# Assignment - 1

Karthik Kurugodu

***Abstract*—This document contains the solution to Exercise 3.39 (b) of Oppenheim.**

**Problem 1.** Suppose the $z-$transform of $x[n]$ is

$$X(z) = \frac{z^{10}}{\left(z-\frac{1}{2}\right)\left(z-\frac{3}{2}\right)^{10}\left(z+\frac{3}{2}\right)^{2}\left(z+\frac{5}{2}\right)\left(z+\frac{7}{2}\right)} \quad (1)$$

It is also known that $x[n]$ is a stable sequence. Determine $x[n]$ at $n = -8$

**Solution:**

$x[n] = \sum$[Residues of $X(z)z^{n-1}$ at the pole inside the circle]

ROC includes unit circle $|z| = 1$ and ROC is $\frac{1}{2} < |z| < \frac{3}{2}$

$x[-8]$ = remainder of $\frac{z}{(z-\frac{1}{2})(z-\frac{3}{2})^{10}(z+\frac{3}{2})^{2}(z+\frac{5}{2})(z+\frac{7}{2})}$ inside unit circle

But $z = 1/2$ is the only pole inside unit circle

$$x[-8] = \frac{\frac{1}{2}}{\left(\frac{1}{2}-\frac{3}{2}\right)^{10}\left(\frac{1}{2}+\frac{3}{2}\right)^{2}\left(\frac{1}{2}+\frac{5}{2}\right)\left(\frac{1}{2}+\frac{7}{2}\right)} = \frac{1}{96} \quad (2)$$