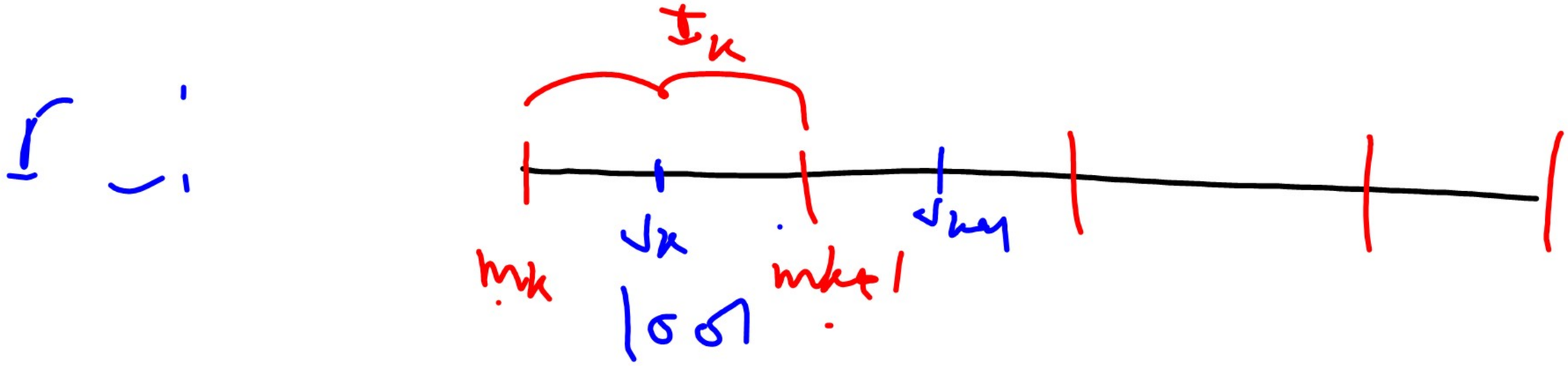
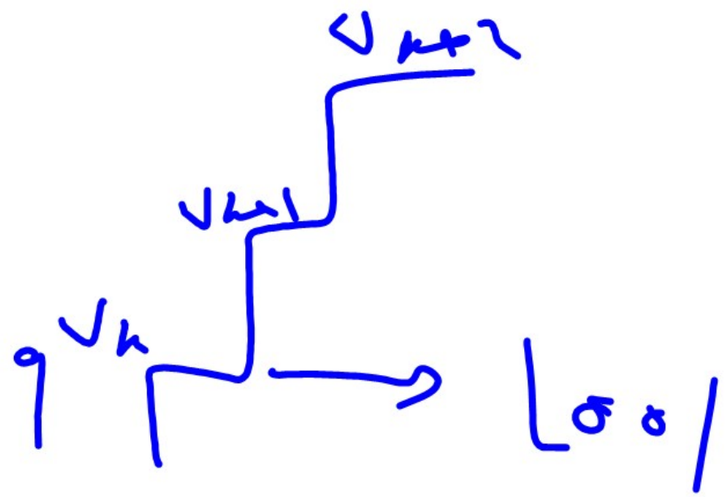




A certain three channel PAM system is composed from multiplexing three analog signals

$f_1(t) \longrightarrow W = 7\,kHz$

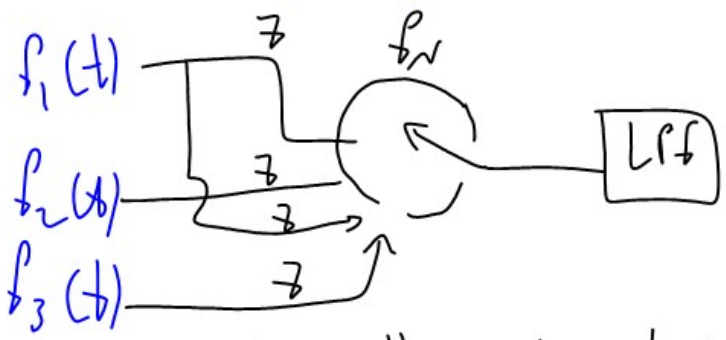
$f_2(t)$, $f_3(t)$ $\longrightarrow W = 3\,kHz$

(a) Design scheme for this multiplexer with each signal sampled at anyquist rate 7 kHz

$f_s \geq 2W$

$f_1(t) \geq 2(7) = 14$

(a)



(b) What must be the min clock freq of the commutator f_N in samples/sec?

f_N = no of signals × f_s

= 4 × 7kHz = 28 ks/s

(c) If a 20kHz LPF is added after the commutator and the transmission what is the max value of f_N?

$BW = \frac{f_N}{2} \longrightarrow 20k = f_N = 40\,kHz$

(d) if the commutator output is quantized with 1024 levels (PCM), what is the output bit rate (use f_N in (b))?

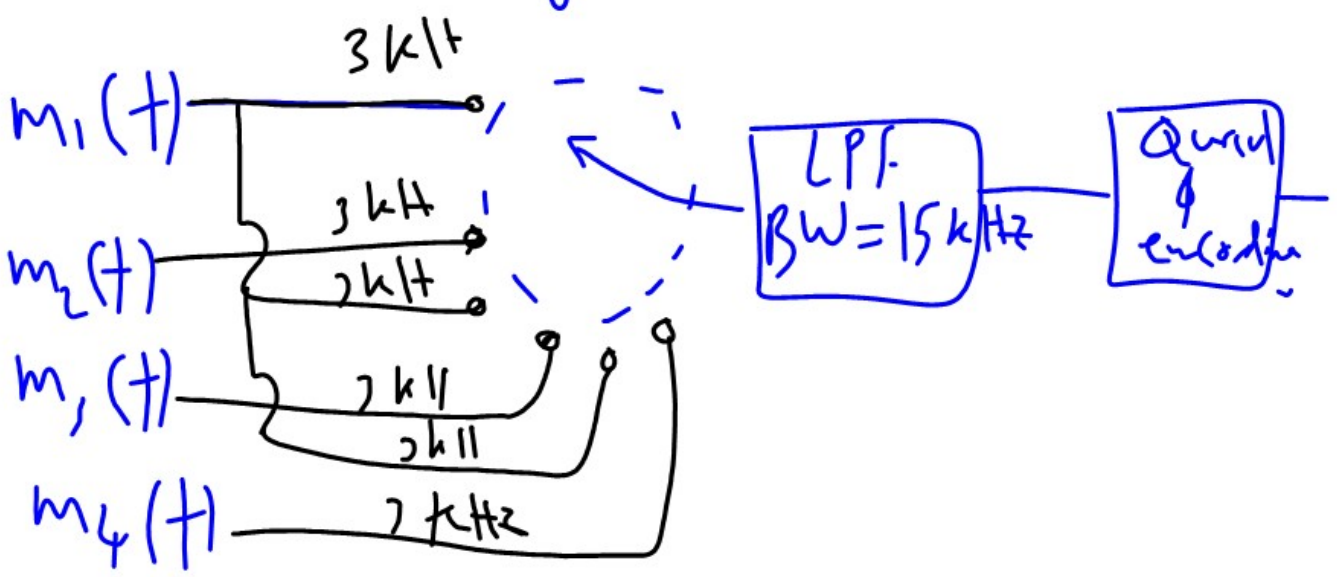
R_b = no of bits × number samples/sec

= 10 × 28k = 280 kb/s

(e) what is the min BW of the DPCM signal?

$BW = \frac{f_N}{2} = \frac{28}{2} = 14\,kHz$

Q2 a TDM system is Composed of 4 analog signals as shown



$m_1(t) \Rightarrow W = 4.5kH$

$m_2(t), m_3(t)$ and $m_4(t) \Rightarrow W = 1.2kHz$

(a) What must be the min f_N?

$$m_1(t) = \frac{4.5k}{3} = 1.5kH$$

$$N_{1/2} rate = 2 \times 1.5 = 3kHz$$

$$f_N = N \times f_s = 6 \times 3 = 18kHz$$

(b) what is max f_N?

$$Bw = \frac{f_N}{2} \Rightarrow f_N = 2 \times 15k = 30kH$$

(c) output of commutator is quantized using 1024 levels, what is the output bit rate?

$$R_b = 10 \times 18k = 180kb/s$$

(d) $LPF \rightarrow BW = \frac{1}{2}(1+\alpha) R_b$

$$\alpha = 0.75$$

$$BW = 157.5 kHz$$