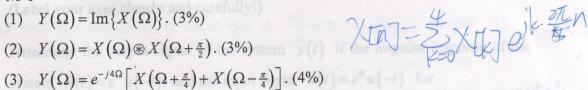
Consider the finite-length sequence 7.

$$x[n] = 2\delta[n] + \delta[n-1] + \delta[n-3].$$

- (1) Compute the five-point DFT X[k]. (3%)
- (2) If  $Y[k] = X^2[k]$ , determine the sequence y[n] with five-point inverse DFT for n=0, 1, 2, 3, 4. (4%)
- (3) If N-point DFTs are used here, how should we choose N such that y[n] = x[n] \* x[n], for  $0 \le n \le N - 1.(3\%)$
- You are given  $x[n] = |n| \left(\frac{1}{3}\right)^{|n|} \stackrel{DTFT}{\longleftrightarrow} X(\Omega)$ . Without evaluating  $X(\Omega)$ , find v[n] if:

  - (3)  $Y(\Omega) = e^{-j4\Omega} \left[ X(\Omega + \frac{\pi}{4}) + X(\Omega \frac{\pi}{4}) \right].$  (4%)



When the input to an LTI system is 9.

$$x[n] = \left(\frac{1}{2}\right)^n u[n] + \frac{1}{4} u[n],$$

the output is

$$y[n] = 6(\frac{1}{2})^n u[n] + 6(\frac{3}{4})^n u[n],$$

- (1) Find the frequency response  $H(\Omega)$  of the system. (4%)
- (2) Find the impulse response h[n] of the system. (4%)
- (3) Write the difference equation that characterizes the system. (2%)
- 10. Consider the signal

$$x[n] = \sin(\frac{\pi n}{8}) - 2\cos(\frac{\pi n}{4}).$$

Suppose that this signal is the input to LTI system with the impulse response

$$h[n] = \frac{\sin(\pi n/6)\sin(\pi n/2)}{\pi^2 n^2},$$

 $(2-\frac{5}{4})(-\frac{3}{4})$ 

- (1) Determine and sketch  $X(\Omega)$  and  $H(\Omega)$ . (6%)
- Determine the output y[n] of this system. (4%)

(*Hint*: 
$$x[n] = \frac{\sin(Wn)}{\pi n}$$
,  $0 < W < \pi \iff X(\Omega) = \begin{cases} 1, & 0 \le \Omega \le W \\ 0, & W \le \Omega \le \pi \end{cases}$ .)