EEN - 521 Digital Signal and Image Processing

Lab-sheet-2

1) Construct a signal $y = \sin(n\pi/10 * n) + 10\sin(n\pi/50) + 20\sin(n\pi/100)$, for $n = \{0, 1, 2, ...200\}$. Add 50 zeros at both of the ends of signal sample. Construct an averaging window of 50 length and unity strength throughout. Further, impose this averaging window to the mentioned signal, and plot the input and output of the signal.
2) Generate a signal $s[n] = 2[n(0.9)^n]$, for $n = \{0, 1, 2, ...50\}$. Corrupt $s[n]$ with an impulse noise $d[n]$. Apply a median filter of length-3 to the corrupted signal $s[n] + d[n]$ and plot the median filtered signal. Increase the median filter length to 5 and 7 and comment on your results.
3) Determine the impulse and step responses of the causal LTI system given by

$$y[n] + 0.7y[n-1] - 0.45y[n-2] - 0.6y[n-3] = 0.8x[n] - 0.44x[n-1 + 0.36x[n-2] + 0.02x[n-3]$$

4) Use MATLAB function "filter" & "filtic", to obtain system response for a difference equation

$$y[n] - 1.143y[n-1] + 0.4128y[n-2] = 0.0675x[n] + 0.1349x[n-1] + 0.675x[n-2]$$

Initial conditions $y[-1] = 1$; $y[-2] = 2$.

5) Evaluate the frequency response at the frequency $\omega = \pi/3$ and 50 values of the steady state output in response to a complex sinusoidal input of frequency $\omega = \pi/3$ for the moving average system with impulse response

$$h[n] = \begin{cases} 1/4 & \text{if } 0 \leq n \leq 3 \\ 0 & \text{otherwise} \end{cases}$$

6) Use MATLAB to determine the DTFS coefficients of N- periodic square wave. For period N = 50 and (a) M = 12 (b) M = 5 (c) M = 20

$$x[n] = \begin{cases} 1 & \text{if } -M < n < M \\ 0 & \text{if } M < n < N - M \end{cases}$$

7) Use MATLAB's "fft" & "ifft" commands to evaluate DTFS coefficients & time-domain signal of the following
(a) $x[n] = \cos(\frac{6\pi}{17}n + \frac{\pi}{3})$
(b) $X[k] = \cos(\frac{8\pi k}{21})$

8) Find the DTFT of the discrete-time rectangular pulse

$$x[n] = \begin{cases} 1 & \text{if } -4 < n < 4 \\ 0 & \text{otherwise} \end{cases}$$

Using "fft".