

Laboratórios de Computadores:  
Apresentação  
Computer Labs: Introduction  
2º MIEIC

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# Objectives

*Upon successful completion of this class you should be able to:*

- 1. Program at the HW interface level of the most common PC I/O Devices*
- 2. Develop system-level programs*
- 3. Use software tools typical of large programming projects*

# Prerequisites

- ▶ **Programação**

- ▶ You'll program a lot, mostly in C
  - ▶ but also in assembly
  - ▶ ... for the IA-32 architecture

- ▶ **Microprocessadores e Computadores Pessoais**

- ▶ Arquitectura de Computadores

- ▶ If you have **not** completed Programação, please consider to drop LCOM, if you do not have enough time for extra programming effort

# Syllabus

I/O devices

C programming with assembly

Programming tools

# Method

## Learn by doing

“I hear, I forget. I see, I remember. I do, I understand”

## Several short lab assignments

- ▶ Each focusing on one I/O device
- ▶ Some of them take only one lab class, others take two lab classes
- ▶ Requiring a preparation of about 6 hours per lab class (excluding classes)

## One integration project

- ▶ Must use at least 3 different I/O devices
- ▶ Must use interrupts
- ▶ Should use both C and assembly
- ▶ Should require about 9 hours per week (during 5 weeks)

**Note:** Both lab assignments and project should be done in groups of 2 students.

# Recent Changes Still in Place

**What?** There are no lab classes on the RTC or on the serial port (UART)

- ▶ However, we will still talk about them in the lectures
- ▶ Students wishing to get a grade of 16 or better, are expected to use these devices anyway
  - ▶ To use any of these devices you are required to use **all** the other

**Why?**

- ▶ Have more lab classes for the other I/O devices
  - ▶ Most of them now have 2 lab classes
- ▶ Remove some pressure out of the graded lab assignments

**Expected results** (and fulfilled)

- ▶ Less cheating
- ▶ Higher passing rate

# Work Load

- ▶ LCOM has 6 ECTS, i.e. about 160 hours
  - ▶ Assuming 1 ECTS equal to 27 hours
    - ▶ Check out the [European Credit Transfer and Accumulation System \(ECTS\)](#)
  - ▶ If you share the load with your team-mate, this should not be a problem.

Unit	Hours/Week	No. Weeks	Total
Lectures	2	11	22
Labs.	3	<b>11/9</b>	<b>33/27</b>
Prep. L0	5	1	5
Prep L2-L5	6	8	48
Proj.	9	5	45
Slack			<b>9/15</b>
Total			162



# Bibliography and Other Resources

- ▶ PC HW is well documented on several books and online resources
- ▶ Book mentioned in SIFEUP

***Mazidi, Muhammad**, The 80x86 IBM PC and Compatible Computers: Assembly Language, Design and Interfacing, 4th Ed., Prentice-Hal*

Note that it does not cover all the subjects, and that, on the other hand, it has a lot more material than needed for this class.

# Grading (1/2)

1. Four lab assignments are graded.
  - ▶ You must submit your code via SVN **at the end of the last class of your section of every lab**;
  - ▶ Grading will be done off-line on code retrieved from the SVN repository
2. We will also grade your participation in the class, i.e. whether you have prepared the lab, whether you participate actively and your contribution to the work of your team
3. The final project must be demonstrated in January (from 3rd to 5th)

Formula  $\sum_{i=1}^3 l_i * 0.15 + 0.45 \text{ FP} + 0.1 \text{ CP}$

i.e. we use the best 3 grades of the 4 graded labs  
**BUT** for a **final** grade of 19 or 20,  
you **must** "choose" the mouse lab

## Grading (2/2)

- ▶ All grades are individual
  - ▶ Even though labs and projects should be done in groups
- ▶ Lab/project grades are normalized for groups of 2
- ▶ The grade of each group member is obtained by applying a factor to the group's grade
  - ▶ The factor depends on the member's **contribution** mostly **participation** also to the final result
  - ▶ We will use a piecewise linear function to determine the value of the factor
    - ▶ Likely "breakpoints" are:  $(0,0)$ ,  $(0.33,0.8)$ ,  $(0.5,1)$ ,  $(0.8, 1.1)$  and  $(1, 1.1)$
- ▶ Each member of the group must fill a Google form with its own self-assessment (contribution and participation) of each of the labs/projects submitted by the end of the day of the respective deadline
  - ▶ **Failure to comply, may penalize you**

# Final Project Grading (1/2)

Execution: 40% + 10%

- ▶ 10% for demo in the last lab class

Code: 20%

- ▶ Structure and Modularity
- ▶ Documentation (use Doxygen)
- ▶ Readability
  - ▶ Names and comments
  - ▶ Indentation
- ▶ Compilation warnings

Final Report: 20%

- ▶ Summary of what is and what is not implemented;
- ▶ Usage instructions (with images)
- ▶ Description of the program's architecture
- ▶ **Relevant** implementation aspects (grades above 18)
- ▶ Function call diagram

Tools: 5% (SVN) (We expect you to commit to the SVN repository at least once a week, and to log messages then)

Project Specification: 5%

# Final Project Grading (2/2)

- ▶ To the grade obtained by applying the above criteria, we'll apply:

## Difficulty Factor

- ▶ number and type of I/O devices
- ▶ features used of the I/O devices
- ▶ I/O techniques used (interrupt vs. polling)
- ▶ use and extent of assembly programming

## Originality Factor

## Team Management Factor

- ▶ load share among group members

## Marketing Bonus

- ▶ of 1 valor for the participation in the Semana Profissão Engenheiro (SPE), sometime in March 2018
- ▶ in recent years, we have selected 3 or 4 projects per year

# Final Project Milestones

**Project proposal:** Beginning of the 7th lab class (week starting 13th November)

- ▶ Half to one page description of the functionalities desired, of the devices used and their role in the program
- ▶ Must be rewritten in class, if the instructor does not accept it

**Project specification:** Beginning of 8th lab class (week starting 20th November)

- ▶ Refinement of the proposal, identifying the modules to implement, their functionality and API.
- ▶ Should include planning of the project
- ▶ Must be rewritten in class, if the instructor does not accept it

**First demo:** At the last lab class of the semester.

**Project submission:** January 2nd, 20:00

**Project presentation:** January: 3rd to 5th

# Project Examples

- ▶ Games (video, timer, keyboard and mouse)
- ▶ Two user games (video, timer, keyboard and serial port)
- ▶ Electronic calendar (video, keyboard, mouse, RTC and timer)
- ▶ Music composer/player (video, keyboard, mouse and timer)
- ▶ Text editor (video, keyboard, mouse, timer and RTC)
- ▶ Typing tutor (video, keyboard, mouse, timer)
- ▶ File transfer between PCs (video, keyboard, serial port)
- ▶ Chat between PCs (video, keyboard, serial port)
- ▶ Video player (video, keyboard, mouse, timer and RTC)
- ▶ Drawing/painting program (video, keyboard, mouse, timer, RTC and serial port)

# TEs Grading

**Labs** 3 of the 4 graded labs, each with a weight of 15%

- ▶ Presentation/discussion in the week of that lab class
  - ▶ Student must get in touch with me (pfs@fe.up.pt) to arrange for an hour, at least 7 calendar days in advance
- ▶ Submission at the end of presentation/discussion

**Project** Similar to that of the other students, but with a weight of 55%.

- ▶ Presentation/discussion of proposal and specification in the same week as that of the other students
  - ▶ Student must get in touch with me (pfs@fe.up.pt) to arrange for a date and hour, at least 7 calendar days in advance
- ▶ Submission by the same deadline as other students
- ▶ Presentation/discussion in the same period as for other students (in January 3rd through 5th).



# Grading in “Época Especial”

**Project** Similar to that of the other students, but with a weight of 100%

- ▶ Presentation/discussion of proposal and specification
  - ▶ Student must get in touch with me (pfs@fe.up.pt) to arrange for a date and hour, at least 7 days in advance
- ▶ Submission and presentation/discussion within 7 days of approval of the specification

# Special Evaluation

**IMPORTANT** Students wishing to:

1. be assessed as TE's
2. use their labs/project (positive) grades from 2015/2016 or 2016/2017

must fill [this Google form](#) by the end of this week, i.e. 2017-09-23.

**IMPORTANT** Please note that by choosing this option, you may have to work alone in some or all grading components

- ▶ If you do not want to work alone, it will be up to you to create a group (together with other students) or find a group that accepts you as a new member.

# Academic Integrity

- ▶ The UP and we take this issue very seriously
  - ▶ Check the [Despacho do Reitor N° 08/09/2011](#)
  - ▶ We believe that the majority of you follow the rules
- ▶ You are allowed to discuss the labs
  - ▶ For each lab and for the project, there will be a discussion forum on Moodle
- ▶ However, all code submitted should be either:
  - ▶ Developed by the group members
  - ▶ Provided by me
- ▶ We will use tools to automatically detect common code
  - ▶ **All groups** with common code will be penalized
  - ▶ You cannot show or share code

The lab assignments are identical to those of last year, but this is no excuse

- ▶ The penalty may range:
  - From** a zero in that lab **and** a penalty of “2 valores” in your final grade;
  - To** failing the course (especially, in case of recidivism or of the project)
    - ▶ The delay in publishing the grades is no excuse.

# Important Dates

## Labs

Lab	Week	Topic	Comments
Lab 0	25-09	Redmine, Devel. and SVN	Not graded
Lab 2	02-10	Timer	Two classes (except Thursdays)
Lab 3	16-10	Keyboard	Two classes
Lab 4	06-11	Mouse	One class, plus Semana da FEUP
Lab 5	13-11	Video (graphics)	Two classes

- ▶ Lab 1 was cancelled because this semester has 1 week less

## Project

What	Week	Comments
Proposal	13-11	7th lab class
Specification	20-11	8th lab class
First demo	13-12	Last lab class
Submission	2018-01-02 @ 20:00	To be confirmed
Presentation	3, 4 and 5 January, 2018 (afternoon)	To be confirmed

- ▶ Three lab classes (but Friday sections will have only one)
  - ▶ We will try to schedule at least one extra class (whose attendance is not mandatory, but to your advantage)

# Lab Sections

- ▶ I've instructed the secretariat not to accept more than 26 students per section
  - ▶ ensure you get help from staff, if you need it
  - ▶ each group should have only 2 students
- ▶ Any changes will have to be done by permutation among sections
  - ▶ We have created a forum in LCOM's Moodle explicitly with that purpose
- ▶ **Next week, students will be allowed to join only groups in their sections**

# Acknowledgments

- ▶ Prof. António Miguel Pimenta Monteiro (who designed the course)
- ▶ Prof. João Cardoso (not the same person as TC's lecturer) (who perfected it)
- ▶ The lab technicians:
  - ▶ Rui Fernandes (from previous years)
  - ▶ Nuno Sousa (from previous years)

# Thank You!

# Questions?



# Platform

## MINIX 3

Unix-like operating system that allows privileged user processes to:

- ▶ Access every memory address
- ▶ Access directly I/O devices
- ▶ Process interrupts

## Linux

- ▶ MINIX 3 is installed in a VirtualBox VM

# Software

- ▶ Eclipse with the Remote System Explorer plugin
- ▶ GNU C compiler and assembler
- ▶ Other SW development tools
  - ▶ make
  - ▶ SVN
  - ▶ doxygen
  - ▶ ar

# Announcements

## Lectures

- ▶ Start 10 minutes after the hour, e.g. 17:40 on Mondays
  - ▶ Actually, this is a FEUP's rule, and therefore applies also to lab classes

## Labs

- ▶ Start next week, i.e. September 25
  - ▶ All sections will have 11 lab classes, except those on Friday, which will have only 9 lab classes
    - ▶ We'll try to schedule extra classes for the Friday sections

# Advice

## For Lecture Preparation

- ▶ Read the material before the lecture:
  - ▶ In each lecture before a lab assignment, I'll present:
    - ▶ The concepts and the information required to complete that lab class
    - ▶ Provide hints to address the key issues of the lab
  - ▶ The lecture slides will be available at least the day before at:  
<http://web.fe.up.pt/pfs/aulas/lcom2017/>
  - ▶ The handout of every graded lab will be also available by Thursday of the previous week via the same [URL](#)

so that you can:

- ▶ Understand better the lecture
  - ▶ Participate more actively in the lecture
  - ▶ Get your questions answered before the lab class
- ▶ If I'm late and you cannot wait, check last year's material available at <http://web.fe.up.pt/pfs/aulas/lcom2016/>