

Fundamentals of Algorithms and Programming for Data Science – Summer 2019

Required topics include:

- Control flow and iteration
- Functions, functionals, and lambda expressions
- Recursion (Fibonacci sequence, binomial coefficients, etc.)
- Data structures (arrays, queues, stacks, lists, hash tables, trees, etc.)
- Files and I/O
- Programming with vectors, arrays, and matrices (transposition, matrix multiplication, etc.)
- Object-oriented programming (classes and methods)
- Basics of combinatorics (graph theory, bijective proofs, etc.)
- Exponentiation, logarithms, and bases (including binary and hexadecimal)
- Computational complexity theory (asymptotics and big O notation)
- Unit tests and system tests

Optional topics:

- String manipulation and regular expressions
- Imperative programming vs. functional programming
- Mutable and immutable state
- Memory management and garbage collection
- Source control and version control systems

Example textbooks

- *How to Design Programs*. M. Flatt, M. Felleisen, R. B. Findler, and S. Krishnamurthi, MIT Press 2001
- *Learning Python*. Mark Lutz. O'Reilly Media, 2013.
- *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython*. Wes McKinney, O'Reilly Media, 2013.