Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

Course

Heuristics and Search Methods (E004152)

Valid as from the academic year 2018-2019

Course size

<table>
<thead>
<tr>
<th>Credits</th>
<th>Study time</th>
<th>Contact hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0</td>
<td>120 h</td>
<td>30.0 h</td>
</tr>
</tbody>
</table>

Course offerings and teaching methods in academic year 2020-2021

A (semester 1)
- English
- Gent
- Lecture: 15.0 h
- Seminar: 10.0 h

B (semester 1)
- Dutch
- Guided self-study: 15.0 h
- Seminar: 10.0 h

Lecturers in academic year 2020-2021

Gautama, Sidharta (TW18 lecturer-in-charge)

Offered in the following programmes in 2020-2021

<table>
<thead>
<tr>
<th>Programme</th>
<th>crdts</th>
<th>offering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridging Programme Master of Science in Industrial Engineering and Operations Research</td>
<td>4</td>
<td>B</td>
</tr>
<tr>
<td>Bridging Programme Master of Science in Industrial Engineering and Operations Research</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Business Engineering (main subject Data Analytics)</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Business Engineering (main subject Operations Management)</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Industrial Engineering and Operations Research</td>
<td>4</td>
<td>B</td>
</tr>
<tr>
<td>European Master of Science in Photonics</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Industrial Engineering and Operations Research</td>
<td>4</td>
<td>A</td>
</tr>
</tbody>
</table>

Teaching languages

Dutch, English

Keywords


Position of the course

This course discusses the most recent developments in the area of non-exhaustive search methods for large and complex search spaces. For most optimization problems encountered in practice, the search space is not convex and contains far too many candidate solutions to enumerate them all in order to find the optimal solution. That is why there is a great need for search methods that crawl through the search space in a more intuitive way, converging very fast to solutions which, although perhaps suboptimal, are still very good. Often, the success of such heuristic methods depends on whether one succeeds in implementing problem-specific knowledge into the search method. In the course, several classes of heuristic approaches are discussed which prove to be extraordinarily successful with some of the hardest realistic problems.

Contents

- Local search methods
- Stochastic local search
- Constraint programming
- Neural networks
- Principles of tabu search
- Genetic algorithms
- Simulated annealing

Initial competences

(Approved)
There are no specific initial competences other than admission to the mentioned master programs.

**Final competences**
1. Being able to describe the different classes of modern search methods and their application areas
2. Having a thorough knowledge of heuristics and approximation methods
3. Awareness of the influence of operators and representation
4. Being able to analyse a solution method in terms of stability and optimality of the solution found
5. Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives
6. Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods
7. Being able to adjust generic methods in order to improve convergence for a given problem
8. Critical assessment of results obtained by different classes of search methods

**Conditions for credit contract**
Access to this course unit via a credit contract is determined after successful competences assessment.

**Conditions for exam contract**
This course unit cannot be taken via an exam contract.

**Teaching methods**
Guided self-study, lecture, seminar, research project

**Extra information on the teaching methods**
Students are each assigned a project individually. The written report and the oral presentation of this project work are the subject of the permanent evaluation.

**Learning materials and price**
Slides used in the lectures, selected research articles and chapters in books.

**References**
Rothlauf F., Design of Modern Heuristics, Principles and Application, Springer 2011

**Course content-related study coaching**
The lecturers and assistants are available before and after the lectures.

**Evaluation methods**
Continuous assessment

**Examination methods in case of periodic evaluation during the first examination period**

**Examination methods in case of periodic evaluation during the second examination period**

**Examination methods in case of permanent evaluation**
Assignment, report

**Possibilities of retake in case of permanent evaluation**
Examination during the second examination period is possible.

**Extra information on the examination methods**
Continuous evaluation: assessment of the project work, the report and presentation.

**Calculation of the examination mark**
Continuous evaluation 100%.