EE562 - Digital Signal Processing I
Second Semester (212)

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Computer Assignment/Homework 6

Date: 20 March 2022
Due date: 27 March 2022

Objective:

To compare the runtime for computing the *N*-point DFT via the direct DFT and the FFT of given sequences with various lengths.

The required tasks:

Let $x_1(n) = u(n) - u(n-10)$ and $x_2(n) = u(n) - u(n-1000)$. Then perform the following tasks for $x_1(n)$ and $x_2(n)$:

1. Compute the 16-point DFT for $x_1(n)$ using $X(k) = \sum_{n=0}^{N-1} x(n) e^{-\frac{j2\pi kn}{N}}$, for $k = 0,1,\ldots,N-1$. You can use MATLAB **for** loops to obtain $X(k)$.
2. Repeat 1 but instead use the MATLAB function **fft** with *N*=16.
3. Compute the 1024-point DFT for $x_2(n)$ using $X(k) = \sum_{n=0}^{N-1} x(n) e^{-\frac{j2\pi kn}{N}}$, for $k = 0,1,\ldots,N-1$. You can use MATLAB **for** loops to obtain $X(k)$.
4. Repeat 3 but instead use the MATLAB function **fft** with *N*=1024.

In each of the above four tasks, use the MATLAB functions **tic** and **toc** to obtain the runtime for computing the *N*-point DFT using the direct computation and via the FFT.

What to submit?

1. A print of the written MATLAB M-file.
2. The following table:

Function	*N*	DFT runtime in seconds	FFT runtime in seconds	FFT time savings %
$x_1(n)$	16			
$x_2(n)$	1024			

3. Your observations if any.

Homework: Solve problems: 5.1(a,c), 5.3, 5.7.