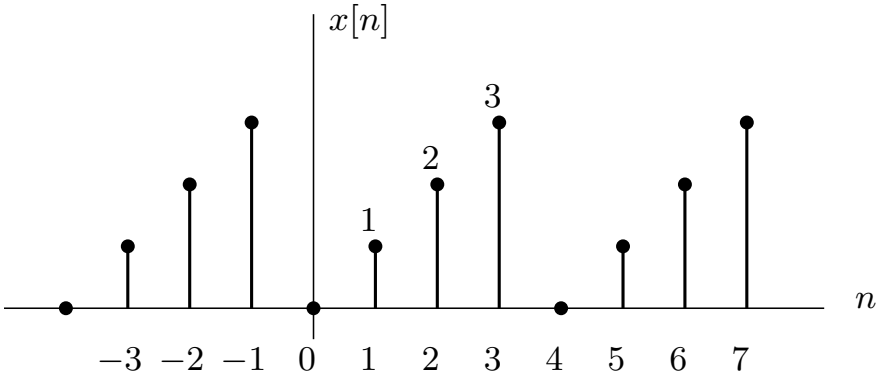
Tutorial 4

1. Determine the Fourier coefficients for the periodic sequence $x[n]$ shown in the figure below.



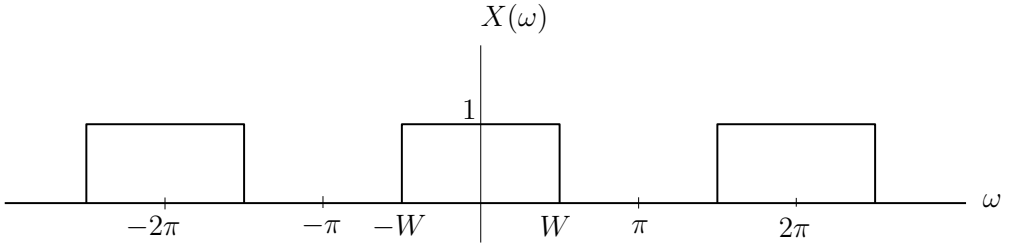
2. Consider the discrete sinusoid $x[n] = 2\cos\left(\frac{8\pi n}{31}\right)$.
   (a) Find the fundamental period and fundamental frequency of $x[n]$.
   (b) Express $x[n]$ in terms of complex exponential functions.
   (c) Find the discrete-time Fourier series (DTFS) coefficients of $x[n]$.

3. Determine the discrete Fourier series representation for each of the following sequences.
   (a) $x[n] = \cos(\frac{\pi}{3}n) + \sin(\frac{\pi}{4}n)$
   (b) $x[n] = \cos^2(\frac{\pi}{8}n)$

4. (a) A discrete-time signal $x[n]$ has the Fourier transform $X(\omega)$ defined by

$$X(\omega) = \begin{cases} 1 & -|\omega| \le W \\ 0 & W < |\omega| \le \pi \end{cases} \tag{1}$$

   which is shown in the following figure



   Use the definition of inverse Fourier transform to find $x[n]$.

(b) Plot $x[n]$ for $W = \pi/4$.

5. Find the DTFT of each of the following sequences:

(a) $x[n] = \left(\frac{1}{2}\right)^n u[n+3]$

(b) $x[n] = \alpha^n \sin(n\omega_0)u[n]$ for $|\alpha| < 1$.