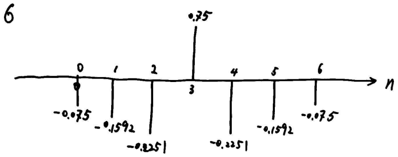
mm4.

1. (a) $M = 6$

(b)



(c) $H(z) = h_0 + h_1 z^{-1} + h_2 z^{-2} + h_3 z^{-3} + h_4 z^{-4} + h_5 z^{-5} + h_6 z^{-6}$

$= -0.075 - 0.1592 z^{-1} - 0.2251 z^{-2} + 0.75 z^{-3} - 0.225 z^{-4} - 0.1592 z^{-5} - 0.075 z^{-6}$

(d) This filter is linear phase. Type-I LP filter.

$M = 6$ even number

$h[n]$ is symmetric arround $\frac{M}{2} = 3$

(e) It's a lowpass filter.

2. $\omega_p = \frac{750}{8000} \cdot 2\pi = \frac{3\pi}{16}$ rad/sample

$\omega_s = \frac{1500}{8000} \cdot 2\pi = \frac{3\pi}{8}$ rad/sample

Take the cutoff frequency $\omega_c = \frac{\omega_p + \omega_s}{2} = \frac{9\pi}{32} = 0.8836$

In order to determine the parameters of Kaiser window, we need

$\Delta\omega = \omega_s - \omega_p = \frac{3\pi}{16} = 0.589$

change the stopband limitation from -10dB to -60 dB

$A = -20\log_{10}\delta = -20\log_{10}\delta_2 = 60$ dB

then from (7.62) on page 474, and (7.63) on page 476, there is

$\beta = 5.6456$; $M = \frac{60-8}{2.285\Delta\omega} = 38.6369 \approx 39$

We obtain $h[n] = \begin{cases} \frac{\sin\omega_c(n-\alpha)}{\pi(n-\alpha)} \cdot \frac{I_0[\beta(1-[(n-\alpha)/\alpha]^2)^{\frac{1}{2}}]}{I_0(\beta)} & 0 \le n \le M \\ 0 & \text{others} \end{cases}$ where $\alpha = \frac{39}{2} = 19.5$