6.3000: Signal Processing

Discrete-Time Fourier Transforms

Synthesis Equation

$$x[n] = \frac{1}{2\pi} \int_{2\pi} X(\Omega)\, e^{j\Omega n}\, d\Omega$$

Analysis Equation

$$X(\Omega) = \sum_{n=-\infty}^{\infty} x[n]\, e^{-j\Omega n}$$

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Discrete-Time Fourier Transform

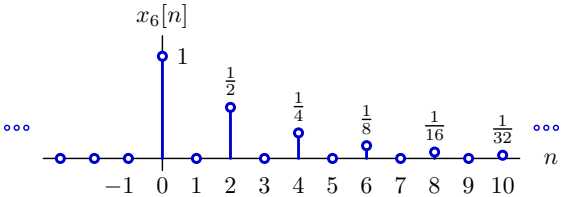
Find the Fourier transforms of the following discrete-time signals.

- $x_1[n] = \begin{cases} a^n & \text{if } n \geq 0 \\ 0 & \text{otherwise} \end{cases}$
- $x_2[n] = x_1[n - n_0]$
- $x_3[n] = \text{Symmetric}\{x_1[n]\}$
- $x_4[n] = \text{Antisymmetric}\{x_1[n]\}$
- $x_5[n] = n x_1[n]$

Discrete-Time Fourier Transform

Find the Fourier transform of $x_6[n]$:

$$x_6[n] = \begin{cases} \left(\frac{1}{2}\right)^{n/2} & n = 0, 2, 4, 6, 8, ..., \infty \\ 0 & \text{otherwise} \end{cases}$$



Inverse Discrete-Time Fourier Transform

Find the signal whose Fourier transform is

$$X(\Omega) = e^{-j3\Omega}$$