

CS2400 – Assignment1

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Generate two sinusoidal signals $x_1(t) = A_1 \sin \omega_0 t$ and $x_2(t) = A_2 \sin \omega_1 t$. Sample them to get $x_1[n]$ and $x_2[n]$, each of length 1024, for different values of A_1, A_2 and different values of ω_0 and ω_1 .

1. (a) Plot the sampled signal for different values of A_1 and A_2 and sampling rate R . Determine the frequency of the sinusoids from the zero-crossing rate for every different value of R . Compare with your true data and document your observations. Plot the error in the estimation of frequency as a function of R .
(b) Plot the Fourier transform of each of the signals generated in 1(a) for different values of R and different values of $N = FFTSize$. Find the location of the peaks in the FFT magnitude spectrum, determine the frequency using the information about the sampling rate. Record your observations and comment on the different results.
2. (a) Add $x_1[n]$ and $x_2[n]$ and determine the Fourier transform of the superposed signal.
(b) Convolve $x_1[n]$ and $x_2[n]$ and determine the new signal's Fourier transform. Remember that the length of the convolved signal is $M + N$, if M and N are the lengths of signals $x_1[n]$ and $x_2[n]$, respectively.
(c) Compute the Fourier transform in each of the above cases and comment on the results. Explain how and why you chose value of the *FFTSize* in each case.
(d) Try any two properties of DFT.

Notes:

1. The enclosed programs take as argument an inputFile, FFTOrder and FFTSize, OutputFile and generates the spectrum. For details see ReadMe.txt in the doc directory.
2. Use gnuplot to plot the various outputs.
3. Submit the programs and report on turnitin.