

# **Computer Programming and its applications (CPIA)**

## **Syllabus**

### **1. Computer Architecture**

- 1.1. Abstraction levels: Physical, Operation system and application
- 1.2. Processor Architecture: functional units, registers, control unit, microprogramming; processing unit; pipelining
- 1.3. Microprocessors evolution
- 1.4. Performance metrics
- 1.5. Processor and memory acceleration techniques
- 1.6. Memory hierarchy
- 1.7. Introduction to Storage and I/O
- 1.8. Overview of multicore systems, multiprocessors and clusters: parallel processing, classification, modern many-core high-performance computing architecture (GPU) and multiprocessor systems networks

### **2. C Programming Language**

- 2.1 Data types, operators and operations
- 2.2 Sentences (assignment, conditional and iterative constructors)
- 2.3 Functions
- 2.4 Parameters by reference and value
- 2.5 Basic data structures
- 2.6 Arrays, strings, structs
- 2.7 Recursion
- 2.8 Files
- 2.9 Examples

### **3. Python Programming Language**

- 3.1 Operations and data types
- 3.2 Algorithmic constructs (sequences, conditionals and iterations statements)
- 3.3 Strings, list, tuples, maps, sets and dictionaries
- 3.4 Functions
- 3.5 Classes and methods in Python
- 3.6 Recursion
- 3.7 Modules specifics: SciPy, NumPy, Matplotlib, Pyro, PuLP, Numba, Panda
- 3.8 Examples

### **4. Parallelism: Programming models for shared memory architectures**

- 4.1 Parallelism and concurrence. Processes and threads
- 4.2 Performance metrics, speedup, scalability, Amdahl's law
- 4.3 Introduction to OpenMP
- 4.4 Abstractions for parallel programming: task parallelism, data parallelism
- 4.5 Synchronization. Load balancing
- 4.6 Concurrency models for C and Python
- 4.7 Examples

## Evaluation

$$\text{Grade course} = 0.25 * L + 0.75 * PF$$

where L are periodic deliverables done in laboratory and PF is a final project

## Bibliography

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