ECEn 487 - Introduction to Digital Signal Processing

Winter 2013

Quiz 7 (Preparing for Midterm)

$X[k] = \sum_{n=0}^{N-1} x[n] W_N^{kn}$

1. (2 pts) Suppose I take L=1000 samples at a frequency of 50 kHz. I then want to compute the FFT of this data. If I want the effective frequency spacing to be less than 1 kHz and I want to use a radix-2 FFT, what should my N be to achieve this resolution?

2. (2 pts) Suppose I have the N from problem 1 above for my radix-2 FFT. How many "butterfly stages" would I need to make this computation?

3. (3 pts) If my DFT takes $O(N \log_2 N)$ multiplications, how many multiplications per second would I need on a processor to compute the DFT fast enough for this application to operate in real-time?

4. (3 pts) If I only needed 8 frequencies out of the N frequencies, would it be more efficient to use the FFT or direct computation/Goertzel algorithm?