

Digital Signal Processing Assignment # 11

1. If the 5-point DFT of $x(n)$ is $X(k) = [-2, 1 + j, 3, 1 - j, 2]$.
 - (a) Find the DFT of $x(-n)_N$.
 - (b) Find $\sum_{n=0}^4 |x(n)|^2$ with the Parseval's theorem.
 - (c) Find $\sum_{n=0}^4 |x(n-2)_N|^2$ with the Parseval's theorem.
2. Define $W_N = \exp\left(-j\frac{2\pi}{N}\right)$. Prove $W_{N/4}^k = W_N^{4k}$
3. There is a DTMF signal with sampling frequency $F_s = 16$ KHz. The duration of the signal is 0.4 s. The signal is generated by pressing the key 5. Performing FFT on the signal. Which digital frequency indices (k) corresponding to the peaks in the frequency domain?
4. There is a DTMF signal with sampling frequency $F_s = 12$ KHz. There are $N = 7200$ samples in the signal. Performing FFT on the signal, and there are two peaks in the frequency domain at $k = 512$ and $k = 803$, respectively.
 - (a) What is the duration of the signal (in second)?
 - (b) What is the resolution of the analog frequency (in Hz)?
 - (c) What are the analog frequencies (in Hz) corresponding to the two peaks?
 - (d) This signal is generated by which key?