

Topic 0: Logistics

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Pierre Flener

ASTRA Research Group
on Combinatorial Optimisation
Uppsala University
Sweden

Course 1DL441:
Combinatorial Optimisation using
Constraint Programming





Learning Outcomes, from the Catalogue

In order to pass, the student must be able to:

- define the concept of combinatorial problem;
- describe the concept of constraint and how a CP solver works, by giving its architecture and explaining the principles it is based on;
- model declaratively a combinatorial problem, using the primitive constraints of a CP solver;
- devise a search heuristic that can be used by a CP solver;
- formulate and compare alternative constraint programs (with model and search parts) for a combinatorial problem;
- change the model, e.g., by introducing redundancy or by detecting and breaking symmetries, and evaluate the consequences;
- augment a CP solver with a constraint, and evaluate whether it is better than a reformulation based on the existing constraints;
- describe briefly some other combinatorial optimisation technologies and hybrid technologies;
- present and discuss topics related to the course content, orally and in writing, with a skill appropriate for the level of education.



Course Organisation & Time Budget

Periods 1–2: August to January (*sic*), budget = 266.7 hours:

- 22 **lectures**, taught in English: budget = 34.5 hours
- 6 teacher-chosen **homeworks**: 3 **assignments** + **project** over 3 parts, with 3 **help sessions**, 1 **grading session**, and 1 **solution session** per homework, to be done in student-chosen duo team: (2 + 3 credits)
budget = average 36 hours / homework / student
- 1 written closed-book **exam** of 5 hours (cancelled if. . .), to be done alone: budget = 16 hours (5 credits)
- Prerequisites: C++; basic algebra, combinatorics, logic, graph theory, set theory, and search algorithms.



6 Homework Cycles of 3 (or 2) Weeks

Let D_i be the deadline day of Homework i , with $i \in 1..6$:

- $D_i - 14$: **publication** & all needed material taught: start!
- $D_i - 8$: **help session a**: attend if you need it; no emails.
- $D_i - 3$: **help session b**: attend if you need it; no emails.
- $D_i - 1$: **help session c**: attend if you need it; no emails.
- $D_i \pm 0$: **submission**, by 13:00 Swedish time on a Friday.
- $D_i + 5$ at 16:00: **initial score** $h_i \in \{0, 1, 2, 3, 4, 5\}$ **points**.
- $D_i + 6$: teamwise oral **grading session** if $h_i \in \{1, 2\}$:
possibility of earning 1 extra point for **final score**;
otherwise final score = initial score.
- $D_i + 6 = D_{i+1} - 8$: **solution session** + next **help session**.



2 Assignment Credits & Overall Influence

Let $a_i \in 0..5$ be **final score** on Assignment i , with $i \in 1..3$:

- **20% threshold:** $\forall i \in 1..3 : a_i \geq 20\% \cdot 5 = 1$.
No catastrophic failure on individual assignments.

- **50% threshold:** $a = \sum_{i=1}^3 a_i \geq \lceil 50\% \cdot (3 \cdot 5) \rceil = 8$.

The formula for **grades** 3, 4, and 5 is at Studentportal.

- **Worth going full-blast:** The **assignment score** a and **project score** p (see next slide) are meshed with the **exam score** e in order to determine the **overall grade**, **if $8 \leq a \leq 15$ and $8 \leq p \leq 15$ and $38 \leq e \leq 75$:** see the formula at Studentportal.



3 Project Credits & Overall Influence

Let $p_i \in 0..5$ be **final score** on Project Part i , with $i \in 1..3$:

- **20% threshold:** $\forall i \in 1..3 : p_i \geq 20\% \cdot 5 = 1$.
No catastrophic failure on individual project parts.

- **50% threshold:** $p = \sum_{i=1}^3 p_i \geq \lceil 50\% \cdot (3 \cdot 5) \rceil = 8$.

The formula for **grades** 3, 4, and 5 is at Studentportal.

- **Worth going full-blast:** The **assignment score** a (see previous slide) and **project score** p are meshed with the **exam score** e in order to determine the **overall grade**, **if $8 \leq a \leq 15$ and $8 \leq p \leq 15$ and $38 \leq e \leq 75$:** see the formula at Studentportal.



Homework Rules

Declare **teams** by Sun 10 Sep at 23:59 at Studentportal:

- **Duo teams:** Two consenting partners sign up at portal.
- **Solo teams:** Apply to head teacher, who rarely agrees.
- **Random partner?** Assent to TAs, else you're bounced.

Other considerations:

- **Why (not) like this? Why no email reply?** See FAQ.
- **Partner swapping:** Allowed, but to be declared to TAs.
- **Partner scores may differ** if no-show or passivity.
- **No joyriding:** Honour declaration required in reports that each partner can individually explain everything. Random checks may be made by us.
- **No plagiarism:** Honour declaration required in reports. Extremely powerful detection tools may be used by us. Suspected cases of using or providing will be reported.