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B TECH 3RD YEAR

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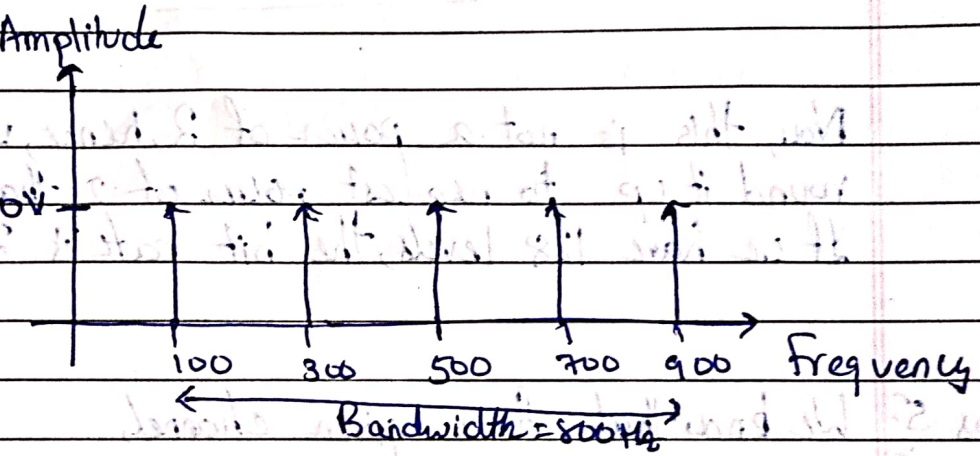
21/8/20

Computer Networks
Tutorial 2

Ans 1) f_h :- Highest frequency = 900 Hz
f_l = lowest frequency = 100 Hz
Bandwidth = $f_h - f_l$ = 800 Hz

Spectrum :-



Ans 2) It is required to sample the signal twice the highest frequency.
So bit rate = current bandwidth * 2 * sample size
= 4 KHz x 2 x 8 bit
= 64 kbps

Ans 3) The answer depends on the accuracy desired :-
a) The ~~maxim~~ minimum bandwidth, a rough approximation, is bitrate/2 or 500 kHz. We need a low-pass channel with frequencies between 0 and 500 kHz.
b) A better result could be achieved by using the first, third and fifth harmonics with B = 5 x 500 x = 2.5 MHz.

Ans 4: Required bitrate = 256 kbps
Channel bandwidth = 20 kHz

Now, Required bitrate = 2 log L × channel bandwidth
$\Rightarrow 256 \times 10^3 = 2 \times 20 \times 10^3 \times \log L$
$\Rightarrow \log L = 6.625$
$\Rightarrow L = 98.7$ levels

Now, this is not a power of 2, hence, we need to round it up to nearest power of 2, that is, 128.
If we have 128 levels, the bit rate is 280 kbps.

Ans 5: We know that for a given channel,

According to Shannon capacity,
Capacity = Bandwidth * $\log_2$ (1 + SNR)
Capacity = $3000 * \log_2 (1 + 3162)$
Capacity = $3000 * 11.61707$
= 34881 bits/Hz

Ans 6: Network bandwidth = 10 Mbps
Average fps = 12000
Bits per frame = 10000

The throughput of network is: $\frac{12000 \times 10000}{60 \times 10 \times 10^6}$
$= \frac{12 \times 10}{60} = 2$ Mbps

Ans 7: The average signal rate is $S = N/2 = 500$ kbaud. The minimum bandwidth for this average baud rate is $B_{min} = S = 500$ kHz.

Ans 8:

a) Nyquist rate = 2 x Bandwidth
= 2 x 200 kHz
= 400 kHz.

b) Nyquist rate = 2 x Bandwidth
= 2 x (100 + 200)
= 600 kHz