Overview

1 Recap

2 Discrete-Time Signals
Recap

- Essential components of DSP
  - Frequency analysis
  - Sampling
  - Filter

- Different types of signals
  - continuous vs. discrete vs. digital
  - deterministic vs. random

- Interesting applications of sinusoids
Basic sequences

- Unit sample sequence (or impulse sequence):
  \[ \delta[n] = \begin{cases} 
  0, & n \neq 0, \\
  1, & n = 0 
\end{cases} \]

- Unit step sequence: \( u[n] = \begin{cases} 
  1, & n \geq 0, \\
  0, & n < 0 
\end{cases} \)

- Exponential sequence: \( x[n] = A\alpha^n \)
  - real sequence
  - complex sequence

- Sinusoid sequence: \( x[n] = A\cos(\omega_0 n + \phi) \)
Basic sequences (cont’)

- What are their relationships?
On definition

- $\delta(t)$ vs. $\delta[n]$
- Properties of the $\delta$ functions
On periodicity

- Continuous-time periodic signals: \( x(t) = x(t + T) \)
- Discrete-time periodic signals: \( x[n] = x[n + N] \)
- Exercises: What is the period of the following signals
  - \( x[n] = \cos(\frac{\pi n}{8}) \)
  - \( x[n] = \cos(\frac{\pi n}{4}) \)
  - \( x[n] = \cos(\pi n) \)
  - \( x[n] = \cos(\frac{7\pi n}{4}) \)
- Questions:
  - Is it always true that the higher the frequency, the lower the period?
  - Is it true that the sinusoidal sequence is always periodic?
On periodicity (cont')