# Problem Set VII

1. Suppose that $H_0(e^{j\omega})$ is an ideal low-pass filter and $H_1(e^{j\omega})$ is an ideal high-pass filter. Both filters have cut-off frequency at $\omega = \frac{\pi}{2}$ and are periodic with period $2\pi$.

   Find the frequency and time responses of the resulting scaling and the wavelet function, i.e., $\Phi(\omega)$, $\Psi(\omega)$, $\phi(t)$, $\psi(t)$.

   Simulate this design in Matlab. Plot the approximate scaling and wavelet function in both time and frequency.

2. Suppose that we have $K$ vanishing moments in an orthonormal wavelet system, prove that

   (a)  $\{\frac{d^k}{dz^k}H_1(z)\}|_{z=1} = 0$,    for $k = 0, 1, \ldots, K-1$.

   (b)  $\sum_n n^k h_1[n] = 0$,    for $k = 0, 1, \ldots, K-1$.

   (c)  $\int t^k \psi(t)dt = 0$,    for $k = 0, 1, \ldots, K-1$.

Due date: **Friday Nov. 16** in class