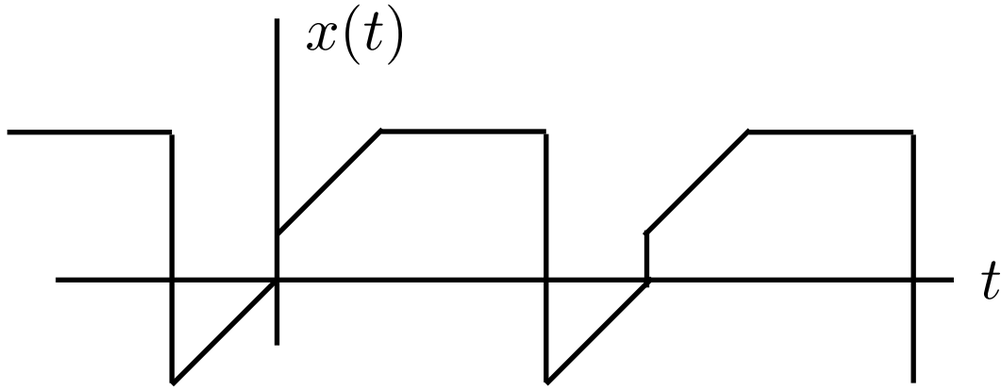
Spectral (Frequency Domain) Representations

Time



$$x(t) = \sum_{k=-\infty}^{\infty} a_k e^{jk2\pi f_o t}$$

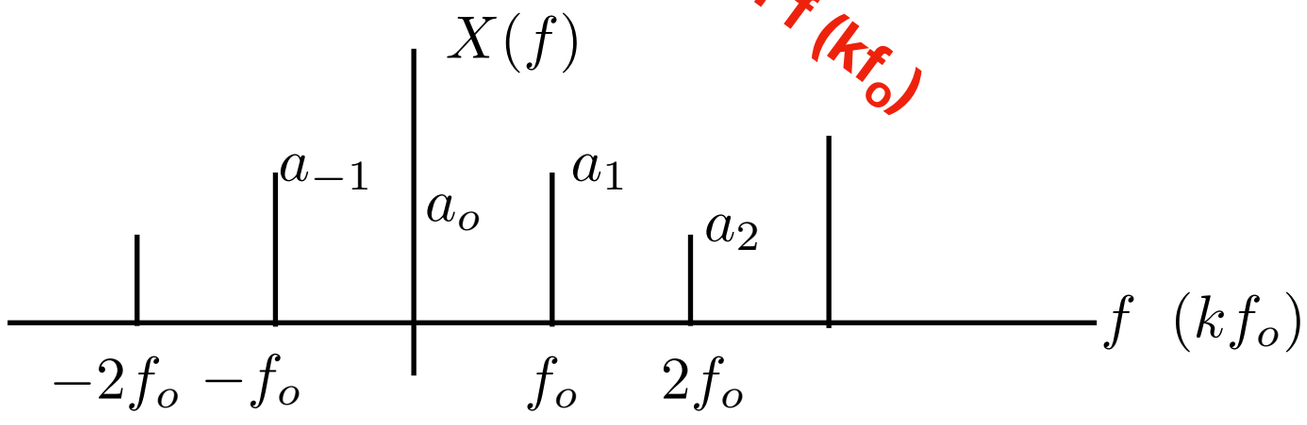
function of t

function of f (kf_o)

Why?

- **Insight**
- **Computation**

Frequency



Synthesis: build (write) signal as a weighted sum of sinusoids

$$x(t) = \sum_{k=-\infty}^{\infty} a_k e^{jk2\pi f_o t}$$

Analysis: find weights associated with each sinusoid

$$a_k = \frac{1}{T} \int_0^T x(t) e^{-jk2\pi f_o t} dt$$

Discrete-Time Signals: the discrete-Fourier transform