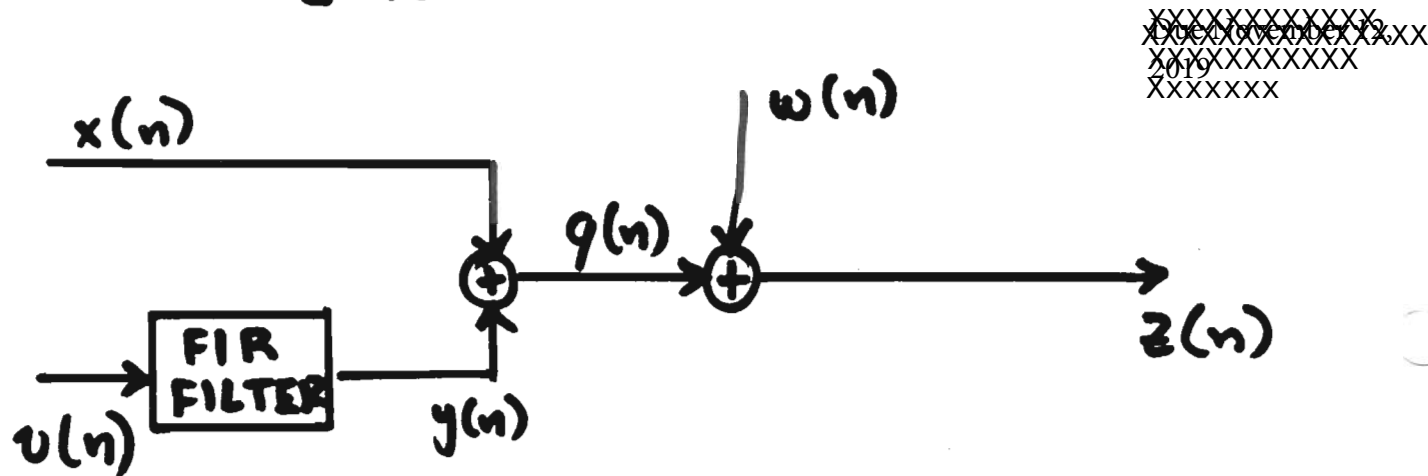


We observe the time series $z(n)$, $n = 1, \dots, N$ which is generated as follows:



where:

- $x(n) = \cos\left[0.3 \pi n + \frac{3\pi}{4}\right] + 2\cos\left[0.7 \pi n + \frac{\pi}{4}\right] + 0.5 \cos[0.8 \pi n]$
- $y(n) = 0.5 v(n) + v(n-1) + 0.5 v(n-2)$
- $v(n)$: white noise uniformly distributed $(-0.5, 0.5)$
- $w(n)$: white, Gaussian, zero mean noise

Calculate and draw the following spectral estimates (PSD in dB scale), i.e.,

$$10 \log_{10} P(f), \quad 0 \leq f \leq \frac{1}{2}$$

→ Periodogram

→ Blackman Tukey

→ MVSE

→ Yule Walker (YW)

→ Apply model order selection criteria whenever appropriate.

→ Use rectangular and Hanning windows

→ Consider the cases

$$N = 32, 128, 256$$

$$SNR = 10 \log_{10} \frac{\sum_n |g(n)|^2}{\sum_n |w(n)|^2}, \quad : 20 \text{ dB}, 5 \text{ dB}.$$

→ Make any assumptions you think are appropriate