

4 Digital Signal Processing (MGK)

The discrete-time Fourier transform (DTFT) of a discrete sequence $\{x_n\}$ can be defined as

$$X(e^{j\omega}) = \sum_{n=-\infty}^{\infty} x_n \cdot e^{-j\omega n}$$

- (a) If $\{x_n\}$ was the result of sampling a signal at sampling rate f_s and we want to know its DTFT at frequency f , what will be the corresponding value for ω ? [2 marks]
- (b) If $\{x_n\}$ has only real values and we know the value of $X(e^{j\pi/4})$, what is the value of $X(e^{j\pi \times 3.75})$? [2 marks]
- (c) Each of the eight plots (i)–(viii) below shows real-valued samples x_0, \dots, x_7 from a discrete sequence $\{x_n\}$, with $x_n = 0$ for $n < 0$ or $n > 7$. For each of these eight sequences, identify which of the eight plots (A)–(H) shows the magnitude $|X(e^{j\omega})|$ of the corresponding discrete-time Fourier transform. [8 × 2 marks]

