Lecture 0:
Signal (digital v.s analog)

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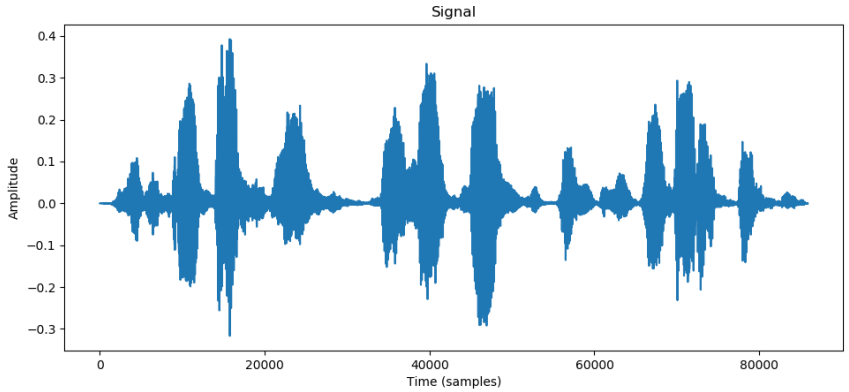
Signal

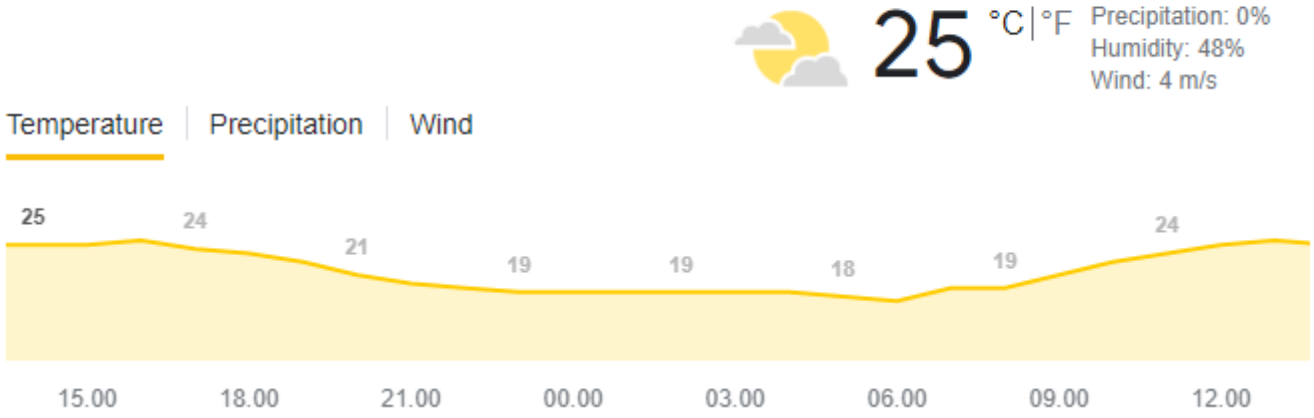
→ Analog v.s. Digital

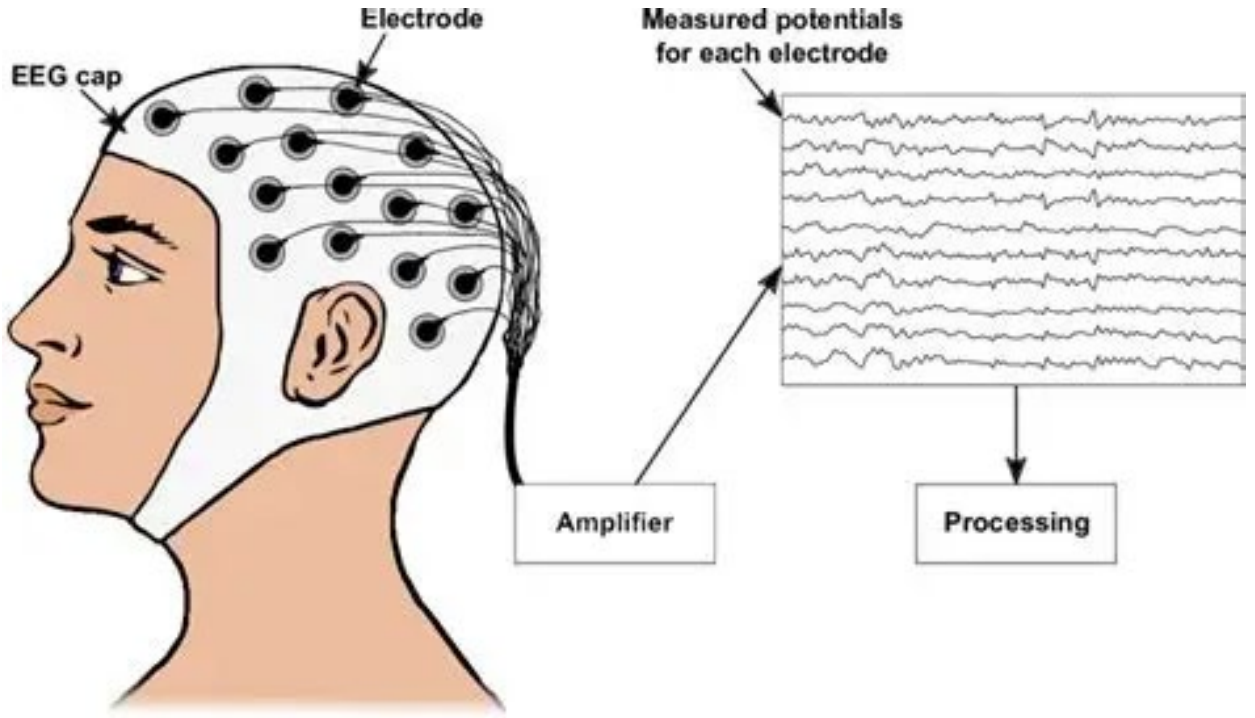
→ Continuous, discrete

→ Digital signal is a discrete time signal with quantization

Why this course?
→ Acquiring, processing and understanding signal.
→ Analysing system







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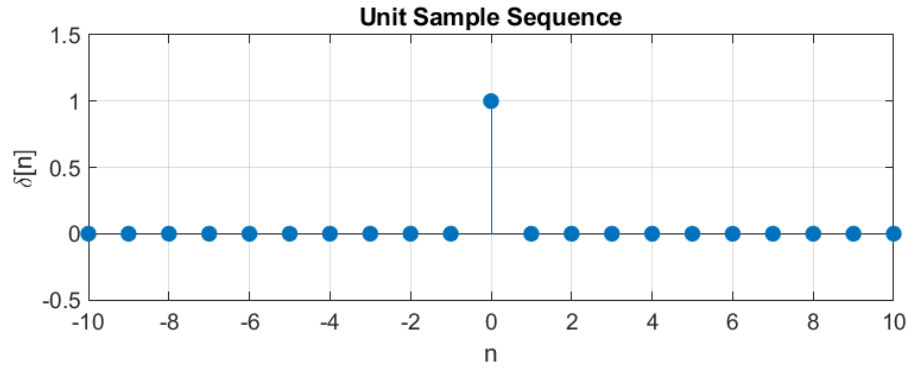
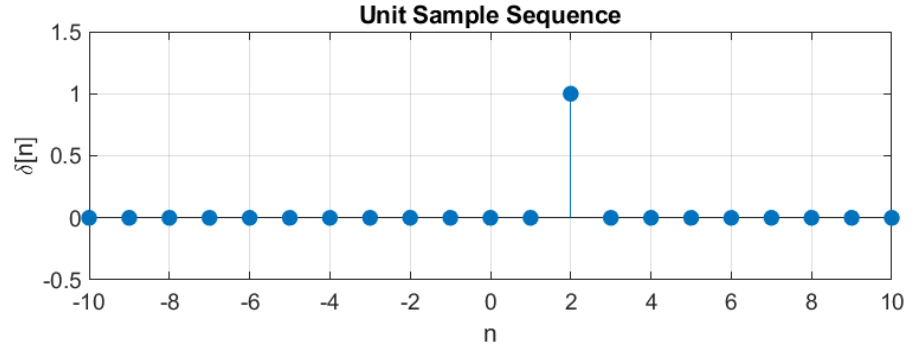
Basic sequence

→ Unit sample sequence (impulse)

$$\delta(n) = \begin{cases} 1, & n = 0 \\ 0, & oherwise \end{cases}$$



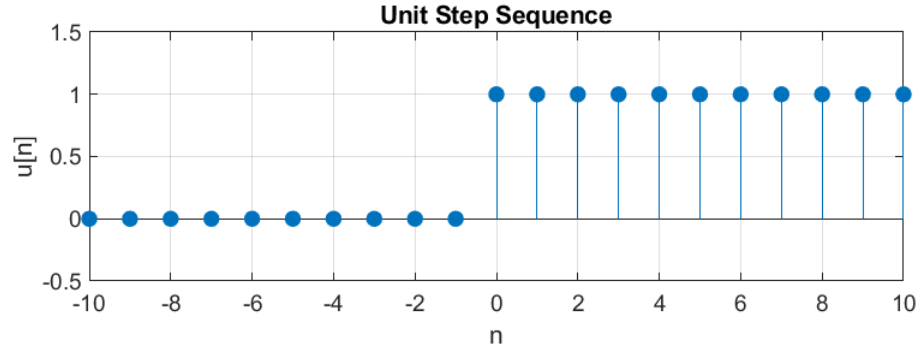
→ Sampling at time t=2, $\delta(t-2)$



→ Shift to the right $\delta(t-1)$ -> delay
→ Shift to the left $\delta(t+1)$ -> advance

→ Step sequence

$$u(n) = \begin{cases} 1, & n \geq 0 \\ 0, & oherwise \end{cases}$$



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Basic sequence

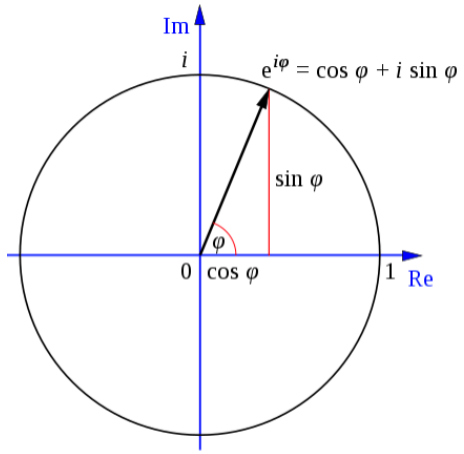
→ Exponential sequence

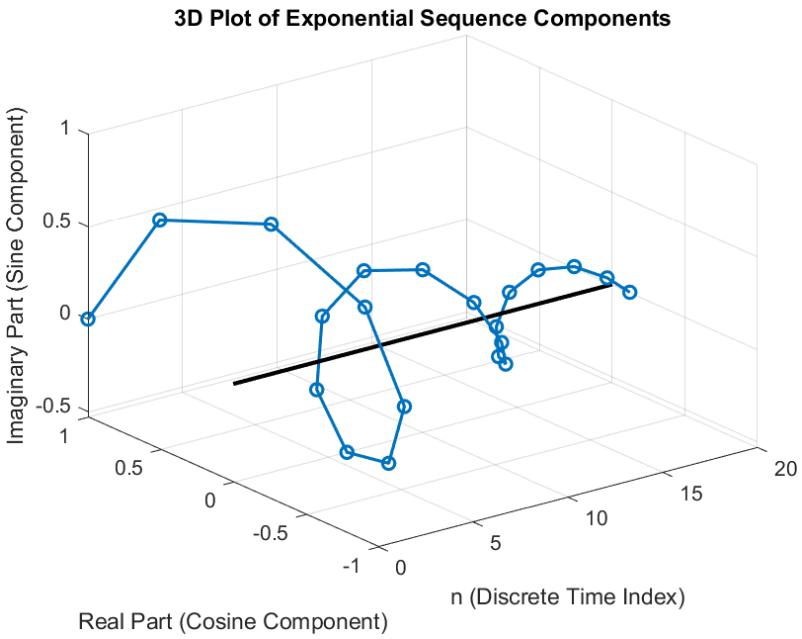
$$x(n) = A\alpha^n$$

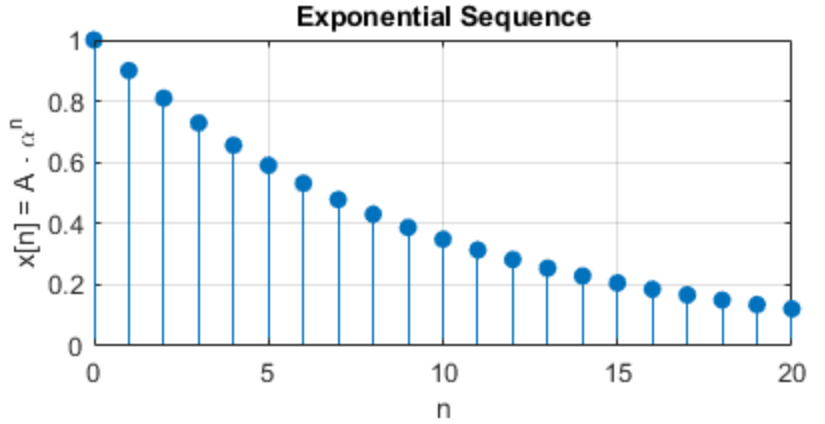
→ Draw an example $x(n) = 0.9^n, n \geq 0$

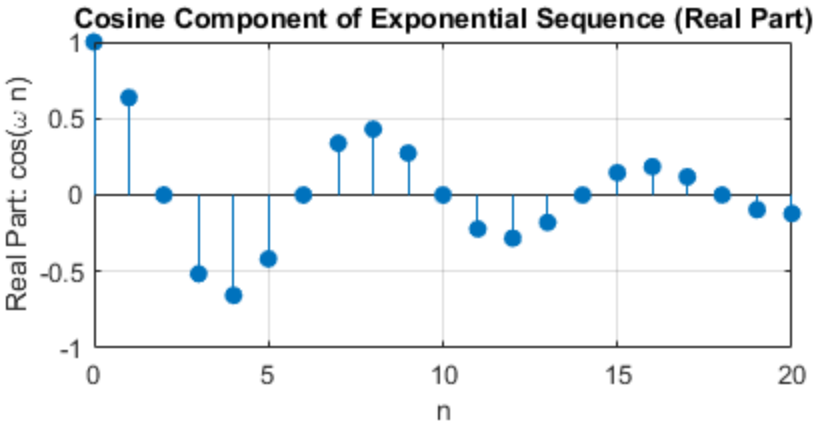
→ Complex exponential $x(n) = e^{j\omega_0 n} = \cos(\omega_0 n) + j\sin(\omega_0 n)$

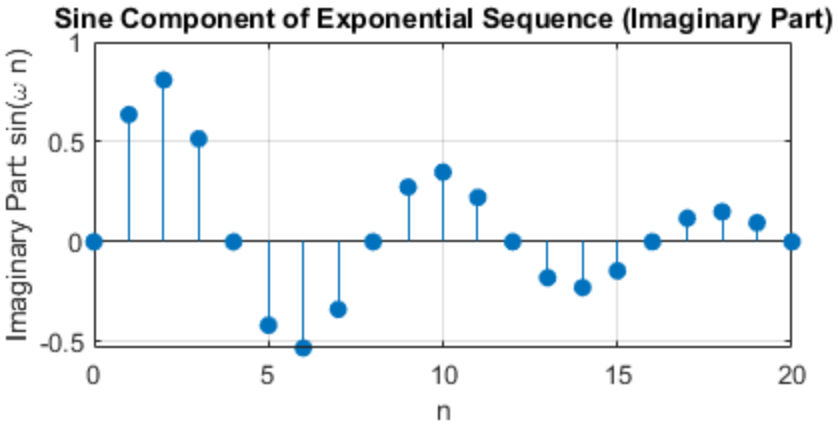
Question:
ω_0 =?











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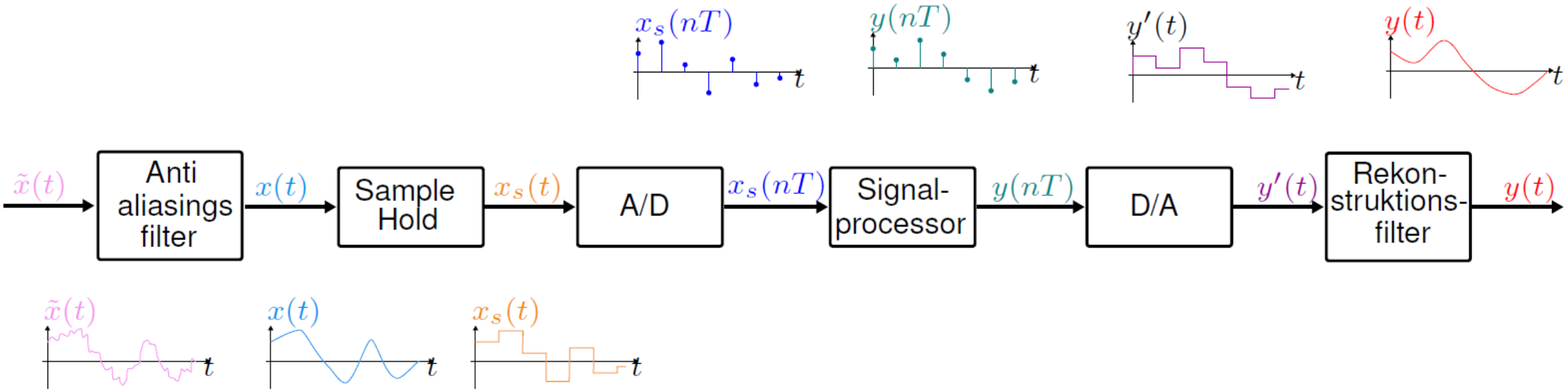
Topics to be covered in this course

→ Sampling and reconstruction
→ Aliasing
→ Implementation
→ Conversion time-frequency domain
→ Z transform
→ System analysis
→ Window functions
→ Filter design
→ Impulse response (FIR and IIR)

Digital signal processing workflow



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Matlab

Signal Processing Toolbox

Perform signal processing and analysis

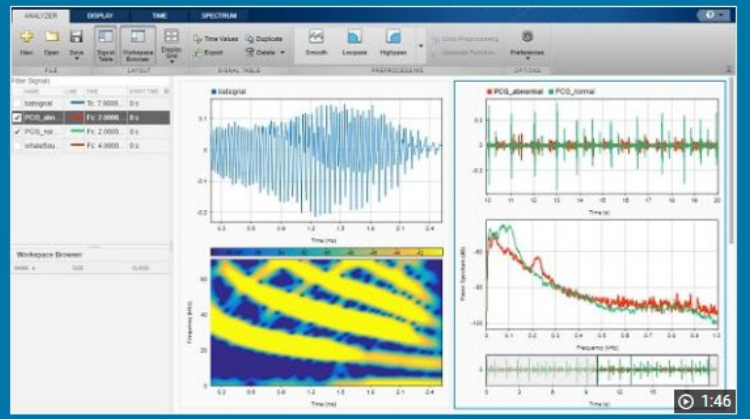
Access your campus license | View pricing

Have questions? Contact Sales.

Signal Processing Toolbox provides functions and apps to manage, analyze, preprocess, and extract features from uniformly and nonuniformly sampled signals. The toolbox includes tools for filter design and analysis, resampling, smoothing, detrending, and power spectrum estimation. You can use the Signal Analyzer app for visualizing and processing signals simultaneously in time, frequency, and time-frequency domains. With the Filter Designer app you can design and analyze FIR and IIR digital filters. Both apps generate MATLAB scripts to reproduce or automate your work.

Using toolbox functions, you can prepare signal datasets for AI model training by engineering features that reduce dimensionality and improve the quality of signals. You can access and process

Show more



What Is Signal Processing Toolbox?

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