Università della Svizzera italiana
Institute of Computing CI

Numerical Computing 2023

Course Organization

Dr. Edoardo Vecchi

edoardo.vecchi@usi.ch

Practical Information

- **Guest lecturer:**
  - Dr. Dimosthenis Pasadakis, dimosthenis.pasadakis@usi.ch
- **Teaching assistants:**
  - Lisa Gaedke-Merzhaeuser, lisa.gaedke.merzhaeuser@usi.ch
  - Pietro Miotti, pietro.miotti@usi.ch
  - Andrea Brites Marto, andrea.brites.marto@usi.ch
- **When and where** (check the course schedule for eventual changes):
  - Tuesday, 15:30-17:00, room **C1.03**
  - Wednesday, 13:30-15:00, room **C1.03**
- **Registration and course material:**
  - Enroll on teaching.inf.usi.ch
  - The course material can be found on iCorsi
- **Main textbook:** Ascher, Uri M. and Greif, Chen, *A First Course in Numerical Methods*, SIAM. A password-protected PDF ('USI-NC') of the textbook is available on iCorsi.

Course Organization

Values in ECTS: 6

Focus: Continuation of the Computational Science course from last semester, but much more emphasis on numerical programming. All hardware-related issues (parallelization, vectorization, memory access) are covered in the MSc course *High-performance Computing*.

The Numerical Computing lab is divided into:

1. **Theoretical lectures (9 slots)**
   - Each topic tackled during the course will be introduced by one or more theoretical lectures, in which we will explain the key concepts necessary for the applied part of each project.
2. **Tutorial sessions (18 slots)**
   - The core of the course will consist in the real-life numerical mini-projects based on the methods explained during the theoretical lectures.
   - We will provide two/three in-class tutorial slots for each project, during which we will answer your individual questions and support you in the solution of the programming tasks.

Course Schedule: Theoretical Lectures and Tutorials I

Date	Event	Description	Reference
19.09.2023	**Lecture 1**	Details on course organization Introduction to `MATLAB` for scientific computing	Slides
20.09.2023	**Tutorial 1**	In-class support for Project 1	–
26.09.2023	**Lecture 2**	Eigenvalues and the PageRank algorithm Introduction to Project 1: PageRank	Chapter 8 Slides
27.09.2023	**Tutorial 2**	In-class support for Project 1	–
03.10.2023	**Tutorial 3**	In-class support for Project 1	–
04.10.2023	**Lecture 3**	An introduction to graph partitioning algorithms Introduction to Project 2: Graph partitioning	Slides
10.10.2023	**Tutorial 4**	In-class support for Project 2	–
11.10.2023	**Tutorial 5**	In-class support for Project 2	–
17.10.2023	**Tutorial 6**	In-class support for Project 2	–
18.10.2023	**Lecture 4**	K-means clustering and spectral graph clustering Introduction to project 3: Graph clustering	Slides

Course Schedule: Theoretical Lectures and Tutorials II

Date	Event	Description	Reference
24.10.2023	**Tutorial 7**	In-class support for Project 3	–
25.10.2023	**Tutorial 8**	In-class support for Project 3	–
31.10.2023	**Tutorial 9**	In-class support for Project 3	–
01.11.2023	–	*Holiday*	–
07.11.2023	**Lecture 5**	Linear least-squares problems	Chapter 6
08.11.2023	**Lecture 6**	Data modelling with linear/nonlinear least squares Bonus assignment: LQ for real-world problems	Slides
14.11.2023	**Tutorial 10**	In-class support for the Bonus assignment	–
15.11.2023	**Lecture 7**	An introduction to the conjugate gradient method Introduction to Project 4: Image deblurring	Chapter 7 Handout
21.11.2023	**Tutorial 11**	In-class support for the Bonus assignment	–
22.11.2023	**Tutorial 12**	In-class support for the Bonus assignment	–

Course Schedule: Theoretical Lectures and Tutorials III

Date	Event	Description	Reference
28.11.2023	**Tutorial 13**	In-class support for Project 4	–
29.11.2023	**Lecture 8**	Linear programming and the simplex method Introduction to Project 5: LP and simplex method	Slides Handout
05.12.2023	**Tutorial 14**	In-class support for Project 4	–
06.12.2023	**Tutorial 15**	In-class support for Project 4	–
12.12.2023	**Tutorial 16**	In-class support for Project 5	–
13.12.2023	**Tutorial 17**	In-class support for Project 5	–
19.12.2023	**Tutorial 18**	In-class support for Project 5	–
20.12.2023	**Lecture 9**	In-class Q&A session on the whole course	–

Course Grading

Grading: The final grade (maximum: 10/10) will be given by:

- 5 mini-projects (40%)
- 1 bonus assignment (10%)
- final written or oral exam (60%)

You need to score at least 5/10 in the mini-projects to be admitted to the final exam. The bonus points will be added only if you scored at least 6/10 in the mini-projects and final exam.

Mini-projects and bonus assignment: Please keep the following rules in mind:

- You are allowed to discuss the projects with anyone you like, but:
  - You must list **everyone** you discussed your solutions with.
  - You must write you submissions **independently** (joint submissions are not possible).
  - **Plagiarism** will be harshly penalized (0 score for all students involved).
- All mini-projects/assignments must be **submitted on iCorsi** according to the provided instructions **strictly before the deadline**. Late submissions will not be considered and will be graded 0 points, regardless of your submission quality. Please submit in time!