

ICE503 Homework-09

Arnav Mukhopadhyay (D123070002)

EMAIL: gudduarnav@gmail.com

Q. 3

(a) Given sequence is $x(t) = \cos(2\pi 5t)$. To find the DFT, the **twiddle matrix** \mathbf{W} is calculated. The (m, n) -th cell of twiddle matrix \mathbf{W} have the value $e^{-j\frac{2\pi}{N}mn}$, where $N = 100$ represents the number of samples of $x(n)$ sampled in 1 seconds. Thereafter, the DFT is computed by the formula $X(k) = W(k)x(n)$.

The sequence $x(n)$ is shown in Fig. (a) and the corresponding amplitude of the DFT $X(k)$ is shown in Fig. (b).

(b) Compute the inverse DFT matrix as $\tilde{\mathbf{W}} = \frac{1}{N}\mathbf{W}^*$, where $*$ represents the conjugate operation. Hence, the IDFT is written as $\hat{x}(n) = \tilde{\mathbf{W}}X(k)$. The sequence \hat{x} is shown in Fig. (c) as $x_{DFT}(n)$.

(c) With the *fft*(x) function the FFT of $x(n)$ is computed with the Fast Fourier Transform (FFT) method. The corresponding amplitude is plotted in Fig. (d).

(d) With the *ifft*(x) function the IFFT of $X(k)$ is computed with the Fast Fourier Transform (IFFT) method. The corresponding amplitude is plotted in Fig. (e).

(e)

