1) Compute the auto-correlation of the sequence [1 2 -2 1 -3 2]

2) Compute the cross-correlation between the sequences [1 2 -2 1 -3 2] and [-3 2 1 2 -2 1]

3) Analytically compute and plot the frequency response $H(\omega)$ of the cascaded system made of a causal differentiating filter $h_1(n)=\delta(n)-\delta(n-1)$ and an anti-causal differentiating filter $h_2(n)=\delta(n+1)-\delta(n)$.

4) A sequence x(n) has its Fourier spectrum $X(\omega)$ as a triangular shape with its maximum in $X(0)=1$ and the two minima in $X(\pi)=X(-\pi)=0$. Can you compute the sequence?

5) A digital sequence r(n) is modeled as the sum of useful signal s(n) and additive noise w(n), i.e. r(n) = s(n) + w(n). Perform a computationally efficient digital FIR filter when the signal has its frequency spectrum (expressed in ω) within the bandwidth $[-\pi/2 , -\pi/3] \cup [\pi/3 , \pi/2]$ while the noise is white (characterized by a flat spectrum at any frequencies).

6) Perform a digital filter that has as input the samples x(n) = s(nT) of analog signal s(t) sampled with period T, to obtain as output the samples $y(n) = s(n \bullet T - 0.25 \bullet T)$.

7) Perform a computationally efficient digital system for signal processing that has as input the samples x(n) = s(nT) of analog signal s(t) sampled with period T, to obtain as output the samples $y(n) = s(1.4 \bullet n \bullet T - 0.6 \bullet T)$.