General Objective
Vehicle routing problems have numerous applications in the field of transportation, distribution and urban freight logistics, among others.
This course introduces the main elements for the design of vehicle routes with particular emphasis on the following aspects:

- Different types of problems that arise in the area, depending on the type of application, service time constraints, constraints in the form of service, etc.
- Potential applications of vehicle routing problem,
- Models and formulations suitable to represent the problems,
- Some solution methods for obtaining solutions.

Specific Objectives
- To understand the main node routing problems (the traveling salesman problem and the vehicle routing problem) and the possible extensions to consider time windows, specific service modes, etc. To know the potential applications of node routing problems.
- To understand the main routes arc routing problems, and in particular, the Chinese postman problem and the rural postman problem. To know the potential applications of arc routing problems.
- To know possible modeling alternatives for different vehicle routing problems, and the possibilities and limitations of each of them.
- To know some basic solution methods for the studied problems.
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<tr>
<th>Study load</th>
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<tbody>
<tr>
<td><strong>Total learning time:</strong></td>
<td>125h</td>
<td>30h</td>
<td>24.00%</td>
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<td>Hours large group:</td>
<td></td>
<td>15h</td>
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<td>Hours medium group:</td>
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<td>0h</td>
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<tr>
<td>Hours small group:</td>
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<tr>
<td>Guided activities:</td>
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<td>80h</td>
<td>64.00%</td>
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<tr>
<td>Self study:</td>
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### Content

<table>
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<tr>
<th>Section</th>
<th>Learning time</th>
<th>Description</th>
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### Additional considerations for Vehicle Routing Problems

**Description:** Problems with time window constraints. Problems with constraints on the type of service: pickup-and-delivery.

**Learning time:** 18h  
Theory classes: 4h  
Practical classes: 2h  
Self study: 12h

### Arc Routing Problems

**Description:** The Chinese Postman Problem, the Rural postman problem, the Capacitated Arc Routing Problem. Modelling the parity at the nodes. Solution methods: valid inequalities and heuristics.

**Learning time:** 27h  
Theory classes: 6h  
Practical classes: 3h  
Self study: 18h

### Other related problems

**Description:** Sequencing problems as vehicle routing problems. Combined Localization/Routing problems.

**Learning time:** 12h  
Theory classes: 4h  
Practical classes: 2h  
Self study: 6h

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**Qualification system**

Implementation and delivery in due date of a series of personalized exercises proposed in class. (20 % final grade)
- Presentation and discussion in class of the problem proposed by the student, its modeling and solution alternatives, as well as the results of the computational experiments. (30 % final grade)
- Implementation and delivery in due date of a comprehensive report containing: (i) a description of the problem proposed and its potential applications; (ii) the considered modeling alternatives; (iii) the design and implementation details of the considered algorithms; and (iv) a description of the computational study of the implemented model and methods, performed on a set of instances, including analysis of the results and conclusions. (40 % final grade)
- Active participation in class (10 % of final grade).
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Bibliography

Basic:


Complementary:


Others resources:

Audiovisual material

Atenea