Nyquist Rate

1) $x_{max} = 1$.

$0.75 = \frac{2 \times 1}{2^N}$ $\boxed{f_s = 100}$

$2^N = \frac{200}{75}$

$N \approx 1$

So,

$r = n \times f_s = 1 \times 100 = 100$

2) $f_s = 2000\ Hz$ & $N = 8$

For given $S/N = 10db$

$4.8dB + 6n \geq S/N$

$4.8dB + 6n \geq 10dB$

$6n \geq 5.2$

$n \approx 1$

As $N > n \Rightarrow$ So, No file transfer occur

Quesh

3) Error $= \frac{\Delta}{2} = \frac{0.2}{100} \times x_{max}$

where $\Delta = \frac{2x_{max}}{2^N}$

$$\frac{\cancel{2}x_{max}}{\cancel{2}\times 2^N} = \frac{0.2}{100} \times \cancel{x_{max}}$$

$2^N = 500$

$N = 9$

Nquist rate $= 2 \times 2KHz = 4KHz$

$f_s =$ Nquist Rate $+ \frac{20}{100} \times$ Nquist rate

$f_s = 4.8KHz$

$r = nf_s = 9 \times 4.8 KHz = 43.2$ kbit/s

10 signals are multiplexed

So, $r' = 10 \times nf_s = 432$ Kbits

4) $f_m = 15 KH_z$

a) $f_s = 2 \times f_m = 30 KH_z$

b) $65536 = 2^N$

$N = 16$

c) $r = n f_s = 16 \times 30{,}000 = 480000$

d) $r' = 16 \times \cancel{40}\, 44{,}1000 = 705600$

5) Nquist rate $= 2 \times 4.5 \times 10^6 = 9 KH_z$

f_s = Nquist rate + $\frac{20}{100} \times$ Nquist rate

$f_s = \cancel{80}\ 10.8$

b) $1024 = 2^{\cancel{10}\,N}$

$N = 10$

c)

Ans 10^6 synals The multiplexer $\Rightarrow r = 10 \times 10^6 \times 10.8$

$r = 108$ Mbit/s

b) Quantization Error $= \frac{0.2 \times X_{max}}{100} = \frac{\Delta}{2}$

$$\frac{\cancel{2} X_{max}}{\cancel{2} \cdot 2^N} = \frac{0.2}{100} X_{max}$$

$$\cancel{\Delta}\, 2^N = 500$$

$$N = 9$$

$$f_s = \text{Nyquist Rate} + \frac{20}{100} \times \text{Nyquist}$$

$$f_s = \cancel{20}\ 2 + \frac{20}{100} \times 2$$

$$f_s = 2.4\,Kz$$

$$r = 9 \times 2.4 = 21.6$$

five are multiplexed

so,

$$r' = 5 \times 21.6 = 108$$

O.T.G of bits are increase

So, New

$$\vartheta' = 108 + \frac{108 \times 0.5}{100}$$

$$\vartheta' = 108.54$$

$$\text{Bandwidth} = \frac{108.54}{2} = 54.27\,kHz$$