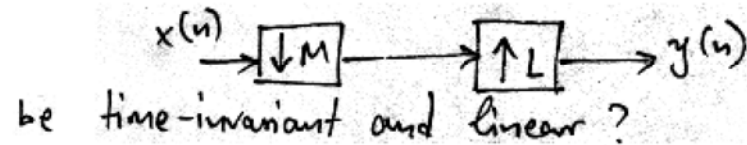
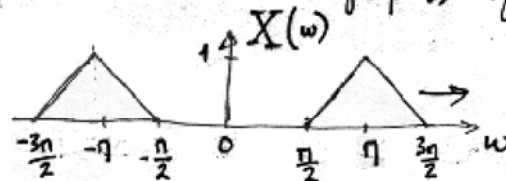


1. Show that the systems $x(n) \rightarrow \boxed{\downarrow M} \rightarrow x(Mn)$ and $x(n) \rightarrow \boxed{\uparrow L} \rightarrow x(\frac{n}{L})$, ($\frac{n}{L}$ integer, 0 - other) are linear but time-variant

2. What should be the relation between M and L so that the system

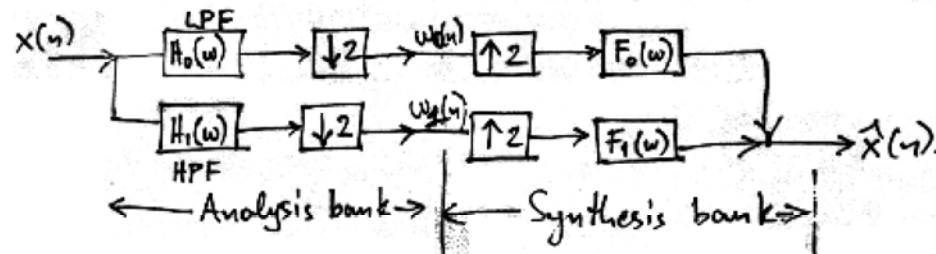


3. Consider the high pass signal with spectrum $X(\omega)$.



Draw the spectrum of the 2-fold decimated signal. Do you observe any aliasing effects, Can you reconstruct the original signal?

Consider the two channel "Quadrature Mirror filter bank"



We want $\hat{x}(n) = C \cdot x(n - n_0)$ (i.e. a delayed scaled replica of $x(n)$). What should be the relation between $F_i(\omega)$ and $H_i(\omega)$ $i=1,2$? Discuss your results appropriately