departamento de informática
FACULDADE DE CIÊNCIAS E TECNOLOGIA
UNIVERSIDADE NOVA DE LISBOA

# Course Administrativia

Concurrency and Parallelism — 2017-18

Master in Computer Science

(Mestrado Integrado em Eng. Informática)

Joao Lourenço <joao.lourenco@fct.unl.pt>

# Administrivia — Basic Info

- Lectures
  - João Lourenço <joao.lourenco@fct.unl.pt>
- Labs
  - João Lourenço <joao.lourenco@fct.unl.pt>
  - Bernardo Ferreira <bf@fct.unl.pt>
- Office location
  - Dep. Informática · Building II · Room P2/9
  - Extension: 10740

# Administrivia — Schedule

- Class hours
  - Lectures:
    - Wed @ 10:10
    - Fri @ 11:10
  - Labs:
    - Wed @ 11:10
    - Thu @ 14:10
    - Fri @ 9:10
    - Fri @ 14:10

| | 2ª | 3ª | 4ª | 5ª | 6ª |
|---|---|---|---|---|---|
| 8:00 9:00 | | | | | |
| 9:00 10:00 | | | | | **CP** p.2 Ed 2: Lab 121/Ed.II |
| 10:00 11:00 | | | **CP** t.1 Ed 7: 1.1/Ed.VII | | |
| 11:00 12:00 | | | **CP** p.1 Ed 2: Lab 121/Ed.II | | **CP** t.1 Ed 2: 127/Ed.II |
| 12:00 13:00 | | | | | |
| 13:00 14:00 | | | | | |
| 14:00 15:00 | | | | **CP** p.4 Ed 2: Lab 119/Ed.II | **CP** p.3 Ed 2: Lab 121/Ed.II |
| 15:00 16:00 | | | | | |

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  - Labs:
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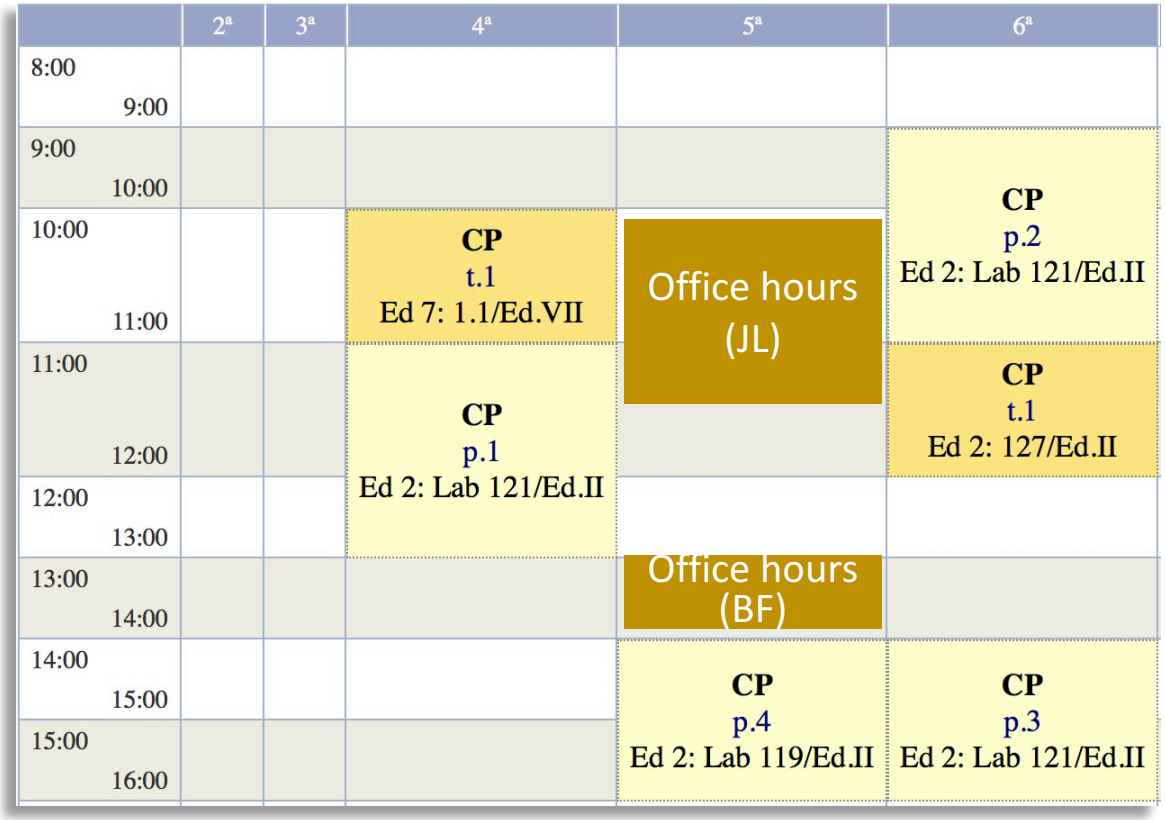
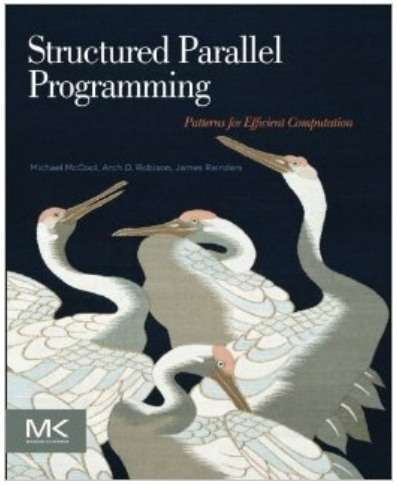
    - Thu @ 14:10
    - Fri @ 9:10
    - Fri @ 14:10
- Office hours
  - João Lourenço Thu @ 10:00–11:30
  - Bernardo Ferreira Thu @ 13:00–14:00



# Administrivia — Main Bib.

- McCool M., Arch M., Reinders J.; **Structured Parallel Programming: Patterns for Efficient Computation**; Morgan Kaufmann (2012); ISBN: 978-0-12-415993-8



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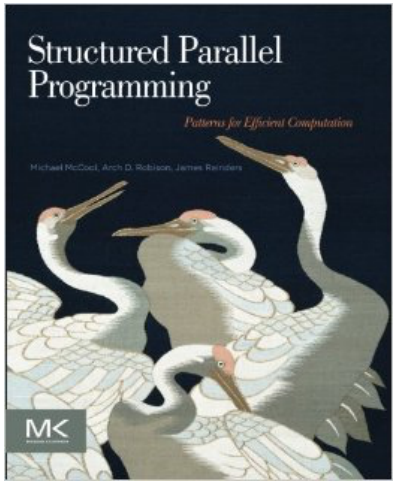
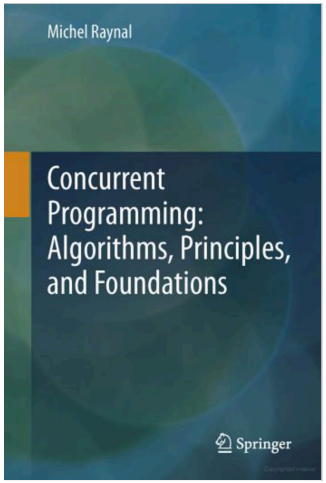



- Raynal M.; **Concurrent Programming: Algorithms, Principles, and Foundations**; Springer-Verlag Berlin Heidelberg (2013); ISBN: 978-3-642-32026-2



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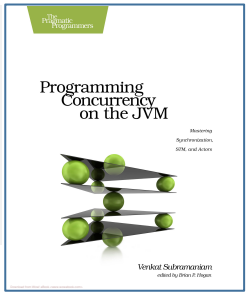

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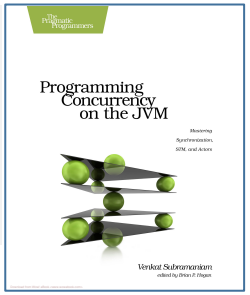
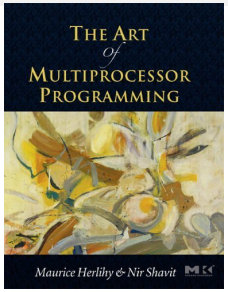



- Herlihy M., Shavit N.; **The Art of Multiprocessor Programming (revised reprint)**; Morgan Kauffman (2012). ISBN: 978-0-12-397337-5



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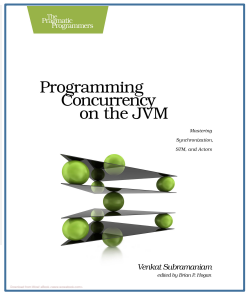


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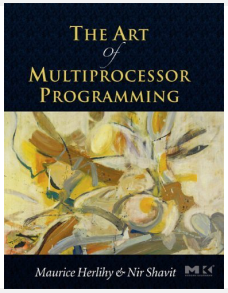


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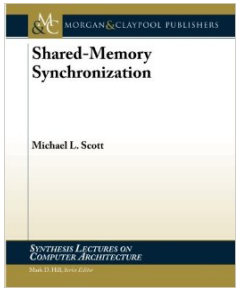

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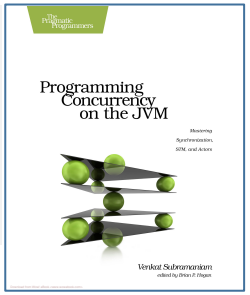


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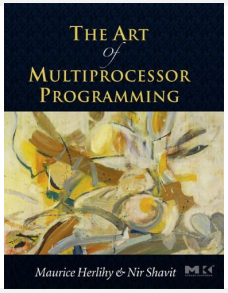


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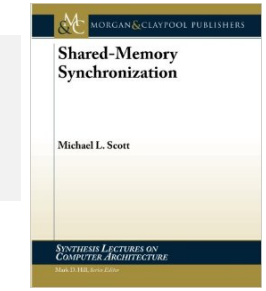
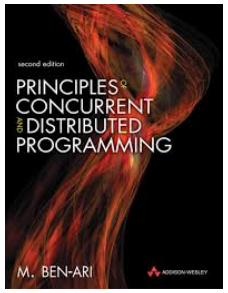
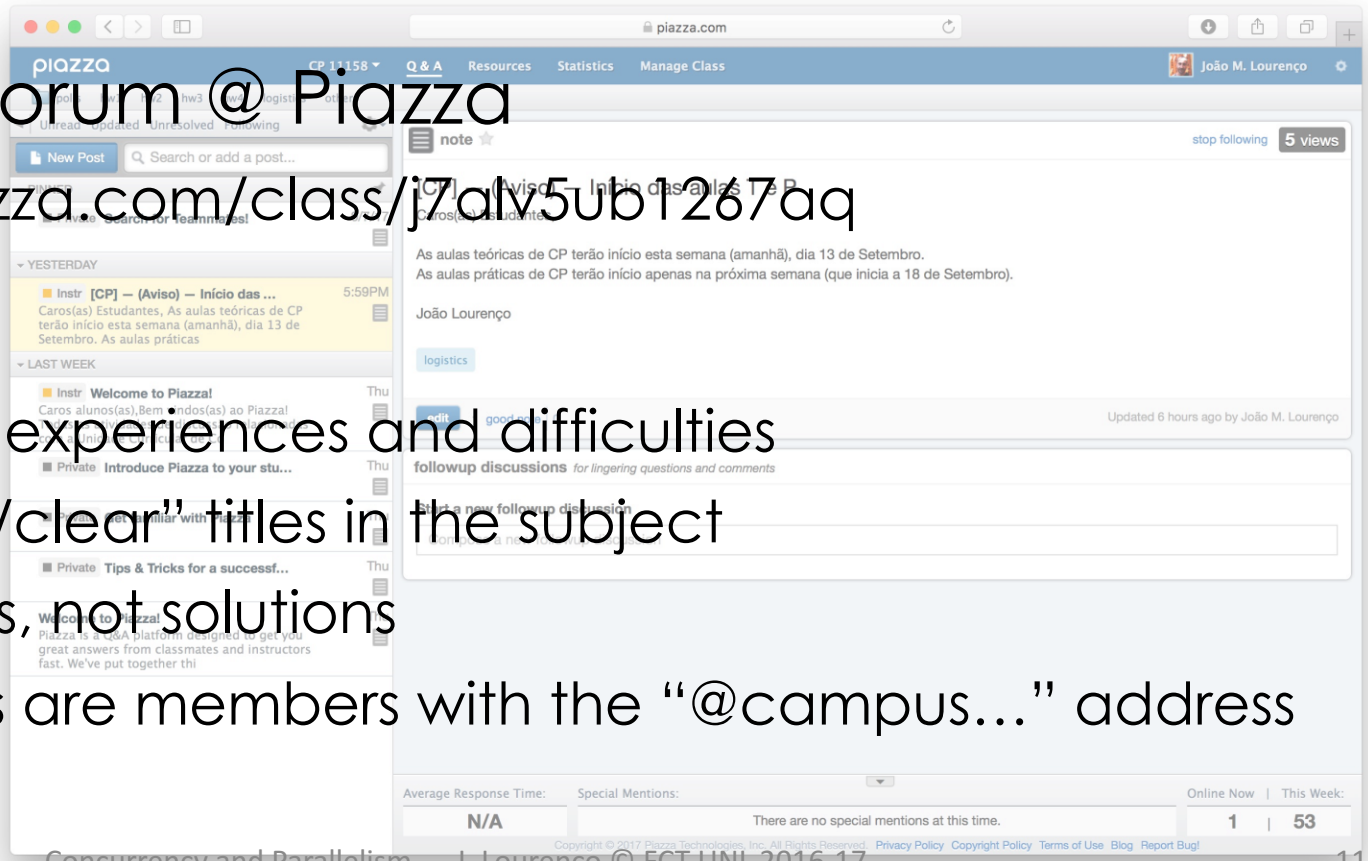



- Ben-Ari M.; **Principles of Concurrent and Distributed Programming, 2/E**; Pearson (2006); ISBN: 978-0-321-31283-9



# Administrivia — Additional Bib.

- Class web page @ CLIP
  - All assignments, handouts, [lecture notes]
- Discussion forum @ Piazza
  - https://piazza.com/class/j7alv5ub1267aq
- Rules
  - Share your experiences and difficulties
  - Use "smart/clear" titles in the subject
  - Share ideas, not solutions
  - All students are members with the "@campus…" address



# Administrativia — Course Goals: Knowledge

- To understand the concepts of concurrency and parallelism, and how they can be explored when designing software;
- To identify the models used for problem solving in multiprocessors and highly-parallel systems;
- To know the paradigms used in the development of algorithms for multiprocessors and highly-parallel systems;
- To know the languages, libraries and tools used in the development of concurrent and parallel programs;
- Be familiar with common concurrency problems, and how to mitigate or avoid them.

# Administrativia — Course Goals: Application

- Be able to identify and exploit opportunities for concurrency and parallelization within a software system;
- Be able to partition a problem into multiple tasks to be executed in a parallel system;
- Be able to reason about the behavior of concurrent and parallel programs;
- Be able to build correct and efficient concurrent and parallel algorithms;
- Be able to use the Java/C-like programming languages and parallel libraries to develop parallel software systems;
- Be able to use programming tools in the development of concurrent and parallel applications, including the design, implementation, debugging and deployment stages;
- Be able to predict and measure the performance characteristics of a parallel system.

# Sylabus: Concurrency

1. **Parallel programming**
   The spectrum of high-demanding computational problems; regular and irregular problems; strategies for problem decomposition and their mapping to programming patterns; the transactional and map-reduce models.
2. **Parallel architectures**
   Flynn's taxonomy; performance theory (including Amdahl's and Gustafson's laws).
3. **Concurrency control and synchronization**
   Competition and collaboration; atomicity; linearization; monitors; locks; semaphores; barriers; producer-consumer; multi-reader single-writer locks; futures; concurrency in practice in Java and C.
4. **Safety and liveness**
   Safety vs. liveness; progress; deadlock; deadlock prevention, avoidance, detection, and recovery; livelock; livelock avoidance; priority inversion; priority inheritance. Lock-free algorithms.
5. **The transactional model**
   Composite operations; transactions (serializability), optimistic concurrency control (OCC) and transactional memory.
6. **Concurrency without shared data**
   Active objects; message passing; actors.

# Lab classes

- In the class
  - Design and implement parallel and concurrent programs
- Two Home Works / Projects
  - One addressing parallelism
  - One addressing concurrency
- Rules for grouping
  - Group members must be enrolled in the same lab class
  - Groups of 2 students
    - **All exceptions** require explicit authorization
    - Non-authorized individual projects **will not** be graded

# Administrivia — Evaluation

- [70%] three tests (individual)

  [ average ≥ 9.5 points ]

- [30%] two HW/projects (groups of 2 students)

  [ each ≥ 7.5 points ]

  [ average ≥ 9.5 points ]

- [up to +5%] participation in lectures and labs

# Administrivia — Frequency

- Frequency:
  - Project ≥ 9.5 points => FREQUENCY ACQUIRED
- Frequency from 2016-17?
  - If used, considered as 30% of the final grade (must be required explicitly)
- Frequency from 2015-16 or before?
  - You have to acquire frequency again this year!

# Administrivia — Grading

- Grading the HW / projects
  - [80%] based in the written report on the project
  - [20%] passing tests / demonstration / discussion

- Distribution of work in group
  - I don't care who does what, as long as everybody does something technically relevant / meaningful for the project
    - **Work division must be reported** in the project report
- Any attempt of fraud => all groups members will fail the course immediately

# Administrivia — Methodology

- Feel free to ask questions in/out classes
  - Teacher, colleagues, Piazza
    - *Please make use of Piazza!*

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- Fell free to answer questions from colleagues
  - Helping finding the solution ≠ giving the solution for free

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- Fell free to answer questions from colleagues
  - Helping finding the solution ≠ giving the solution for free

- Cite any source that inspired your work
  - As long as you cite what/who you used, it's not cheating
  - Worst case I will deduce some points if it undermines the assignments

# Administrivia — Important Dates

## Year 2017-18 - 1st semester

***Setembro 2017***

| Seg | Ter | Qua | Quin | Sex | Sáb | Dom |
|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | |

***Outubro 2017***

| Seg | Ter | Qua | Quin | Sex | Sáb | Dom |
|---|---|---|---|---|---|---|
| | | | | | | 1 |
| 2 | 3 | 4 | ***5*** | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 39 |
| 30 | 31 | | | | | |

***Novembro 2017***

| Seg | Ter | Qua | Quin | Sex | Sáb | Dom |
|---|---|---|---|---|---|---|
| | | ***1*** | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | ***FCT*** | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | | | |

***Dezembro 2017***

| Seg | Ter | Qua | Quin | Sex | Sáb | Dom |
|---|---|---|---|---|---|---|
| | | | | ***1*** | 2 | 3 |
| Sexta | 5 | 6 | 7 | ***8*** | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| ***N*** | 26 | 27 | 28 | 29 | 30 | 31 |

***Janeiro 2018***

| Seg | Ter | Qua | Quin | Sex | Sáb | Dom |
|---|---|---|---|---|---|---|
| ***1*** | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 | 31 | | | | |

***Fevereiro 2018***

| Seg | Ter | Qua | Quin | Sex | Sáb | Dom |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 |
| ~~5~~ | ~~6~~ | ~~7~~ | ~~8~~ | ~~9~~ | 10 | 11 |
| 12 | ***C*** | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | | | | |

# Remember…

- Clip is the official source of information for the course.
- Confirm @Clip all the administrativia related topics.
- If yours is a special case where the rules are unclear or do not apply, please let me know (*so that we can handle it appropriately*)!

# The END