ISRA UNIVERSITY
Islamabad Campus

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

EL-322 Digital Signal Processing

Quiz – 3 Solution
Marks: 10 **Handout Date: 20/04/2016**

Question # 1:

Find the inverse z-transform using the method of Partial fractions:

$$X(z) = \frac{2z^2 + z}{z^2 - 1.5z + 0.5}$$

Solution:

Divide z on the left side of the equation before expanding:

$$X(z) = \frac{z(2z+1)}{z^2 - 1.5z + 0.5} \Longrightarrow \frac{X(z)}{z} = \frac{(2z+1)}{z^2 - 1.5z + 0.5}$$

Now perform Partial fraction:

$$\frac{X(z)}{z} = \frac{(2z+1)}{(z-1)(z-0.5)}$$

$$\frac{X(z)}{z} = \frac{(2z+1)}{(z-1)(z-0.5)} = \frac{A}{(z-1)} + \frac{B}{(z-0.5)}$$

After cross multiplication we get:

$$(2z+1) = A(z-0.5) + B(z-1)$$

Now put z=1 then we get,

$$(2(1)+1) = A(1-0.5) + B(1-1)$$

$$A = 6$$

Now put z=0.5 then we get,

$$(2(0.5)+1) = A(0.5-0.5) + B(0.5-1)$$

$$B = -4$$

Putting values of A and B we get,

$$\frac{X(z)}{z} = \frac{6}{(z-1)} + \frac{-4}{(z-0.5)}$$

Bring the z from left hand side back to the right hand side,

$$X(z) = \frac{6z}{(z-1)} - \frac{4z}{(z-0.5)}$$

To get the forms that we have in Table of z-transform divide z on R.H.S with numerator and denominator:

$$X(z) = \frac{6}{1 - z^{-1}} - \frac{4}{1 - 0.5z^{-1}}$$

Now from the method of inspection:

Using the pair $a^n u[n] \leftrightarrow \frac{1}{1-az^{-1}}$ for the inverse transform we get,

$$\frac{6}{1 - z^{-1}} \leftrightarrow 6u[n]$$

And

$$\frac{4}{1 - 0.5z^{-1}} \leftrightarrow 4(0.5)^n u[n]$$

Hence,

$$x(n) = 6u[n] - 4(0.5)^n u[n]$$

Question # 2:

Choose the best answer:

1. The cost of the digital processors is cheaper because:
   a) Processor allows time-sharing among a number of signals. ✔
   b) The hardware is cheaper.
   c) Less power consumption
   d) None of the above.

2. The interface between an analog signal and a digital processor is:
   a) D/A converter.
   b) Modulator.
   c) Demodulator.
   d) None of the above. ✔

3. What is the typical device that performs an operation on the signal?
   a) Signal source.
   b) System. ✔
   c) Medium.
   d) None of the above.

4. Which of the following conditions made digital signal processing more advantageous over analog signal processing?
   a) Flexibility.
   b) Accuracy.
   c) Storage.
   d) All of the above. ✔

5. A system is said to be invertible if:
   a) The input signal can be recovered by output signal. ✔
   b) If it depends only on the past and future values.
   c) If it is discrete.
   d) None of the above.
