Algoritmos e Estruturas de Dados

Licenciatura em Engenharia Informática e Computação
2023/2024

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Information

- Course moodle page 

- Theoretical classes:
  - Pedro Diniz
  - Ana Paula Rocha

- Practical classes:
  - Ana Paula Rocha
  - António Costa
  - Bernardo Leite
  - Filipa Ramos
  - João Pires
  - Pedro Henrique Diniz
  - Vanessa Silva

Methodology

- Theoretical classes
  - formal exposition of the subjects, presentation of examples, analysis and discussion.

- Practical classes
  - programming exercises in C++ using unit tests: CLion, Google Tests
  - group project monitoring (will also have to be outside of classes)

Evaluation

Final Mark = 0.3*CIP + 0.3*CIT + 0.4*CG

- A minimum mark of 40% is required in every assessment component (CIP, CIT, CG1, CG2)

- **Individual Component – 60%**
  - *Practical Component (CIP)* - 30%
    - practical on computer evaluation, programming assignments using unit tests: CLion, Google Tests
  - *Theoretical Component (CIT)* - 30%
    - multiple-choice questions
- **Group Component (CG)** - 40%
  - two small projects (CG1 and CG2) to be implemented in group (3 students)

Evaluation

- Students registered under any special status:
  - group assessment may be performed individually
  - student must talk to the lecturer to make all the arrangements and fix a reasonable schedule.
  - should attend and perform the individual assessment componentes (CIP; CIT), as normally scheduled

- Student may not exceed the limit of absences (25% of classes)

Pre-requirements

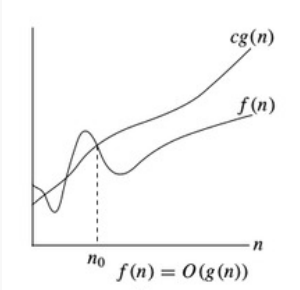
- Basic knowledge of programming and C++

Objectives

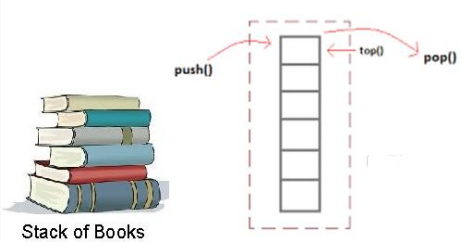
- Analyze the **correctness of simple algorithms** (and test experimentally)
- Analyze the **temporal and spatial complexity** of algorithms (and measure experimentally)
- Understand the concept of **abstract data type** and know how to organize programs around this concept
- Know the **fundamental data structures** and associated algorithms and respective complexity
- **Choose appropriate** collections, data structures and algorithms to solve practical problems

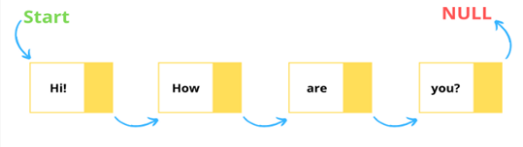
Program

- Analysis of algorithm correctness
- Algorithmic efficiency
  - temporal and space complexity

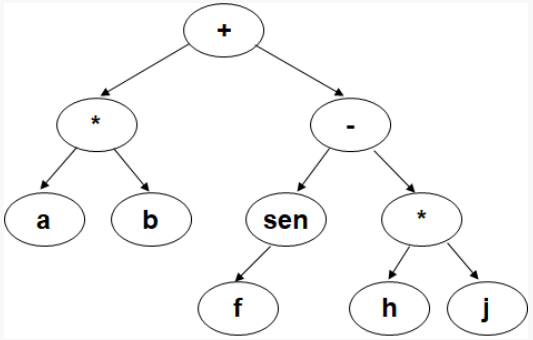


- Linear data structures
  - Lists : array-based and linked list; doubly linked lists; circular list.
  - Stacks
  - Queues



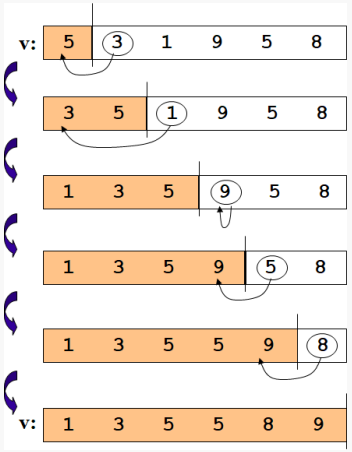


- Hierarchical data structures
  - Binary Trees; Binary Search Trees; balanced binary trees

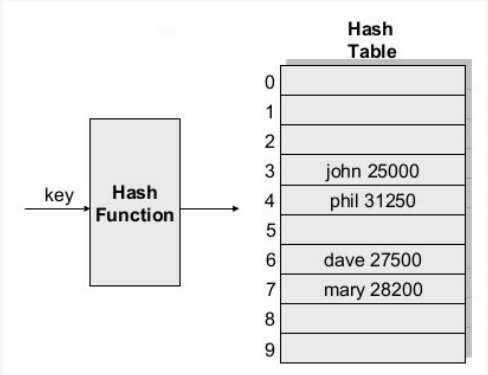


Program

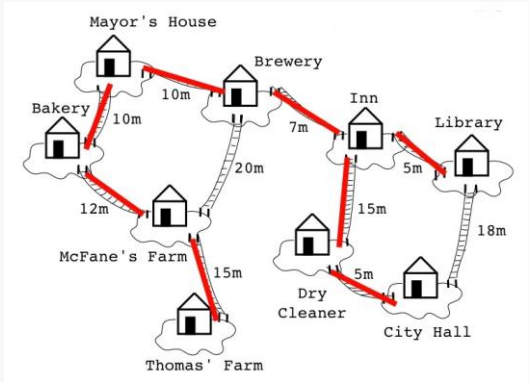
- Searching and sorting algorithms
  - Sequential search, binary search
  - Comparative and non-comparative algorithms



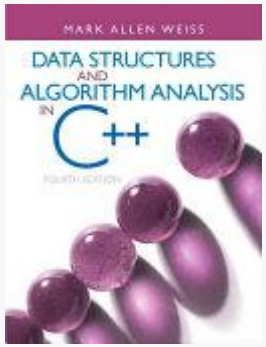
- Other data structures
  - Hash Tables
  - Priority Queues



- Graph algorithms
  - Representation
  - DFS, BFS and applications
  - simple algorithms: topological sorting, connected components



Bibliography



Data Structures & Algorithm Analysis in C++
Mark Allen Weiss, 4th Edition, Pearson Education, 2014

additional:

- Algorithms in C++
  Robert Sedgewick, 3rd Edition, Princeton University, 2002