1. Let $h(n)$ be the impulse response of a FIR filter with $h(n) = -h(N-1-n)$, please draw the direct form of its network structure when N is odd.

2. Suppose the function system of a IIR filter is

$$H(z)=\frac{1}{\sum_{n=0}^{2} h(n)z^{-n}}, \text{ where } h(0)=1,\ h(2)\neq -1$$

realize $H(z)$ using an all-pole grid network structure.

3. Suppose the function system of a FIR filter is $H(z)=\sum_{n=0}^{2} h(n)z^{-n}$, where $h(0)=1$, $h(2)\neq -1$, realize $H(z)$ using an all-zero grid network structure

4. Assume that there is a analog Butterworth filter with $N=6$ and $\Omega_c=0.7032$, please write out its system function $H_a(s)$

5. Let $H_{proto}(z)$ be the system function of a digital lowpass filter with cutoff frequency θ_c, please find out a function $f(z)$ such that $H(z)=H_{proto}(f(z))$ is a highpass filter with cutoff frequency ω_c

6. Please prove that $H(e^{j\omega})=e^{-j\frac{N-1}{2}\omega}\sum_{m=0}^{\frac{N-1}{2}}\alpha_m \cos(m\omega)$ is the frequency response of a linear phase FIR filter when even symmetric and N odd.