Practical Assignment

Description: The practical assignment consists of choosing an optimization problem, designing and testing both a mathematical programming (MIP) model and a constraint programming (CP) model for the problem, and reporting on the findings of the analysis of each model and comparison of the two models.

It is divided into two stages: design, implementation and test of the MIP model; and design, implementation and test of the CP model, as well as comparison between the MIP and CP models.

The assignment can be done in groups of two students or individually.

Evaluation: The assignment will be evaluated based on a written **paper** and an oral **presentation**, as well as information regarding **self-evaluation**. Evaluation of each component of the work, as well as scheduled dates are presented below:

Choice of topic and work group	10/03/2021	-
Intermediate version of the paper	28/04/2021	15%
Final version of the paper	02/06/2021	20%
Oral presentation	02/06/2021	15%
Self-evaluation	09/06/2021	-

Choice of topic (10/03/2020): Each group/student should choose one of the available topics. This should be done in [this Google Sheets](#) by placing the name(s) of the student(s) next to the topic, in the white cells. Each topic can only be chosen by a maximum of three groups.

In case you want to suggest a different topic, please contact us (lfigueira@fe.up.pt and dcs@fe.up.pt) with information about the topic and instance dataset to use, for validation.

Intermediate report (28/04/2021): Each group/student should submit (via Moodle) the intermediate report, containing the MIP model for your chosen problem, as well as an analysis of the model and the obtained results. You should write the model for the chosen problem and test the limitations of the model, starting with smaller instances and successively increasing the dimensions of the instances to be solved (identifying which are the relevant parameters for the instances' dimension).

The paper should have the following structure:

1. Abstract
2. Introduction (including a description of the problem and the objectives of the paper)
3. The MIP model you used for the problem at hand
4. An analysis of the tests and results (including some KPI's on the difficulty of the instances and resolution time)
5. Conclusions

Final report (02/06/2021): Each group/student should submit (via Moodle) the final report and practical assignment.

The report should be based on the intermediate report, with new sections describing the implemented CP model, an analysis on the impact of different search options, and a comparison between MIP and CP models, comparing both the solutions (to check for correctness) and the running times (to check for efficiency) of the models.

The implementation of the model can be done using CP in OPL or using the CP library and a general-purpose programming language (like Java or C++). An aspect to explore is the kind of constraints that can be used in CP, contrasting them with the linear constraints that you have designed for the MIP model. Note that you are not forced to linearize your model, as the CP Optimizer allows you to use basic constraints on your problem variables but also provides more powerful constraints suited to your problem. You can compare CP models using the basic and the more compact constraints on your problem instances.

(more detailed submission information will be made available closer to the submission deadlines)

Oral presentation (02/06/2021): Each group/student should prepare a presentation (15 minutes) reporting on the chosen problem, the MIP model, the CP model, the obtained results from both models, as well as a comparison of the models, in terms of correctness and efficiency.

The slides used in the presentation should also be submitted (via Moodle), in pdf format, for evaluation.

Self-evaluation (09/06/2021): In case of two students working together, each student must send us (lfigueira@fe.up.pt and dcs@fe.up.pt) an e-mail containing the percentage of contribution from each member of the group. Please use 'OPT - SelfEval' as the subject of the e-mail.

Assignment Topics: A list of suggested topics follows, including a link to resources (datasets) to be used in the assignment:

- Open Shop and Job Shop (Difficulty level 1)

    http://mistic.heig-vd.ch/taillard/problemes.dir/ordonnancement.dir/ordonnancement.html

- VRP-TW (Difficulty level 4)

    https://www.quintiq.com/optimization/vrptw-world-records.html

- Aircraft landing (Difficulty level 2)

    http://people.brunel.ac.uk/~mastjjb/jeb/orlib/airlandinfo.html

- Extended Cap Warehouse Location (Difficulty level 2)

    http://people.brunel.ac.uk/~mastjjb/jeb/orlib/capinfo.html
    (discuss the problem extension with the course teachers)