Systems programming
1 – Introduction

MEEC MEAer MEIC MEFT

João Nuno Silva

Offering

- Electrical Engineering
  - 69 students

- Aerospace Engineering
  - 11 students

- LEIC + MEIC + MEFT
  - 4 students

Objectives

- Present concepts of systems programming

- Exercise direct interaction with the OS

- Increase knowledge on the organization and systems interface

- Explore tools and functionality for good SW development practices

Teaching Staff

- **Theoretical Classes**
  - João Nuno Silva
    - TEAMS!
  - Office at Teams
  - Office hours
    - +- Any hour
      - With appointment

- **Laboratories**
  - Alexandra Carvalho
    - TEAMS!
  - Office at Teams
  - Office hours
    - +- Any hour
      - With appointment

Classes

- Theoretical
  - Presentation of course material
  - Resolution of some problems (with programming)

- Laboratories
  - Resolution of programming problems

Theoretical classes

- Theoretical
  - Tuesday 13:30.. 15:30
  - Thursday 13:30 - 15:30

Laboratory Classes

- Exercise theoretical concepts
  - Use of systems and libraries
  - Implementation of simple systems

- Implementation of the project
  - 2/3 full weeks

- Based in C

Laboratory Classes

- 1st laboratory
  - Tuesday – 16:00 - 17:30
  - Wednesday – 12:30 - 14:00
  - Wednesday – 14:00 - 15:30

- Groups of 2
  - Also for project

- 2nd laboratory
  - Thursday – 09:30 - 11:00
  - Thursday – 11:00 - 12:30
  - Thursday – 15:30 - 17:00

- Enrollment
  - Online
  - In person
    - 1st Lab1 or lab2

Laboratory Classes

- Assignment defined the previous week

- Laboratory work does not fit into 2 hours
  - Requires study of fundamental concepts
  - Requires understanding the problem
  - Requires work at home
    - Before and/or after laboratory
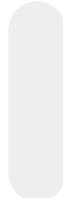
Work methodology

- Theoretical classes
  - Individual study
  - Based on supplied materials
  - Classes to review subjects

- Laboratories
  - Individual work
  - Resolution of most assignments at home
  - Classes to answer questions and doubts

Reading material

- Material to be supplied
  - PDF Documents to be posted on the web page
  - Scientific papers/ reviews
  - Chapters of text-books

Work schedule

- Maintain a constant work load

- My courses does not require
  - lots of hard work

- My courses require
  - Steady work

  - Focused work

  - You to know what work is needed

Academic honesty

- In PConc plagiarism includes:
  - Use of ideas, code or solutions from other students, person or source, without proper credit acknowledgment

- Students can discuss their problems with other colleagues,
  - This discussion will not lower the grade

- BUT:
  - Students should not copy code from or provide solutions to other colleagues

Academic honesty

- Academic dishonesty also included copying in exams

- Exams are solved without any external help
  - communication of printed material

- Academic dishonesty is considered fraud.

- The immediate consequence is the automatic fail in the evaluation where a copy of fraud was detected

Communication

- Communication is fundamental
  - To know what to do
  - To keep motivated

- In this courses communication of fundamental
  - Get a 20!

Communication

- Theoretical classes
  - Direct interaction with me
  - Only way to know where we are

- Laboratories
  - Direct interaction with me and other professors
  - One way to know what is expected of the project
  - One way to answer doubts

Communication

- TEAMS
  - Preferred method of communication with teaching staff
  - Fast answer time
  - Public knowledge dissemination

TEAMS

- Requires Office 365 registration
  - Free MS tools
  - ciist.ist.utl.pt/ciistadmin/user/office365.php

- IST / FENIX authentication

TEAMS

Grading

- Exam
  - 50% final grade
  - Minimum grade - 8.0

- Project
  - 50% final grade
  - Minimum grade - 10.0

Project

- Programming assignment
  - Complex system
  - Using presented technologies and techniques

- To be developed during the trimester
  - In groups of two students
  - To be submitted on
    - Part 1 - Week 4
    - Part 2 - Week 7

Project

- Default Assignment defined by teaching staff

- Students can proposed topic

  - From Thesis (for instance)

- Technologies

  - C

  - Communication (high level MQ)

  - Synchronization

Project Evaluation

- 5/6 laboratories
  - Dedicated to the project
  - Progress of the project evaluated

- Project Grade
  - 10% - Progress evolution (labs)
  - 10% - Report
  - 10% - Discussion
  - 70% - Functionalities

Academic honesty

- In PConc plagiarism includes:
  - Use of ideas, code or solutions from other students, person or source, without proper credit acknowledgment

- Students can discuss their problems with other colleagues,
  - This discussion will not lower the grade

- BUT:
  - Students should not copy code from or provide solutions to other colleagues

Academic honesty

- Academic dishonesty also included copying in exams

- Exams are solved without any external help

  – communication of printed material

- Academic dishonesty is considered fraud.

- The immediate consequence is the automatic fail in the evaluation where a copy of fraud was detected
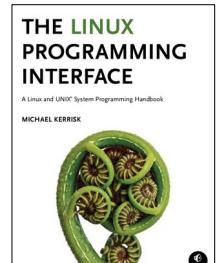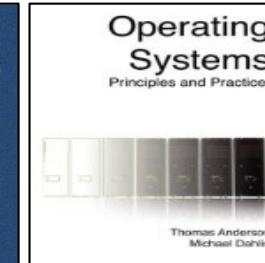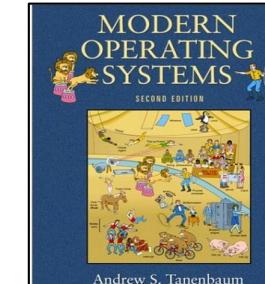
Student profile

- Course
  - LEEC MEEC
  - LEAer MEAer

- Previous knowledge
  - Programming language
    - c
  - Operating Systems (user level)
  - Networking sockets (not required)

Bibliography

- Operating Systems: Principles and Practice
  - Michael Dahlin, Thomas Anderson

- Modern Operating Systems;
  - A.S. Tanenbaum; Prentice-Hall

- The Linux Programming interface A Linux and UNIX System Programming Handbook
  - Michael KerrisK

- Other
  - Papers, book chapters
  - Provided in the FENIX

System

- Set of interacting or interdependent components forming an integrated whole.
  - Delineated by its spatial and temporal boundaries,
  - Surrounded and influenced by its environment
  - Described by its structure and purpose
  - Expressed in its functioning.

System Programming

- **Understanding of a System**
  - e.g. Operating System

- **Use of a System**
  - e.g. Operating System

- **Development/implementation of a System**
  - project

Systems programming

- Fundamental in the area of computer networks
  - And Distributed Systems / Internet

- Presents the interface and connection between:
  - Hardware (CPU / memory / peripherals)
  - Applications

- Relevant in other areas
  - Telecommunication
  - Control

Program

- Systems
- Introduction to Software engineering
  - Requirements
- SYSML
- Architectures and patterns
- Operating System Architectures
- Operating System programming
  - Process management
  - Threads
  - Synchronization
- Communication
  - Shared memory
  - Inter-process communication
  - Data Interoperability

- C review
- Communication
- Processes and shared memory
- Threads and Synchronization