

# Signals and Systems Primer<sup>1</sup>

## Using Python<sup>2</sup>

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February 2, 2020

<sup>1</sup>This is a footnote.

<sup>2</sup>This is yet another footnote.

<sup>3</sup>`www.example.com`



Dedicated to my family.



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# Preface

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## Structure of book

Each unit will focus on <SOMETHING>.

## About the companion website

The website<sup>1</sup> for this file contains:

- A link to (freely downloadable) latest version of this document.
- Link to download LaTeX source for this document.
- Miscellaneous material (e.g. suggested readings etc).

## Acknowledgements

- A special word of thanks goes to Professor Don Knuth<sup>2</sup> (for T<sub>E</sub>X) and Leslie Lamport<sup>3</sup> (for L<sup>A</sup>T<sub>E</sub>X).
- I'll also like to thank Gummi<sup>4</sup> developers and LaTeXila<sup>5</sup> development team for their awesome L<sup>A</sup>T<sub>E</sub>X editors.
- I'm deeply indebted my parents, colleagues and friends for their support and encouragement.

Amber Jain

<http://amberj.devio.us/>

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<sup>1</sup><https://github.com/amberj/latex-book-template>

<sup>2</sup><http://www-cs-faculty.stanford.edu/~uno/>

<sup>3</sup><http://www.lamport.org/>

<sup>4</sup><http://gummi.midnightcoding.org/>

<sup>5</sup><http://projects.gnome.org/latexila/>

# 1

## Discrete Time Signals

*“This is a quote and I don’t know who said this.”*

– Author’s name, *Source of this quote*

### 1.1 Continuous and discrete time signals.

A signal is a function that conveys information about a phenomenon, and a continuous-time signal changes continuously with time, such as the electromagnetic waves that are transmitted or received by a wireless device.

A discrete-time signal is a sequence of measurements that are typically made at uniform times, for example stock prices observed at fixed times. Thus, a discrete-time signal  $x[n]$  and the corresponding continuous-time signal  $x(t)$  are related by a sampling process:

$$x[n] = x(nT_s) = x(t)|_{t=nT_s} \quad (1.1)$$

```
import numpy as np
import matplotlib.pyplot as plot

# Get x values of the sine wave
time = np.arange(0, 10, 0.1);

# Amplitude of the sine wave
amplitude = np.sin(time)

# Plot a sine wave using time and amplitude obtained for the
# sine wave
plot.plot(time, amplitude)

# Give a title for the sine wave plot
plot.title('Sine wave')
```

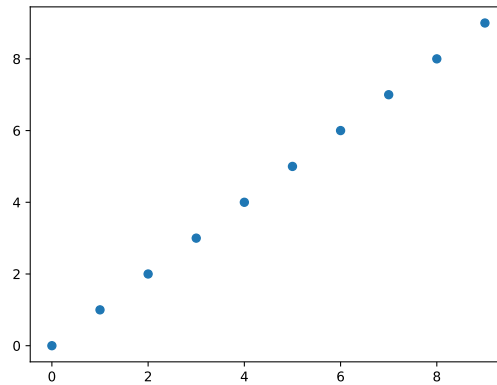


Figure 1.1: Scaled down of the original matplotlib plot. Now, the text looks very small.

```
# Give x axis label for the sine wave plot
plot.xlabel('Time')

# Give y axis label for the sine wave plot
plot.ylabel('Amplitude = sin(time)')

plot.grid(True, which='both')

plot.axhline(y=0, color='k')

plot.show()
```

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### 1.1.1 Continuous and discrete time signals.

A signal is a function that conveys information about a phenomenon, and a continous-time signal changes continously with time, such as the electromagnetic waves that are transmitted and received by a mobile phone. A discrete-time signal is a sequence of measurements that are typically made at uniform times. Thus, a discrete-time signal  $x[n]$  and the corresponding continuous-time signal  $x(t)$  are related by a sampling process: A continous time signal changes continuously with time, for While a continous time signal changes continously with time, such as the .

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<sup>2</sup>[www.example.com](http://www.example.com)

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Table 1.1: Sample table

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2	47	877	230
3	31	25	415
4	35	144	2356
5	45	300	556

- Nullam ac enim neque, non *dapibus* mauris.

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