# Introduction to Python for Science and Engineering

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11.00 to 13.00

## Part I

1. Introduction
   1. Why python?
   2. Python History
   3. Installing Python
   4. Python resources
2. Working with Python
   1. Workflow
   2. ipython vs. CLI
   3. Text Editors
   4. IDEs
   5. Notebook
3. Getting started with Python
   1. Introduction
   2. Getting Help
   3. Basic types
   4. Mutable and in-mutable
   5. Assignment operator
   6. Controlling execution flow
   7. Exception handling
4. Functions and Object Oriented Programming
   1. Defining Functions
   2. Decorators
   3. Writing Scripts and New Modules
   4. Input and Output
   5. Standard Library
   6. Object-oriented programming
   7. Magic Functions
5. Iterators and Generators
   1. Iterators
   2. Generators
6. Creating Graphic Interfaces (optional)
7. Debugging code
   1. Avoiding bugs
   2. Debugging workflow
   3. Python's debugger
   4. Debugging segfaults using gdb

## Part II

1. Introduction to NumPy
   1. Overview
   2. Arrays
   3. Operations on arrays
   4. Advanced arrays (ndarrays)
   5. Notes on Performance (\%timeit in ipython)
2. Matplotlib
   1. Introduction
   2. Figures and Subplots
   3. Axes and Further Control of Figures
   4. Other Plot Types
   5. Animations
3. Plotting with Mayavi
   1. Mlab: the scripting interface
   2. Interactive work
4. Advanced Numpy
   1. Life of ndarray
   2. Universal functions
   3. Interoperability features
   4. Array siblings: chararray, maskedarray, matrix
   5. Summary
   6. Contributing to Numpy/Scipy

## Part III

1. Scipy
   1. Introduction
   2. Input/Output
   3. Statistics
   4. Linear Algebra
   5. Fast Fourier Transforms
   6. Optimization
   7. Interpolation
   8. Numerical Integration
   9. Signal Processing
   10. Image Processing
   11. Special Functions
2. Sparse Matrices in SciPy
   1. Introduction
   2. Storage Schemes
   3. Linear System Solvers
   4. Others
3. Optimizing code
   1. Optimization workflow
   2. Profiling your code
   3. Speeding your code
4. Sympy
   1. First Steps with SymPy
   2. Algebraic manipulations
   3. Calculus
   4. Equation solving
   5. Linear Algebra

## Part IV

1. Python scikits
   1. Introduction
   2. scikit-timeseries
   3. scikit-audiolab
2. scikit-learn
   1. Datasets
   2. Sample generators
   3. Unsupervised Learning
      1. Clustering
      2. Gaussian Mixture Models
      3. Novelty/Outliers Detection
   4. Supervised Learning
      1. Linear and Quadratic Discriminant Analysis
      2. Nearest Neighbors
      3. Support Vector Machines
      4. Partial Least Squeares
   5. Feature Selection
3. Practical Introduction to Scikit-learn
   1. Solving an eigenfaces problem
      1. Goals
      2. Data description
      3. Initial Classes
      4. Importing data
   2. Unsupervised analysis
      1. Descriptive Statistics
      2. Principal Component Analysis
      3. Clustering
   3. Supervised Analysis
      1. k-Nearest Neighbors
      2. Support Vector Classification
      3. Cross validation