Homework 1 (Due: April 10th)

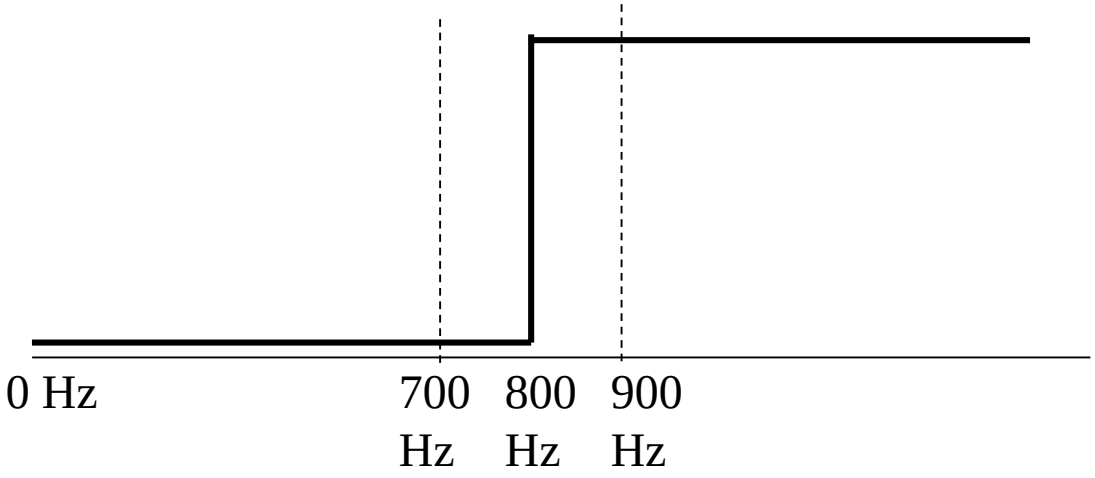
(1) Design a Mini-max **highpass** FIR filter such that (40 scores)

① Filter length = 19, ② Sampling frequency f_s = 4000Hz,

③ Pass Band 800~2000Hz ④ Transition band: 700~900 Hz,

⑤ Weighting function: $W(F) = 1$ for passband, $W(F) = 0.5$ for stop band .

⑥ Set $\Delta = 0.0001$ in Step 5.



※ Matlab program should be E-mailed to me，E-mail 主旨上註明學號

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(a) the Matlab program, (b) the frequency response,

(c) the impulse response $h[n]$, and (d) the maximal error for each iteration.

(2) Suppose that $x[n] = y(0.0005n)$ and the length of $x[n]$ is 10000 and $X[m]$ is the FFT of $x[n]$. Find m_1 and m_2 such that $X[m_1]$ and $X[m_2]$ correspond to the 100Hz and 250Hz components of $y(t)$, respectively. (10 scores)

(3) In IIR filter design, why the step invariant method and the bilinear transform method can reduce the aliasing effect? (10 scores)

(4) Suppose that the IIR filter $h[n]$ is $(1.5 \times 0.8^n + 0.95^n)u[n]$. What is the efficient way to implement $y[n] = x[n]*h[n]$ (* means convolution)? (10 scores)

(5) Why ① the transition band and ② the weighting function play important roles in digital filter design? (10 scores)

(6) Make a comparison among the methods of MSE, Minimax, and frequency sampling for FIR filter design and show their advantages and disadvantages. (20 scores)