Assignment-1

EE3900: Digital Signal Processing
IIT Hyderabad

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August 30,2022

Q3(c) Find the z - transformation X(z) of an input x[n] that will produce the output

$$y[n] = -\frac{1}{3}(-\frac{1}{4})^n u[n] - \frac{4}{3}(2)^n u[-m-1].$$

Solution:-

$$y[n] = -\frac{1}{3}(-\frac{1}{4})^n u[n] - \frac{4}{3}(2)^n u[-m-1]. \quad (1)$$

$$Y(z) = \frac{-\frac{1}{3}}{1+\frac{1}{4}z^{-1}} + \frac{\frac{4}{3}}{1-2z^{-1}} \quad (2)$$

$$= \frac{1+z^{-1}}{(1+\frac{1}{4}z^{-1})(1-2z^{-1})} \quad (3)$$

And we know that,

$$H[n] = \frac{1+z^{-1}}{(1-\frac{1}{2}z^{-1})(1+\frac{1}{4}z^{-1})} \quad (4)$$

Also we know that,

$$X[z] = \frac{Y[z]}{H[z]} \qquad \frac{1}{4} < |z| < 2 \quad (5)$$

$$= \frac{(1-\frac{1}{2}z^{-1})}{(1-2z^{-1})} \qquad |z| < 2 \quad (6)$$

$$x[n] = -(2)^n u[-n-1] + \frac{1}{2}(2)^{n-1} u[-n] \quad (7)$$