# EE473 HomeWork3

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## I. Part A

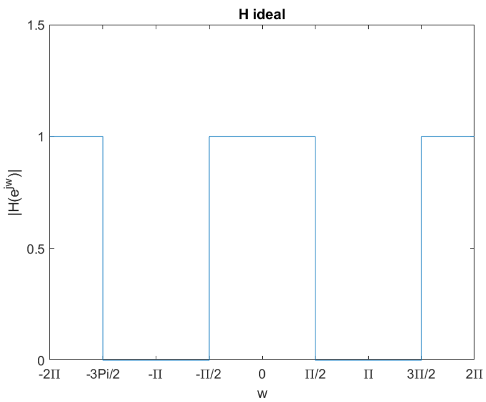


Fig. 1. Magnitude of Ideal Frequency Response

## II. Part B

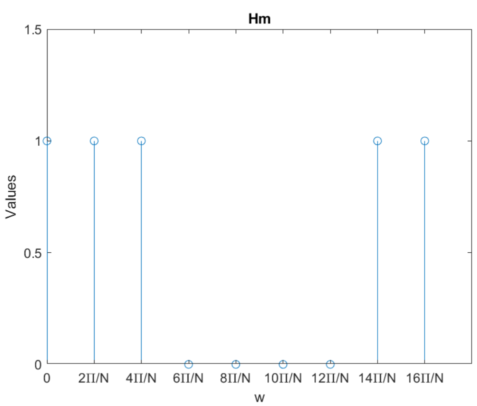


Fig. 2. Magnitudes of Desired Frequency Response

As it has 1's near zero and near $2\pi$, and 0's between them, it does actually look like a low-pass filter.

## III. Part C

Because of the fact that it is delayed version of a signal by $\frac{N-1}{2}$, whose frequency response is real; it's frequency response must be something real multiplied with $e^{-j\omega\frac{N-1}{2}}$.

Then our phase angle is nothing but $-\omega\frac{N-1}{2}$.

After computing and wrapping to the range $(0, 2\pi)$ we get; $H_p = [0, 3.49, 0.69, 4.18, 1.39, 4.88, 2.09, 5.58, 2.79]$

## IV. Part D

As $H_m = [111000011]$ and we know $H_p$ from Part C, then we can calculate $\mathbf{H}$ matrix as point-wise multiplication of $H_m$ and exponential values of $H_p$. Then we can solve the equation $\mathbf{F}x = \mathbf{H}$ After solving we get impulse response which is shown in Fig.3

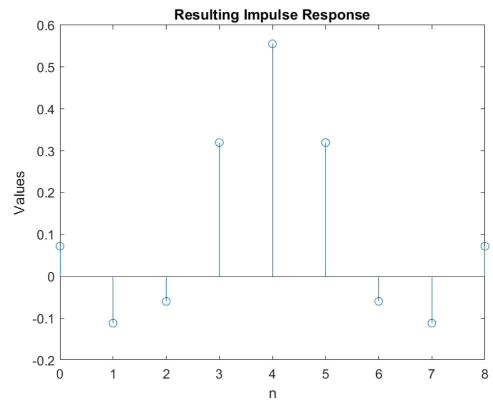


Fig. 3. Impulse Response Values are shown

## V. Part E

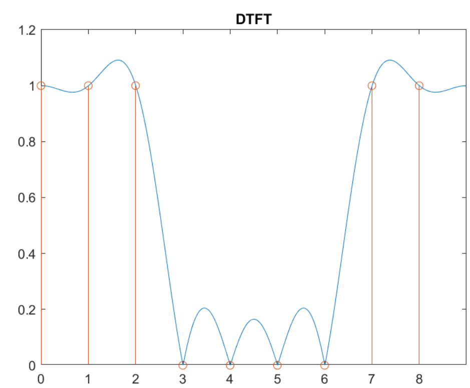


Fig. 4.

Even if in the Fig.4 the x labels are shown from 0 to 8, it actually is going from 0 to 2000 in Discrete Time Fourier Transform of the signal. To do see clearly that they are actually equal the values that we got from ideal low-pass filter. And it can be easily seen that it verifies what we want.