross point $= 200 \times 200 = 40000$

অর্থাৎ multistage switch use করলে No. of cross point কমবে, dedecated link established হওয়ার ফলে কোন dedicated link unused থাকবে না, এক্ষেত্রে অসুবিধা হল Blocking.

Blocking :-

at a time যখন অনেক user access চায়, তাদের সবাই access পাবে না সবাই at a time, কাউকে wait করতে হবে একে বলা হয় blocking.

এক্ষেত্রে যদি কিছু cross point বাড়ায় দেওয়া হয় তবে blocking কে overcome করা যায়। Blocking এর জন্য একটা algorithm আছে। (clos criteria আছে।

- According clos criteria :

$$n = (N/2)^{1/2}$$

$$K > 2n - 1$$

Total Number of Crosspoint $= \sum 4N \left[(2N)^{1/2} - 1\right]$

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এগুলা satisfied হলে blocking দূর হবে।

$N = 200$ হলে

$$n = (200/2)^{1/2} = \sqrt{100} = 10$$

$$k = 2n - 1 = 19$$ [cross bar বের হচ্ছে]

এখন middle stage এ 19 টা cross bar আছে।

then একেকটা cross bar এ 20 টা input, 20 টা output, then total cross bar middle এ 19 (20×20)

1st stage এ ⟶ $20 \times (10 \times 19)$

3rd stage এ ⟶ $20 \times (19 \times 10)$

then, total cross bar, $19(20 \times 20) + 20 \times (10 \times 19) + 20 \times (19 \times 10)$

$= 9500$ cross bar.

আগের ক্ষেত্রে crossbar = 2000, Now,

= 9500

ফলে blocking অবস্থাও দূর হচ্ছে এক্ষেত্রে এবং cross bar ও কমছে। 100% cross point হচ্ছে না, পাওয়া যাচ্ছে 24% cross point.

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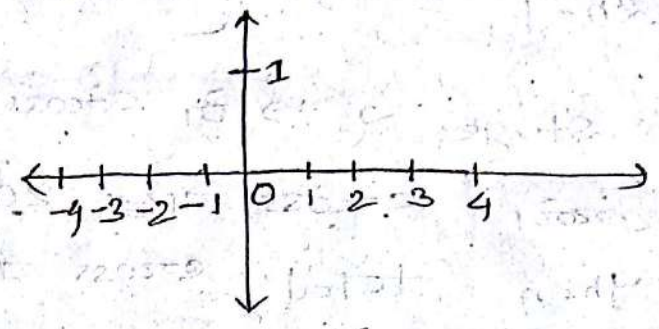
12-03
11th(E)day

delta function: এই function এ শুধু একটাই output হবে

$$\delta[n] = \begin{cases} 1 & n=0 \\ 0 & \text{, otherwise} \end{cases}$$

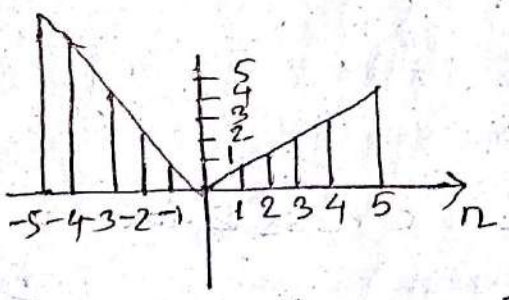
$f(x) = \{1, 0, 1\}$
↑
↑ = origin
এর মানে হল
$x=0$ হলে
$f(x) = 1$



$$\delta[n] = \{\cdots 0,0,0,0,\ 1,\ 0,0,0,0 \cdots\}$$

এইটার আরেকনাম impulse response (হওয়া করে response 1 unit যদি হয়)

Even signal: (symmetric signal)

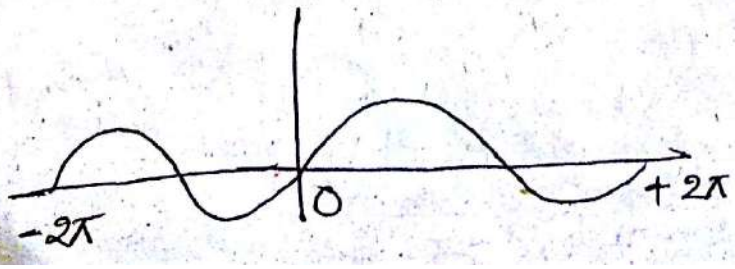


[Even digital signal]

$x(n) = x(-n)$

$x(n) = n$ এর corresponding output

n = positive হলে যে signal পাওয়া যায়, n = negative হলেও একই signal হলে তাকে even signal বলে



[Even Analog signal]

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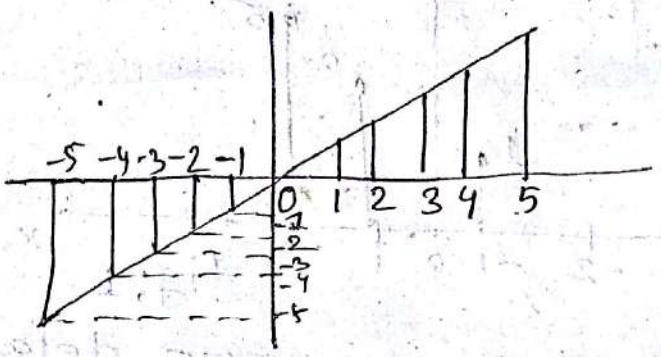
$x(n) = \{0, 1, 2, 3, 4, 5\}$
$x(-n) = \{0, 1, 2, 3, 4, 5\}$
$x(-n) = \{5, 4, 3, 2, 1, 0\}$

even signal

Odd signal :- (Antisymmetic signal)



$$x(n) = -x(-n)$$

$x(1) = +1$
$x(-1) = -1$

যেই signal এর half portion graph এর একদিকে বাকি half portion opposite দিকে থাকে তাকে odd

Co-relation : একজনের সাথে আরেকজনের Similarity কতটুকু তা বুঝায়

Cross correlation : দুইটা আলাদা আলাদা signal কে কতদূর পর্যন্ত co-related তাকে বলে cross correlation.
$x(n)$, $y(n)$ } দুইটা আলাদা signal

Auto correlation : একই signal টা পাশাপাশি এবং যা পাশে তাদের মধ্যে similarity কতটুকু।
$x(n) \rightarrow$ একটা signal.

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Shifting:-

(i) delay signal

(ii) Advance :

$x(n) = \{1, 0, 3, 5\}$
↑

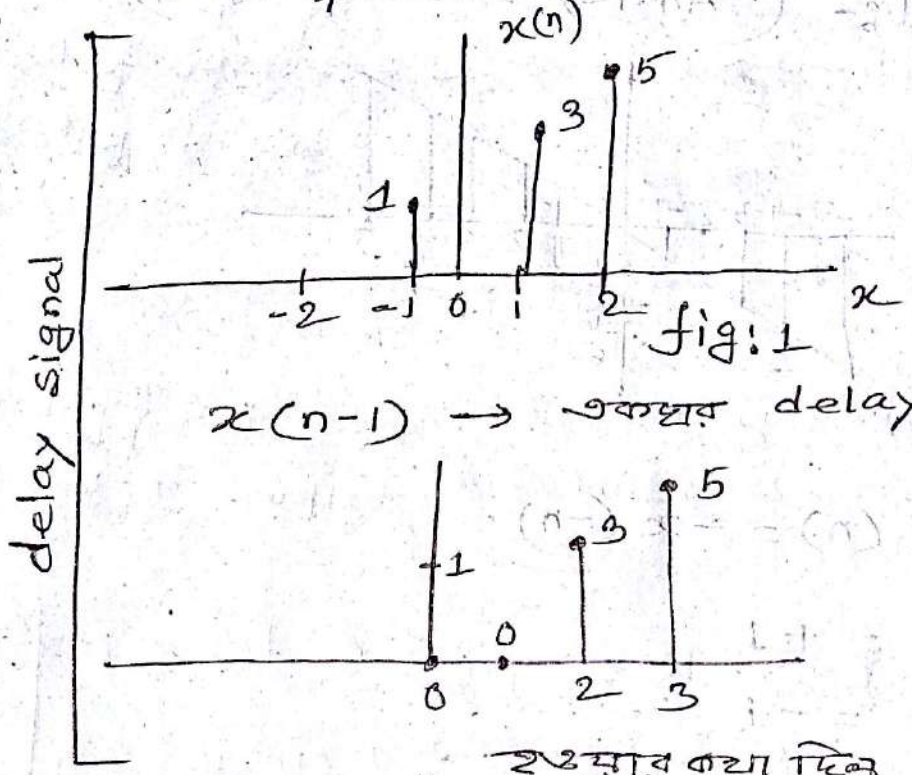


fig: 1

$x(n-1)$ → একঘর delay then,

~~এক~~ যে time ও শুরু হওয়ার কথা ছিল তার থেকে যদি বেশি সময়ে শুরু হয় তবে তাকে delay signal বলে

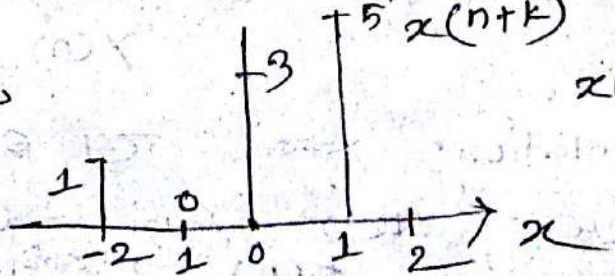
$k = 1, 2, \cdots$ $(n-k) \rightarrow k$ delay

$x(n-1) = \{0, 1, 0, 3, 5\}$
↑

(ii) $x(n+1)$

এখন left shif হবে বুঝলে।

fig: 1 এর (ii) হবে,



$x(n+1) = \{0, 1, 0, 3, 5\}$
↑

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23-09-17
13th (B)day

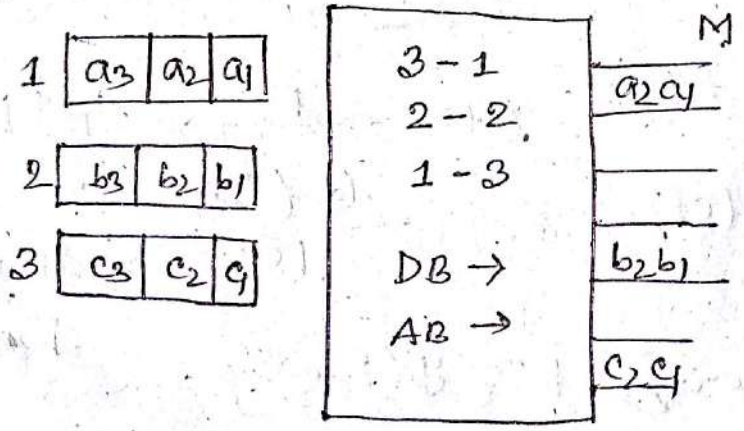
এর আগের lecture mobile-এ আছে

Crossbar switch ⟶ N × M

Multistage » ⟶ crosspoint বাড়ে যাওয়ার কারণে Hacking তৈরী হতে পারে এজন্য blocking দূর করা জন্য clos criteria use করা হয়।

TIME DIVISION Switching:-

** Time slot interchange: (TSI)



⟶ যার priority বেশি হবে তাকে আগে send করবে

Time slot interchange কি? কিভাবে কাজ করে?

Scalling property:-

$f(x) = 2x$ or $f(t) = 2t$

$f(x/2) = x/2$ or $f(t/2) = t/2$

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$t = 0 \quad f(t) = 0$

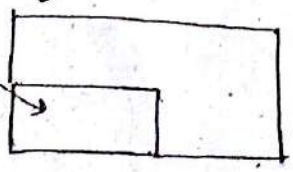
$t = 1 \quad f(t) = 2$

$t = 2 \quad f(t) = 4$

একেত্র $f(t) = 2t$ → scalling factor

Scalling factor = 2

Scalling factor = 0.5



Scalling factor হল একটা constant value, যার উপর base করে signal টা change হবে।

$= 0 =$

scalling property

$g(t) \xrightarrow{F} G(f)$

$F\{g(ct)\} = \frac{G(f/c)}{|c|}$ → always positive

Shifting property, $F\{g(t-a)\} = e^{-i2\pi fa} G(f)$

Scalling factor > 0 হলে signal amplify.

Scalling " < 0 " signal reduce.

Signal এর আগে যখন scalling factor যুক্ত হয় then তা scalling factor যুক্ত signal হবে।

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$$F\{g(t)\} \longleftrightarrow \int_{-\infty}^{\infty} g(t)\, e^{-i2\pi ft}\, dt$$

$$F\{g(ct)\} \longrightarrow \int_{-\infty}^{\infty} g(ct)\, e^{-j2\pi ft}\, dt$$

Substitute,

$$u = ct$$

$$\Rightarrow du = c\,dt$$

If c is positive

$$F\{g(ct)\} = \int_{-\infty}^{\infty} \frac{g(u)}{c}\, e^{-i2\pi f u/c}\, du$$

$$= \int_{-\infty}^{\infty} \frac{g(u)}{c}\, e^{-i2\pi f u/c}\, du$$

$$= \frac{G_1(f/c)}{|c|}$$

If c is negative,

$$F\{g(ct)\} = \int_{+\infty}^{-\infty} \frac{g(u)}{c}\, e^{-i2\pi f u/c}\, du$$

$$= -\int_{-\infty}^{\infty} \frac{g(u)}{c}\, e^{-i2\pi f u/c}\, du$$

$$= \frac{G_1(f/c)}{|c|}$$

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