GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2024-2025

Algorithms and Data Structures 1 (C003773)

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0 **Study time 180 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 2)	Dutch	Gent	lecture
			seminar

Lecturers in academic year 2024-2025

Fack, Veerle	WE02	lecturer-in-charge

Offered in the following programmes in 2024-2025	**crdts**	**offering**
Bachelor of Arts in Moral Sciences	6	A
Bachelor of Arts in Philosophy	6	A
Bachelor of Science in Computer Science	6	A

Teaching languages

Dutch

Keywords

Algorithms, complexity analysis, algorithm design, abstract datatypes

Position of the course

Acquire basic skills in the domain of algorithms and data structures:
- to learn to design simple algorithms and perform a complexity analysis for those algorithms;
- to become aware of the importance of data structures for the development of efficient algorithms;
- to get acquainted with some standard techniques for algorithm design;
- to get acquainted with some standard data structures and their use in applications;
- to be able to do a basic implementation of standard data structures.

Contents

- Introduction to algorithms
- Complexity of algorithms
- Recursion
- Sorting algorithms
- Design strategies for algorithms (e.g. exhaustive search, divide and conquer, greedy algorithms, backtracking, branch-and-bound)
- Standard abstract data types (ADT) with applications: Stack, Queue, PriorityQueue, List, Set, SortedSet, Map, SortedMap (from Java Collections)
- Graph algorithms (such as breadth-first and depth-first seach, minimal-cost spanning trees, shortest path algorithms, approximation algorithms for the traveling salesman problem)
- Implementation of standard abstract data types
  - Stack: using arrays and List
  - Queue: using arrays and List
  - List: using arrays and linked lists
  - Set/Map: using hash tables
  - SortedSet/SortedMap: using binary search trees
  - PriorityQueue: using binary heaps

Initial competences

Knowledge of the programming language Java and basic concepts of object-oriented programming, as taught in "Programming".

Final competences

1 The student has obtained a thorough knowledge of basic techniques in the field of algorithms and data structures: the student can design, implement and analyse algorithms for simple problems.
2 He/she knows how to use data structures effectively in applications and knows a basic implementation for the standard data structures.
3 His/her programming skills have been further improved by implementing several algorithms and by studying basic implementations of standard data structures.

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

Seminar, Lecture

Study material

Type: Syllabus

Name: Algoritmen en Datastructuren 1
Indicative price: Free or paid by faculty
Optional: no
Language : Dutch
Available on Ufora : Yes

Type: Handouts

Name: Oefeningen
Indicative price: Free or paid by faculty
Optional: no
Language : Dutch
Available on Ufora : Yes

References

- Cormen T.E., Leiserson C.E., Rivest R.L. & Stein C., "Introduction to Algorithms", MIT Press, 2009 (3rd edition).
- T. Roughgarden, "Algorithms Illuminated", Soundlikeyourself Publishing, 2017.
- Sedgewick R. & Wayne K., "Algorithms", Addison-Wesley, 2011 (4th edition).

Course content-related study coaching

Student coaching in the classroom lectures and lab sessions on PC.
Use of an electronic teaching environment.

Assessment moments

end-of-term assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment with open-ended questions

Examination methods in case of periodic assessment during the second examination period

Written assessment with open-ended questions

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Calculation of the examination mark