

Introduction to Advanced Aspects of Nature-Inspired Search and Optimisation

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Module 06-27818 and 27819: Advanced Aspects of
Nature-Inspired Search and Optimisation (Ext)

Learning outcomes

- ▶ Describe different nature-inspired search and optimisation methods and explain how they are applied to solve real world problems
- ▶ Discuss relations, similarities and differences between the most important heuristics and nature-inspired algorithms presented in the module and other search and optimisation techniques
- ▶ Design and adapt nature-inspired algorithms including operators, representations fitness functions and potential hybridisations for non-trivial problems
- ▶ **Implement nature-inspired algorithms using different programming languages and compare them experimentally**

What will we learn

We will learn how to implement

- ▶ **Local search algorithms**, e.g, simulated annealing
- ▶ **Evolutionary algorithms**, e.g., genetic algorithms
- ▶ **Swarm intelligence algorithms**, e.g., particle swarm optimisation
- ▶ **Constrained optimisation algorithms**
- ▶ **Multi-objective optimisation algorithms**

What programming languages?

- ▶ **Matlab**
- ▶ R
- ▶ **Java**
- ▶ C/C++

Are they useful??

We will apply them to

- ▶ real-world combinatorial optimisation problems, e.g., scheduling/timetabling problems
- ▶ real-world numerical optimisation problems, e.g., design optimisation problems
- ▶ solve real-world decision making problem, e.g., Scottish trauma center configuration
- ▶ algorithmic trading, e.g., construct and optimise an automatic trading system

What problems we will solve in this module?

We will apply the algorithms to solve

- ▶ **Office Assignments (a Binary integer programming problem)**
- ▶ **Set Covering problems**
- ▶ **Flight crew scheduling problems**
- ▶ **Design optimisation problems**
- ▶ **Multi-objective design optimisation problems**

How the 2 hours lectures are organised

- ▶ I will present and explain some **code examples**
- ▶ You then try those code examples and complete **some practical exercises**
- ▶ Sometimes I will introduce some new and cool stuff which Joshua did not cover, i.e., Genetic Programming.

How this module is assess?

- ▶ Examination and fortnightly homeworks (Joshua's 10 credit module): 50%
- ▶ 3 Continuous Assessments: 50%
- ▶ Important dates