



Code: ING-INF/05

Credits: 6

Matter: Operating Systems

Main language of instruction: Italian

Other language of instruction: English

Teaching Staff

Head instructor

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Introduction

1. Objective of the course:

The course deals with the technical principles of Operating Systems. It provides the fundamentals of software and hardware computer architectures. Emphasis is given to Unix and Linux systems. In addition the course provides also details programming languages, synchronization and scripting.

Objectives

2. Course Structure:

- Operating System objectives and role in a computer system
- Hardware and Software Operating System components
- Modern Operating Systems capabilities and issues
- Synchronization mechanisms, semaphore, condition variables, design, and implementation of concurrent software
- Shell functionalities and programming
- Linux Operating System and scripting

Competencies:

A. Knowledge and understanding.

The student at the end of the course will have knowledge on principles and concepts of operating systems. The course provides the capability to understand the architecture and functionalities of modern computing system, resource management (memory, CPU, external devices), process synchronization, multi-

thread and time-shared systems. In addition, with the activities focused on linux kernel, students will get knowledge on modern techniques and programming on operating systems.

B. Applying knowledge and understanding.

The student will be able to use the methodologies learned to analyze the performance of an operating system in a particular application context; He will also be able to formulate alternatives or propose original solutions to problems related to the functioning of complex computing systems; He will be able to propose and support arguments in the context of operating systems, highlighting the advantages and disadvantages of implementation solutions.

C. Making judgements.

The student will be able to follow modern trends in the design of operating systems, in collecting data necessary for evaluating the performance of a particular operating system, to interpret the evaluation results, and to elaborate necessary requirements to design new operating system. The student will be also able to evaluate the effectiveness of different alternative solutions to identify the most appropriate for each goal.

D. Communication skills.

The student will be able to describe and hold conversations on modern issues and problems related to operating systems, using adequate terminology, and correctly identifying the indicators relevant in the comparison between different operating systems, in order to offer possible solutions.

E. Learning skills.

At the end of the course, the student will have knowledge of the fundamental notions necessary for the design of operating systems and concurrent programming. All this it will allow the student to continue engineering studies with a high degree of autonomy and will provide the basis for being able to learn what will be proposed in the specialized courses of computer engineering, with reference to topics related to the design and programming of virtualization systems.

Syllabus

3. Programme of the course:

Subject 1. Programming review.

Introduction to operating systems, computer hardware, assembly language (hints), C language (review).

Subject 2. Processes and Threads.

Process concept, Communication between processes, Introduction to threads, Introduction to process scheduling, Algorithms for process scheduling.

Subject 3. Virtual memory.

Physical memory, Virtual memory organization (paging), Virtual memory organization (segmentation), Virtual memory management.

Subject 4. Concurrent programming

Concurrent Programming (Dekker / Peterson), Monitors, Concurrent Programming Paradigms, deadlock and indefinite postponement. Pthread programming tutorials.

Subject 5. I/O and Filesystem

I/O management(hints), Secondary memory management, File system, File allocation methods.

Subject 6. Linux

Linux Kernel, Shell. Exercises on scripting.

Evaluation system and criteria

The exam usually consists in carrying out a written test a series of activities (e-tivity) which verifies the analytical skills and the concepts acquired.

The expected learning outcomes about the knowledge of the subject and the ability to apply them are evaluated by the written test, while communication skills, the ability to draw conclusions and the ability to self-study they are evaluated through the e-tivities.

Bibliography and resources

4. Materials to consult

The didactic material on the platform is divided into 6 modules. They fully cover the program each of them contains handouts, slides and video lessons in which the teacher comments on the slides. Such material contains all the elements necessary to tackle the study of the subject.

5. *Recommended bibliography*

Suggested readings are:

- A. Silberschatz; P. Baer Galvin; G. Gagne, "Operating systems. Concepts and Examples", Pearson, 9th Ed.
- M. Kerrisk, "The Linux Programming Interface: A Linux and UNIX System Programming Handbook", No Starch