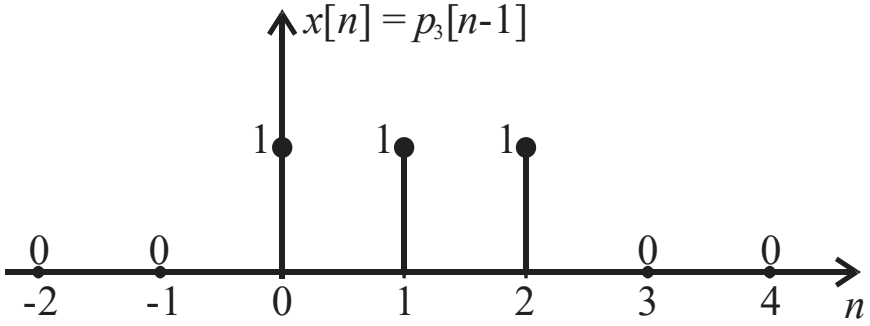
Ex. Recursively find/solve the response of a discrete-time Chebyshev Type I highpass filter that is at rest to a rectangular pulse input $p_3[n\text{-}1]$ for $n \geq 0$.

Input signal-



I/O difference equation-

$$y[n] - 1.516\,y[n\text{-}1] + 0.703\,y[n\text{-}2] = 0.57\,x[n] - 1.14\,x[n\text{-}1] + 0.57\,x[n\text{-}2]$$

Put I/O difference equation into recursive form-

$$y[n] = 1.516\,y[n\text{-}1] - 0.703\,y[n\text{-}2] + 0.57\,x[n] - 1.14\,x[n\text{-}1] + 0.57\,x[n\text{-}2]$$

Initial conditions needed to start recursion at $n = 0$-

'at rest' $\Rightarrow$ $\boldsymbol{y[-2] = y[-1] = 0}$, and, from graph of input, $\boldsymbol{x[-2] = x[-1] = 0}$.

at $n = 0$, $y[0] = 1.516\,y[-1] - 0.703\,y[-2] + 0.57\,x[0] - 1.14\,x[-1] + 0.57\,x[-2]$
$= 1.516\,(0) - 0.703\,(0) + 0.57\,(1) - 1.14\,(0) + 0.57\,(0)$
$\boldsymbol{y[0] = 0.57}$

at $n = 1$, $y[1] = 1.516\,y[0] - 0.703\,y[-1] + 0.57\,x[1] - 1.14\,x[0] + 0.57\,x[-1]$
$= 1.516\,(0.57) - 0.703\,(0) + 0.57\,(1) - 1.14\,(1) + 0.57\,(0)$
$\boldsymbol{y[1] = 0.29412}$

at $n = 2$, $y[2] = 1.516\,y[1] - 0.703\,y[0] + 0.57\,x[2] - 1.14\,x[1] + 0.57\,x[0]$
$= 1.516\,(0.29412) - 0.703\,(0.57) + 0.57\,(1) - 1.14\,(1) + 0.57\,(1)$
$\boldsymbol{y[2] = 0.04517592}$

at $n = 3$, $y[3] = 1.516\,y[2] - 0.703\,y[1] + 0.57\,x[3] - 1.14\,x[2] + 0.57\,x[1]$
$= 1.516\,(0.04518) - 0.703\,(0.29412) + 0.57\,(0) - 1.14\,(1) + 0.57\,(1)$
$\boldsymbol{y[3] = -0.708279665}$

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