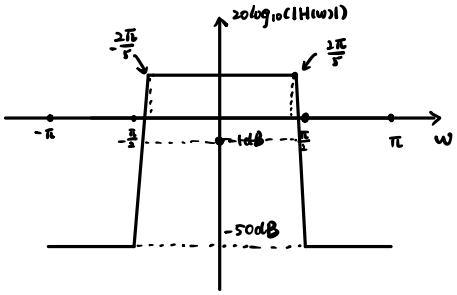
[1] $x_c(t) = 5\cos(400\pi t) + 10\sin(500\pi t)$, $f_s = 1\text{kHz}$

$w_1 = \frac{400\pi}{1k} = \frac{2\pi}{5}$ $w_2 = \frac{500\pi}{1k} = \frac{1}{2}\pi$

the digital filter should go in this:



the cutoff frequency is $\frac{2\pi}{5}$,

the transition bandwidth is $\frac{\pi}{2} - \frac{2\pi}{5} = \frac{1}{10}\pi$

[2]

(a)

10kHz, sample at 30kHz $\Rightarrow w = \frac{5k \cdot 2\pi}{30k} = \frac{1}{3}\pi$

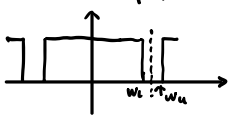
filter: low pass filter cutoff frequency: $\frac{1}{3}\pi$.

(b) sample rate 400Hz, 60Hz noise, transition band $\frac{\pi}{10}$ for the filter.

$w = \frac{60 \cdot 2\pi}{400} = \frac{3}{10}\pi$

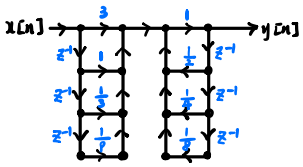
filter: bandstop filter cutoff frequency: $w_L = \frac{3}{10}\pi - \frac{\pi}{20} = \frac{1}{4}\pi$

$w_u = \frac{3}{10}\pi + \frac{\pi}{20} = \frac{7}{20}\pi$



[3]. $y[n] = 3\sum_{k=0}^{3}(\frac{1}{3})^k x[n-4] + \sum_{k=1}^{3}(\frac{1}{2})^k y[n-k]$

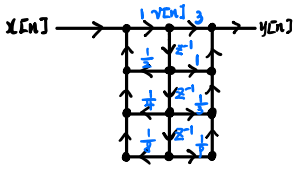
form I:



multiplications: 6 additions: 6

register: 6

form II:



multiplication: 6 addition: 6

register: 3