

14X013: Metaheuristics for Optimization

Syllabus – Fall 2026

Course General

The course meets:

- Mondays 1.15–4.00 p.m. (Bat A/319) – Practical sessions (TPs)
- Thursdays 9.15 a.m.–12.00 p.m. (Bat A/301) – Lectures

The course also meets asynchronously (on Moodle): [14X013]

Teaching Staff

- *Course Instructor:* Prof. Roland Bouffanais
Office hours: By appointment (roland.bouffanais@unige.ch)
- *Teaching Assistants:*
 - . Ms. Francesca Zucchelli (francesca.zucchelli@unige.ch)
 - . Ms. Chloé Marteil (chloe.marteil@unige.ch)

Course Description

This course seeks to offer an accessible introduction to metaheuristics for optimization. Heuristic methods are employed when more rigorous approaches are either unknown or impractical, often due to their inefficiency or slow performance. A metaheuristic is a broad optimization framework designed to guide a problem-specific heuristic, making it adaptable to a variety of problems. Over the past two decades, metaheuristics have proven effective in solving or providing satisfactory solutions for many complex optimization challenges including problems in Machine Learning. Despite their shared foundations and theoretical principles, these techniques are diverse and can be difficult for beginners to understand.

Topics covered:

1. Introductory concepts about metaheuristics
2. Tabu search
3. Simulated annealing and parallel tempering
4. Ant colony optimization
5. Phase transitions in optimization problems
6. Particle swarm optimization and the firefly method
7. Evolutionary algorithms
8. Genetic programming
9. The “no-free lunch theorem”
10. Performance analysis of metaheuristics

Course Schedule

First day of classes: Thursday 17 September 2026

Last day of classes: Thursday 17 December 2026

Week	Monday	Thursday	Assessment
1	14.09.2026	17.09.2026	
2	21.09.2026	24.09.2026	
3	28.09.2026	01.10.2026	
4	05.10.2026	08.10.2026	
5	12.10.2026	15.10.2026	Lecture quiz #1 (Material: until end of Week #4)
6	19.10.2026	22.10.2026	
7	26.10.2026	29.10.2026	
8	02.11.2026	05.11.2026	Lecture quiz #2 (Material: Weeks #5 to #7)
9	09.11.2026	12.11.2026	
10	16.11.2026	19.11.2026	
11	23.11.2026	26.11.2026	Lecture quiz #3 (Material: Weeks #8 to #10)
12	30.11.2026	03.12.2026	
13	07.12.2026	10.12.2026	
14	14.12.2026	17.12.2026	Lecture quiz #4 (Material: Weeks #11 to #13)

The four lecture quizzes are held during the Thursday lecture sessions, as indicated above. The five TP quizzes take place during the Monday practical sessions; their exact dates, as well as all assessment deadlines, will be announced on Moodle.

Examination session: Monday 25 January to Friday 12 February 2027.

Assessments & Grading Components

- Tutorials (a.k.a. TPs); 20% broken down into:
 - ◊ *TP quizzes* (50% of the TP grade): five quizzes covering tabu search, simulated annealing, evolutionary algorithms, genetic programming, and performance analysis & phase transitions. Each quiz bears on specific points of the corresponding practical session, so students are expected to have completed the practical work beforehand;
 - ◊ *Reports* (40% of the TP grade): written in groups of two or three students, depending on course enrollment;
 - ◊ *Presentation* (10% of the TP grade): delivered in the same groups, with no more than two presentations scheduled per tutorial session;
 - ◊ *Eligibility for the oral examination*: an aggregate score of at least 60% on the TP quizzes, together with the submission of all reports and the completion of the presentation;
- Lecture quizzes (20%): Four 20-min quizzes held during lectures. This grade component is calculated based on the average of all 4 scores;
- Final exam (60%): oral exam (randomly selected topic with 20-min preparation followed by a 20-min interrogation)
- Total: 100%

Academic Integrity

Students are expected to be familiar with and adhere to the following policy about academic integrity at the University of Geneva [\[here\]](#)