

Quiz #6
ECEn 380 - Fall 2013

You have 12 minutes to complete the following quiz. Closed book, closed note, and closed neighbor.

1. Consider the periodic discrete-time function $x[n] = \{\dots, \underline{2}, 1, 2, 1, \dots\}$

- a) Find the Discrete Time Fourier Series (DTFS) coefficients of $x[n]$. (4 points)

$$X_k = \frac{1}{N_0} \sum_{n=0}^{N_0-1} x[n] e^{-jk \frac{2\pi}{N_0} n} \quad , k=0, \dots, N_0-1$$

$$X_k = \frac{1}{2} \sum_{n=0}^1 x[n] e^{-jk\pi n} = \frac{1}{2} [2e^{-jk\pi(0)} + 1e^{-jk\pi}]$$

$$= 1 + \frac{1}{2}(-1)^k$$

$$\boxed{X_0 = \frac{3}{2}} \\ \boxed{X_1 = \frac{1}{2}}$$

- b) Write the DTFS expansion of $x[n]$. (4 points)

$$x[n] = \frac{3}{2} + \frac{1}{2} e^{j\pi n}$$

$$\text{or } x[n] = \frac{3}{2} + \frac{1}{2}(-1)^n$$

2. Compute the Discrete Time Fourier Transform (DTFT) of the signal $x[n] = \{2, \underline{0}, -2\}$. Simplify your answer to sums of sines and cosines for full credit. (4 points)

$$X(e^{j\Omega}) = \sum_{n=-\infty}^{\infty} x[n] e^{-j\Omega n}$$

$$= \sum_{n=-1}^1 x[n] e^{-j\Omega n} = 2e^{j\Omega} - 2e^{-j\Omega}$$

$$= \boxed{4j \sin(\Omega)}$$

3. Given $x[n] = \{1, 2, 3, \underline{2}, 1, 5, 8, 7\}$, evaluate the following integral: (4 points)

$$\frac{1}{2\pi} \int_{-\pi}^{\pi} X(e^{j\Omega}) e^{j2\Omega} d\Omega$$

NOTICE:

$$x[n] = \frac{1}{2\pi} \int_{-\pi}^{\pi} X(e^{j\Omega}) e^{j\Omega n} d\Omega$$

SO THIS IS JUST

$$x[2] = \boxed{5}!$$

4. What is a common algorithm used for computing the Discrete Fourier Transform (DFT)? (4 points)

FFT