

Teacher name	Vito Nicola Convertini
Degree Course	Statistical Science
Teaching	Fundamentals of computing, databases and information systems
Academic year	2023-2024
Performance period	Second semester
University credits (CFU)	10
Disciplinary scientific area	INF/01
Teacher webpage	

Pre-requisites

NONE.

Knowledge and skills to be acquired (Objectives)

The course aims to provide a general introduction to computing and the use of computers, and also to provide practical knowledge on some of the most popular computer tools to support personal and small business productivity.

Detailed programme

1. Computer structure

The virtual machine concept. Hardware and software. General outline of a data processing system. Typology of computers. The memories of the electronic computer. The central memory. ROM memory. Cache memory. Buffer memory. Flash memories. Mass memories. The processor. Evolution of microprocessors. Multiprocessor architectures. Input/output: The input/output ports of the computer. The input units. The output units.

2. Numbering systems

The positional numbering systems. The binary numbering system. Binary coding of data. The representation of numbers. The two's complement coding system. The floating point coding system. Character encoding.

3. Boolean algebra

Propositional logic: propositions. Boolean variables and constants. Operations on the set of Boolean variables. The NOT operation. OR operation. The AND operation. The NOR operation. The NAND operation. The OR operation. Properties of Boolean algebra. Theorems of Boolean algebra. De Morgan theorems. Boolean functions. Canonical form. Synthesis of Boolean functions.

4. Algorithms

The concept of an algorithm. Constants, variables and instructions of an algorithm. Representation of algorithms.

5. Operating Systems

Characteristics of operating systems. The Onion Skin model. Monotasking operating systems. The multitasking operating systems. The processor manager. The central memory manager. The file system. The peripheral managers. The Windows operating system.

6. Data Storage

The concept of traditional data files. Sequential and indexed files. Operations on data files. The Data Base Management System (DBMS). Data base design. Requirements analysis. Conceptual design. The Entity-Relationship model. Implementation according to a data base model. Data base management languages. Types of data base users. The operations of relational algebra.

7. Computer networks

Communication between computers. The ISO/OSI model. Layers and their functions. How transmission takes place. Protocols and interfaces. Local networks. Transmission media. Network types. Network technologies. Client-server and peer-to-peer architectures. Geographic networks. Analogue connectivity. Digital connectivity. Packet-switched networks. Internetwork. Repeaters. Bridges. Routers. Gateways. The Internet. Internet services. Firewalls.

8. Security.

Password theory. Encryption techniques. Cryptography in practice: data protection and secure e-mail transmission. Symmetric keys.

9. Computer security, encryption and digital signatures

Cryptography: history, definitions and principles. Authentication using certificates. Algorithm and key. Main types of ciphers. RSA algorithm. Digital signature: what it is, why it is used, procedures and regulations. Electronic payment systems. Security: in Operating Systems, Databases, Internet/intranet environment. Firewalls. Security evaluation criteria. Security planning.

Bibliographic References and Teaching Materials

- Handouts issued by the lecturer

Organisation of teaching

- Internal lesson cycles: Yes
- Supplementary courses: Yes
- Exercises: Yes
- Seminars: Yes
- Laboratory activities: Yes
- Project work: Yes
- Study visits: No

Mode of delivery of training activities

Lectures, practical exercises, seminar activities with external professionals.

Methods of assessing knowledge

- The examination includes a **written exam at** the end of the course in which the knowledge acquired by the student in relation to all course topics will be tested.
- This test is followed by an **oral discussion to** refine the assessment, which includes discussion of the results obtained in the design and verification of knowledge on additional topics not covered in the written test.
- The assessment of the written test and the oral test contribute equally to determining the final grade.