Assignment - 1

Syed Saqib Habeeb

***Abstract*—This document contains the solution to Exercise 3.16 (b) of Oppenheimer.**

Problem 1. Given that,

$$x(n) = (\frac{1}{3})^n u(n) + 2^n u(-n-1) \tag{1}$$

and

$$y(n) = 5(\frac{1}{3})^n u(n) - 5(\frac{2}{3})^n u(n) \tag{2}$$

Calculate h(n)
Solution:
Here $H(z) = \frac{Y(z)}{X(z)}$

$$Y(z) = \frac{5}{1-\frac{1}{3}z^{-1}} - \frac{5}{1-\frac{2}{3}z^{-1}} \tag{3}$$

$$= \frac{-\frac{5}{3}z^{-1}}{(1-\frac{1}{3}z^{-1})(1-\frac{2}{3}z^{-1})} \tag{4}$$

Similarly,

$$X(z) = \frac{1}{1-\frac{1}{3}z^{-1}} - \frac{1}{1-2z^{-1}} \tag{5}$$

$$= \frac{-\frac{5}{3}z^{-1}}{(1-\frac{1}{3}z^{-1})(1-2z^{-1})} \tag{6}$$

Implies,

$$H(z) = \frac{Y(z)}{X(z)} \tag{7}$$

$$= \frac{\frac{-\frac{5}{3}z^{-1}}{(1-\frac{1}{3}z^{-1})(1-\frac{2}{3}z^{-1})}}{\frac{-\frac{5}{3}z^{-1}}{(1-\frac{1}{3}z^{-1})(1-2z^{-1})}} \tag{8}$$

$$= \frac{1-2z^{-1}}{1-\frac{2}{3}z^{-1}} \tag{9}$$

Taking the inverse Z transform we get,

$$h(n) = (\frac{2}{3})^n u(n) - 2(\frac{2}{3})^{n-1} u(n-1) \tag{10}$$

$$= (\frac{2}{3})^n (u(n) - 3u(n-1)) \tag{11}$$

Therefore, $h(n) = (\frac{2}{3})^n (u(n) - 3u(n-1))$