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Computer Networks
Tutorial 3.

Ans 1: Our goal in telecommunications is to increase the data rate and decrease the signal rate.
Increasing data rate increases the speed of transmission while decreasing the signal rate decreases the bandwidth requirement.
The relationship between data rate and signal rate can be represented by

$$S = \frac{CN}{R}$$

; N = bit data rate
C = Case factor
S = No. of signal elements
r = ratio b/w data & signal elements.

Ans 2: Baseline Wandering :- The receiver averages the signal power (Baseline) and uses it to decode the received signal bit value.

DC Components :- Constant level for long period of time creates very low frequency components in the frequency spectrum that might not pass through some medium. Hence, we need to remove the DC from the Digital signal.

Long strings of 0's and 1's causes a drift of the obtained baseline, hence "baseline wandering" that leads to incorrect bit decoding.

Ans 3: Both Pulse Code Modulation and Delta Modulation use sampling to convert an analog signal to a digital signal.
PCM finds the value of signal amplitude for each sample whereas DM finds the change between two consecutive samples.

PCM	DM
• Feedback does not exist in transmitter or receiver.	• Feedback exists in transmitter
• 4, 8 or 16 bits are used per sample.	• Only 1 bit is used per sample.
• Requires high transmitter bandwidth	• Requires lowest transmitter bandwidth
• It is complex in implementation.	• It is simple in terms of implementation
• Good signal to noise ratio.	• Poor Signal to noise ratio.

Ans 4:

Serial Transmission	Parallel Transmission
• Serial Transmission is the type of transmission in which a signal communication link is used to transfer the data from end to another.	• Parallel transmission is the transmission in which multiple parallel links are used that transmit each bit of data simultaneously
• Transmits only 1 bit per clock pulse.	• Transmits 8 bits or more to setup per clock pu

Ans 5:

Serial Transmission	Parallel Transmission
• Comparitively simple and cost efficient	• Comparitively complex and costly.
• Comparitively lower performance	• Comparitively higher performance
• More preferred for long distance transmission.	• More preferred for short distance transmission.

Ans 5: In the process of 5B/6B encoding, it is possible to have two kinds of data sequences:

1. 32 data sequence
2. 64 data sequence

Therefore, this can leave us with some unused code sequences that are 32 in number.

In the encoding process of 3B/4B, it is possible to have another set of data sequences as follows:-

1. 16 data sequences
2. 8 data sequences

Therefore, this can leave us with some unused code sequences that are 8 in number.

Ans 6: a) In a lowpass signal, minimum frequency is 0.
Therefore,

$f_{max} = 0 + 200 = 200\ KHz$

$f_s = 2 \times 200000 = 400\ KHz$ (Sampling)

b) Given $n_b = 10$

$SNR_{dB} = 6.02 \times n_b + 1.76 = 61.96$

c) Given $n_b = 10$

$B_{PCM} = n_b \times B_{analog} = 10 \times 200\ KHz = 2\ MHz$

Ans 7: Given $B = 200\ KHz$

$L = 4$

a)

b)

Data rate $= 2B \log_2 L$

$= 2 \times 200 \times 2$

$= 800\ KHz$

c)

d)

Ans 8: Given

$B = 20\ KHz$

$C = 30 \times 10^3\ bps$

Given: Now,

$C = B \log_2 (1 + SNR)$

$\frac{30 \times 10^3}{20} = \log_2 (1 + SNR)$

Ans 9:

$$1500 = \log_2(1+SNR)$$

$$1+SNR = 2^{1500}$$

$$SNR_{DB} = 10\log_{10}(2^{1500}+1)$$

$$= 10 \times \log_{10}(2^{1500})$$

$$= 10 \times \log_2 2^{1500} \times \log_{10} 2$$

$$= 10 \times 1500 \times 0.3$$

$$= 4500$$

Ans 9:

Given,

an NRZ signal has a data rate of 100 kbps.

a) $f/N = 0/100 = 0 \rightarrow P = 1.0$

b) $f/N = \frac{50}{100} = 1/2$ $\quad P = 0.25$

c) $f/N = 100/100 = 1/1$ $\quad P = 0$

~~d) $f/N = 150/100 = 1.5$ $\quad P = 0.0$~~