

Models & Algorithms

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Synopsis: This course provides a hands-on introduction to some key mathematical problems that can be solved thanks to a computer, and to the techniques that allow to do it. The course will start with an introduction of the Python programming language and recursion programming. A significant part of the time will be spent writing programs to solve practical examples.

Syllabus:

- Introduction to Python (4h)
 - Data structures
 - Functions
 - Control Structures
- Recursion, Divide-and-Conquer (2h)
- Dynamic Programming and examples (8h)
 - Sorting
 - Edit Distance
 - Heaps
 - Discrete Convolution Problems
- Discrete control problems (6h)
 - The Bellman equation
 - Two player games
 - Stochastic control
- Monte Carlo methods (10h)
 - Direct Monte Carlo methods
 - Markov Chain Monte Carlo, Metropolis algorithm
 - Simulated Annealing
 - Continuous-time Monte Carlo