Calculus & Optimization (Master’s Degree of Computer Science)

Prof. Giovanni Fasano, A.Y. 2020-2021

Calculus & Optimization: structure of the course

Detailed structure of the course

1. duration of 48 hours: 28 hours of ‘face-to-face teaching’ and 20 hours of ‘online teaching’
2. 14 face-to-face lessons (including exercises) will include 2 AMA lessons (Ask Me Anything)
3. 10 online lessons including 1 AMA lesson (Ask Me Anything)
4. activation of the course and publication of materials on Moodle platform
5. preparation of afternotes (in English) covering the course contents, available to students, including a selection of bibliography
6. creation of 20 videos lasting up to 15 minutes each, made available on Moodle and related to the theoretical contents of the course. These 20 videos will be added to the section of video-recordings of lessons
7. initial (informal) test about students’ basic knowledge (available on Moodle, when the platform will be available !!)
8. online mid-term exam with grade (about halfway through the course, after an AMA lesson)
9. final self-assessment test / exam simulation (without grade)
10. Office Hours: in presence (where allowed by COVID-19 rules) + Zoom online meetings (during the teaching period, on Wednesday from 18.00 to 19.30) + Skype / Gmeet / Zoom meetings at the request of the student
11. NO tutor will support the teacher

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INITIAL PROGRAMME

a. Introductory examples with Mathematical Programming models
b. Basics of Calculus in $\mathbb{R}^n$ and General Definitions
c. Basics on Continuous Differentiability in $\mathbb{R}^n$
d. Introduction to Mathematical Programming: definitions
e. Properties and structure of Convex Problems (Theorem 5.1: omit the second part of the prof; Proposition 5.4: to be omitted)
f. Basics of Linear Algebra
g. Eigenvalues and Eigenvectors for linear functions: elements
h. Notes on Homogeneous functions and Curves in $\mathbb{R}^n$ (Section 8.1: to be omitted)
i. Examples of Chain Rules
j. Implicit Function Theorem (Dini’s Theorem) in $\mathbb{R}^2$; extensions of Dini’s Theorem in $\mathbb{R}^n$ (Section 10.3: to be omitted)
k. Optimality conditions for Constrained and Unconstrained problems: general and convex case
l. Optimization methods for Unconstrained Optimization (Definition 14.5: to be omitted; Proposition 14.2 and therein comments: to be omitted)

All the issues are treated in the Afternotes of the teacher, which are freely available on Moodle platform. Further material for the course can be found on Moodle.
Exam Rules*

The final exam will take place in any of the regular calls advertised by the University Ca’ Foscari; it will be focused on the issues presented at lessons and included in the programme. General rules for the final exam are as follows:

- **For the students who have passed the Intermediate Call**
  
  *Written Part:* including 3 exercises + 2 written questions (relative to parts h. - n. in the programme); possible *Oral Part*. The 3 exercises will be chosen among:
  
  - Chain rules
  - Exercise on Dini’s Theorem
  - Exercise on Fritz-John or KKT conditions
  - Exercise on applying a Gradient Method
  - Exercise on applying a Linesearch Procedure (Minimization rule, Limited Minimization rule, Armijo rule, convergence properties)

- **For the students who have NOT passed/done the Intermediate Call**
  
  *Written Part:* including 5/6 exercises + 2/3 written questions (relative to the entire programme); possible *Oral Part*. The 5/6 exercises will be chosen among:
  
  - any treated issues of Calculus (i.e. issues a. - g. in the Afternotes, included in the Programme)
  - Chain rules
  - Exercise on Dini’s Theorem
  - Exercise on Fritz-John or KKT conditions
  - Exercise on applying a Gradient Method
  - Exercise on applying a Linesearch Procedure (Minimization rule, Limited Minimization rule, Armijo rule, convergence properties)

The possible *Oral Part* (say 20-25 minutes) may include final questions to clarify the written elaborate of the student. The entire exam will be completed within the day of the official call.

*Observe that exam rules may be subject to possible modifications, due to COVID-19 emergence.*
Instructions for all the students

1. **install** (possibly) the IMMUNI app on your mobile
2. **avoid** meetings/gatherings and where necessary always use a protective nose-mouth mask
3. **avoid** the use of lifts whenever possible
4. teaching material available on the university website (e.g. handouts, documents, audio/video recordings, etc.) is subject to the **copyright laws** provided by the university
5. students are invited to use the course contents through the **use/registration on MOODLE**
6. students can contact the teacher, for any clarification/explanation concerning the subject, via the email fasano@unive.it
7. at the beginning of each lesson the teacher will provide:
   - a **summary of the previous lesson contents**, in order to allow students an easy connection among the topics of the programme
   - a **summary of the topics** of the current lesson, including references to the handout/ audio/video module, available on MOODLE, which cover them

Instructions for students attending the lesson face to face

1. the teacher **does not manage** the app with which students book attendance at the various lessons
2. students booked for each lesson are invited to arrive in time to allow the lesson to start on time
3. at the beginning of the lesson any free seats in the classroom will be left at the sides and at the bottom of the latter, in order to allow any **late students** to sit down without disturbing the lesson
4. during the lesson the **room cannot host** more students than the number of those booked
5. during the lesson the students in the presence must **wear the mask** covering nose-mouth. Otherwise the teacher will have to interrupt the lesson
6. at the end of the lesson the student can ask **questions in person to the teacher**, staying at a minimum distance of 1-2 meters, compatibly with the start times of the next lesson
7. if the student experiences **flu-like symptoms**, she/he must go to the meeting point of the university seat and follow the instructions specified on the university website

Instructions for students who attend the lesson remotely

1. the student must **access the lesson** through the appropriate ZOOM link, **specific for the course and the single lesson**, which is available on the MOODLE platform. For this purpose, the student will have to previously access MOODLE with her/his university credentials, then selecting the course and lesson of interest. For students who **at the beginning of the course** still do not have credentials, a list of the aforementioned ZOOM links is available below:
2. the student must join ZOOM meeting in any single lesson at the established time, remaining in silence (i.e. with silenced microphone). The student can intervene during the lesson raising his hand with the appropriate ZOOM option, waiting for the teacher to give her/him the floor. If necessary, use the ZOOM chat for brief communications to the teacher during the lesson.

3. as far as possible the teacher will try to give speech priority to students remotely, compared to students in presence.

4. if a student who follows remotely wants or is requested to share a document or write on the ZOOM whiteboard, she/he will receive from the teacher on the spot the status of co-host.

5. the student should try to familiarize with the use of reactions in ZOOM (e.g. raised hand, like, etc.) as they will be used for short surveys during the course by the teacher.