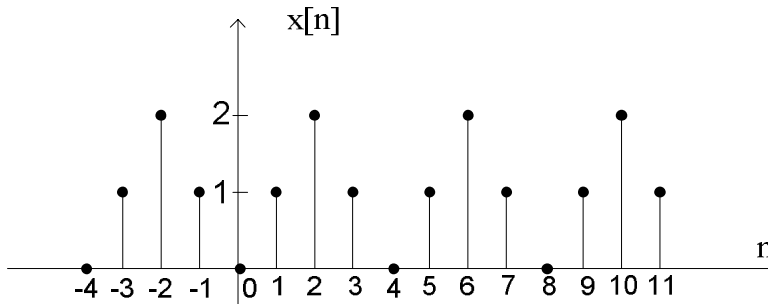


Question 1:

- (a) Consider the CT periodic signal $x(t) = -2 + \sin\left(\frac{\pi}{2}t + \frac{\pi}{4}\right)$. Find the fundamental period then determine the Fourier series coefficients (a_k) of $x(t)$.
- (b) Determine the Fourier series coefficients (a_k) of the periodic DT signal shown below:



Question 2:

- (a) Consider a DT signal $x[n]$ with a Fourier transform given by

$$X(e^{j\omega}) = \begin{cases} -1 & \text{if } -1 < \omega < 0 \\ 1 & \text{if } 0 < \omega < 1 \\ 0 & \text{elsewhere} \end{cases} \quad (X(e^{j\omega}) \text{ is periodic with period } 2\pi)$$

Find $x[n]$. (Hint, you can use the direct inverse Fourier transform).

- (b) i- Find the Fourier transform ($X(e^{j\omega})$) of the following DT signal:

$$x[n] = -2(3)^{2n} (u[n] - u[n - 21])$$

ii- From $X(e^{j\omega})$ find the average of $x[n]$.

$$\text{Hint: } \sum_{k=a}^b c^k = \frac{c^a - c^{b+1}}{1 - c}$$

Question 3:

- (a) Find the phase equation of FT for the following $x(t)$

$$x(t) = \begin{cases} -t + 2 & 0 < t < 1 \\ t & -1 < t < 0 \\ 0 & \text{elsewhere} \end{cases}$$

- (b) Find $x(n)$ for the given DTFT

$$X(e^{j\omega}) = \frac{4 + e^{-j\omega}}{2 + e^{-j\omega}}$$