ISRA UNIVERSITY
Islamabad Campus

Department of Electrical Engineering
Program: B.E. (Electrical)
Semester – Spring 2016

EL-322 Digital Signal Processing

Assignment – 2 Solution **Due Date: 22/04/2016**
Marks: 10 **Handout Date: 18/04/2016**

Question # 1:

Determine the inverse z-transform, using the method of partial fractions:

$$X(z) = \frac{1 - \frac{1}{2}z^{-1}}{1 + \frac{3}{4}z^{-1} + \frac{1}{8}z^{-2}}, \qquad |z| > \frac{1}{2}$$

Solution:

$$X(z) = \frac{1 - \frac{1}{2}z^{-1}}{1 + \frac{3}{4}z^{-1} + \frac{1}{8}z^{-2}}, \qquad |z| > \frac{1}{2}$$

$$X(z) = \frac{1 - \frac{1}{2}z^{-1}}{1 + \frac{3}{4}z^{-1} + \frac{1}{8}z^{-2}} = \frac{1 - \frac{1}{2}z^{-1}}{\left(1 + \frac{1}{4}z^{-1}\right)\left(1 + \frac{1}{2}z^{-1}\right)}$$

$$X(z) = \frac{1 - \frac{1}{2}z^{-1}}{\left(1 + \frac{1}{4}z^{-1}\right)\left(1 + \frac{1}{2}z^{-1}\right)} = \frac{A}{1 + \frac{1}{4}z^{-1}} + \frac{B}{1 + \frac{1}{2}z^{-1}}$$

$$1 - \frac{1}{2}z^{-1} = A\left(1 + \frac{1}{2}z^{-1}\right) + B\left(1 + \frac{1}{4}z^{-1}\right)$$

$$X(z) = \frac{A}{1 + \frac{1}{4}z^{-1}} + \frac{B}{1 + \frac{1}{2}z^{-1}} = \frac{-3}{1 + \frac{1}{4}z^{-1}} + \frac{4}{1 + \frac{1}{2}z^{-1}}, \qquad |z| > \frac{1}{2}$$

$$x[n] = \left[-3\left(-\frac{1}{4}\right)^{n} + 4\left(-\frac{1}{4}\right)^{n}\right]u[n]$$

Question # 2:

The continuous time signal

$$x_c(t) = cos(4000\pi t)$$

Is sampled with a sampling period T to obtain a discrete-time signal:

$$x[n] = cos\left(\frac{\pi n}{3}\right)$$

a) Determine a choice for T consistent with this information.
b) Is your choice for T in part (a) unique? If so, explain why. If not, specify another choice of T consistent with the information given.

Solution:

a) Since $x[n] = x_c(nT)$,

$$\frac{\pi n}{3} = 4000\pi nT$$

$$T = \frac{1}{12000}$$

b) No our choice for T is not unique. For example, since

$$cos\left(\frac{\pi}{3}n\right) = cos\left(\frac{7\pi}{3}n\right)$$

T can be 7/12000.

Good Luck