COS30008

Data Structures and Patterns

2024

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Convener: Dr Markus Lumpe

Lecture: Monday 12:30-14:30 (online)

Labs: Monday 10:30 (ATC325)

Monday 14:30 (BA513)

Tuesday 08:30, 10:30, 12:30, 14:30, 16:30 (BA603)

Wednesday 08:30, 10:30, 12:30, 14:30 (BA603)

Grading: Problems sets (4), mid-term, final exam

Assessments: self-guided study projects with specific deadlines

Subject Aims

- How can a given problem be effectively expressed?
- What are suitable data representations for specifying computational processes?
- What is the impact of data and its representation with respect to time and space consumption?
- What are the reoccurring structural artifacts in software and how can we identify them in order to facilitate problem solving?

Learning Objectives

1. Apply object oriented design and implementation techniques.
2. Interpret the tradeoffs and issues involved in the design, implementation, and application of various data structures with respect to a given problem.
3. Design, implement, and evaluate software solutions using behavioral, creational, and structural software design patterns.
4. Explain the purpose and answer questions about data structures and design patterns that illustrate strengths and weaknesses with respect to resource consumption.
5. Assess the impact of data structures on algorithms.
6. Analyze algorithm designs and perform best-, average-, and worst-case analysis.

Overview

The following gives a tentative list of topics not necessarily in the order in which they will be covered in the subject:

- Introduction
- Sets, Arrays, Indexers, and Iterators
- Basic Data Structures and Patterns
- Abstract Data Types and Data Representation
- One-Dimensional Data Structures
- Hierarchical Data Structures
- Algorithmic Patterns and Problem Solvers

Why?

"Smart data structures and dumb code works a lot better than the other way around."

Eric S. Raymond: The Cathedral and the Bazaar