Tutorial 4 DFT

Exercise 1

Given a sequence $x(n)$ for $0 \leq n \leq 3$, where $x(0) = 1, x(1) = 1, x(2) = -1$, and $x(3) = 0$, compute its DFT $X(k)$.

Exercise 2

Given the DFT sequence $X(k)$ for $0 \leq k \leq 3$ obtained in Exercise 1, evaluate its inverse DFT $x(n)$.

Exercise 3

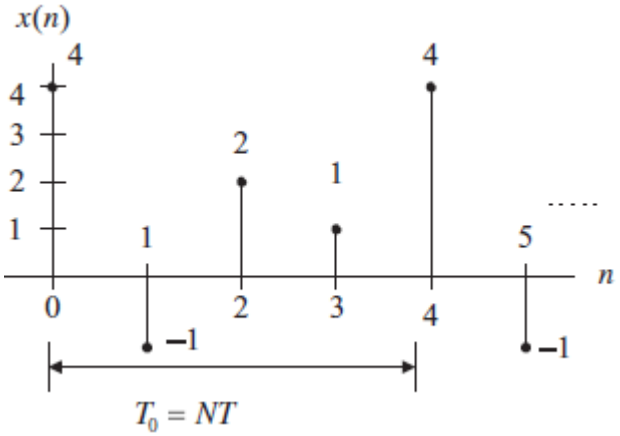
Consider a digital sequence sampled at the rate of 20,000 Hz. If we use the 8,000-point DFT to compute the spectrum, determine

a. the frequency resolution;

b. the folding frequency in the spectrum.

Exercise 4

Given the sequence in Figure and assuming $f_s = 100$ Hz, compute the amplitude spectrum, phase spectrum, and power spectrum.



Exercise 5

Given a sequence $x(n)$ for $0 \leq n \leq 3$, where $x(0) = 4, x(1) = 3, x(2) = 2$, and $x(3) = 1$, evaluate its DFT $X(k)$ using the decimation-in-frequency FFT method, and determine the number of complex multiplications.

Exercise 6

Given the DFT sequence $X(k)$ for $0 \leq k \leq 3$ obtained in exercise 5, evaluate its inverse DFT $x(n)$ using the decimation-in-frequency FFT method.

Exercise 7

Given a sequence $x(n)$ for $0 \leq n \leq 3$, where $x(0) = 4, x(1) = 3, x(2) = 2$, and $x(3) = 1$, evaluate its DFT $X(k)$ using the decimation-in-time FFT method, and determine the number of complex multiplications.

Exercise 8

Given the DFT sequence $X(k)$ for $0 \leq k \leq 3$ obtained in exercise 7, evaluate its inverse DFT $x(n)$ using the decimation-in-frequency FFT method.