



UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

COMPUTER PROGRAMMING, ALGORITHMS AND DATA STRUCTURES

Anno immatricolazione	2021/2022
Anno offerta	2021/2022
Normativa	DM270
SSD	INF/01 (INFORMATICA)
Dipartimento	DIPARTIMENTO DI MATEMATICA 'FELICE CASORATI'
Corso di studio	ARTIFICIAL INTELLIGENCE
Curriculum	PERCORSO COMUNE
Anno di corso	1°
Periodo didattico	Annualità Singola (04/10/2021 - 17/06/2022)
Crediti	12
Ore	110 ore di attività frontale
Lingua insegnamento	INGLESE
Tipo esame	SCRITTO E ORALE CONGIUNTI
Docente	FERRARI STEFANO (titolare) - 6 CFU DONDI PIERCARLO - 6 CFU
Prerequisiti	None
Obiettivi formativi	The course introduces the student to programming in Python and solving computational problems using algorithms. The main notions of imperative programming (variables, expressions, loops, functions, recursion, input / output) and the fundamental elements of object-oriented programming are provided. The course also illustrates the analysis and design of algorithms (asymptotic analysis, dynamic programming, greedy algorithms), presents the most important data structures (arrays, lists, trees, graphs) and the algorithms that work on them.
Programma e contenuti	Module 1: Computer Programming Computer science overview

- logic circuits
- computer architecture
- operating system
- computer network
- information systems

Imperative programming

- top-down / bottom-up programming
- values, variables, expressions
- I/O instructions
- constructs, selection, loop
- functions, recursion
- I/O file
- libraries

Object-oriented programming

- fields and methods
- data types (arrays, lists)

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Module 2: Algorithms and Data Structures

Introduction

- concept of algorithm and structured data
- notion of cost (time / space)

Complexity measure

- asymptotic notations for cost functions
- methods of analysis (worst case, average, best case)

Analysis of recursive algorithms

- abstract data types (stacks, queues, trees)
- tree visit algorithms

Sorting algorithms

- SelectionSort, InsertionSort, BubbleSort, HeapSort, MergeSort, QuickSort
- cost of the order (comparison / exchanges)
- lower bound

Search algorithms

- type of dictionary data
- binary search trees
- hash table

Algorithms on graphs

- visit
- greedy techniques
- coverage
- shortest path

Testi di riferimento	Think Python: How to Think Like a Computer Scientist by Allen B. Downey Beijing: O'reilly Media Problem Solving With Algorithms and Data Structures Using Python, 2nd edition, By Brad Miller and David Ranum Franklin Beedle & Assoc (Optional) Introduction to Algorithms, 3rd edition By Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein The MIT Press
Modalità verifica apprendimento	Written test
Altre informazioni	
Obiettivi Agenda 2030 per lo sviluppo sostenibile	\$lbl_legenda_sviluppo_sostenibile