Mathematical Programming

Course of the PhD Program in Mathematics

docente, Prof. Romeo Rizzi

Contents

The course offers an introduction to Linear Programming (LP) and Combinatorial Optimization (CO) also exploring some of the links between the two. The approach adopted is algorithmic.

Program

The three main subjects comprising the course (DP, LP and CO) will not be treated strictly one after the other but rather in parallel where most convenient.

- Hands on introduction to Dynamic Programming (DP).

- Introduction to Linear Programming (LP)

  1 what is an LP problem
  2 modeling your problem as a linear program
  3 the simplex method (description and analysis)
  4 duality theory
  5 complementary slackness
  6 economic interpretation
  7 sensitivity analisys
  8 geometric interpretation

- Introduction to graphs and Combinatorial Optimization (CO)

  1 graphs and digraphs as models
  2 a few good characterizations (bipartite graphs, eulerian graphs, Planar Graphs)
  3 shortest paths
  4 minimum spanning trees
  5 max flows and min cuts
  6 bipartite matching

Period

January 22 - February 1, 2018. More details at the home page for the course.

Place

The offert is broadcast in streaming (just ask for the URL and we can also organize uplinks for questions, feedback and syncronization via WhatsApp). The streaming is from Room A108 in Povo 1. A group of attending students is organized in Verona, in Ca' Vignal (ask `Alice Raffaele` `<bibliofila@hotmail.it>`).

Timetable

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Calendario Corso in Mathematical Programming (Corso PhD Interateneo TN-VR).
(In streaming from Aula A108 Povo 1 --- Tutti i giorni 4 ore: 9-13.)
Monday          Tuesday         Wednesday       Thrsday         Friday
22/1/2018       23/1/2018       24/1/2018       25/1/2018       26/1/2018
sala r. 2       auletta CV1     sala r. 2       sala r. 2       sala r. 2
29/1/2018       30/1/2018       31/1/2018       1/2/2017
auletta CV1     auletta CV1     sala r. 1       sala r. 2

dove:
auletta CV1 = auletta di Ca' Vignal 1
sala r. 1 = sala riunioni al piano terra
sala r. 2 = sala riunioni al secondo piano
```

Reference Material

- Linear Programming: Foundations and Extensions. Robert J. Vanderbei, Kluwer Academic Publishers (2001)
  WWW: `http://www.princeton.edu/∼rvdb/LPbook/`

- notes and manuals borrowed from the web or elaborated by the teacher
  WWW: `profs.sci.univr.it/~ rrizzi/classes/MathProg`

WWW page of the course

From the options at the page:

> `profs.sci.univr.it/~ rrizzi/classes/`

choose your edition of the PhD Course in MATHEMATICAL PROGRAMMING.

Exam

You can choose among two possible modalities for the exam of this course:

level B you are supposed to do two things in order to collect a level B on this course:

1. attend the course;
2. submit codes (in c, or c++, or Pascal, or Python, or essentially any language you might prefer) scoring at least a total of 1000 points at the phd CMS (Contest Management System) I will set up for you:
   `https://cms.di.unipi.it/phd`
   you'll need to solve problems employing recursion, dynamic programming, hints and/or proofs discussed during the class. Each problem delivers at most 100 points (which you will get in full if your algorithmic solution is most smart and efficient, and otherwise you will go collecting a few point here and a few point there). Exercises can be done in group (which is actually encouraged so that this first course will also serve as an occasion for you to get to know each other), but you are supposed to have a good understanding of the solutions you will be submitting as an individual.

level A level B + a your-own project. The project can e.g. be a presentation of something you are interested in, like e.g. a topic related to operations research or an algorithmic issue which might have relation to your own subject of study and research. The project can be anything reasonable we will agree upon. It is your project, propose and choose something which makes sense to you.