Algorithms and Complexity

COMP 314

What is an algorithm?

Any well-defined computational procedure that takes some value, or set of values, as input and produces some value, or set of values, as output.

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Study of algorithms includes

1. How to devise algorithms
2. How to validate algorithms
3. How to analyse algorithms
4. How to test a program

Objectives

- Develop a broad understanding of **standard algorithms** and their common uses
- Be able to analyze the **asymptotic performance** of a variety of algorithms
- Be able to **experimentally test** the performance of a particular algorithm in a particular context
- Develop a degree of fluency in the mathematical techniques used to demonstrate **correctness**
- Develop and implement algorithms using various **algorithm design strategies**
- Develop an understanding of **NP-complete (hard) problems and approximation algorithms**

Prerequisites

- Programming (loops, functions, objects, recursion etc.)
- Data structures
- Mathematics
- Some high level programming languages like C, C++, Python or Java

Syllabus

Available at ELF / KU LMS.

Chapters

1. Introduction to algorithms - 6 hrs
2. Data structures revisited - 7 hrs
3. Algorithm strategies - 10 hrs
4. Dynamic Programming - 6 hrs
5. Graph Algorithms - 10 hrs
6. NP-Completeness - 6 hrs

Evaluation

Internal: 50

- Lab and Practical assignments: 15
- Quiz and internal exams: 22
- Lab exam: 8
- Final viva: 5

External: 50

Text Books

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein. Introduction to Algorithms. Third Edition.
2. Horowitz E., Sahni S., and Rajasekaran S. Fundamentals of Computer Algorithms, Second Edition.
3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Data Structures & Algorithms in Python, Wiley & Sons, 2013.
4. Rance D. Necaise, Data Structures and Algorithms Using Python, John Wiley & Sons, Inc., 2011.

Reference Books

1. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman. The Design and Analysis of Computer Algorithms. Fourth Indian Reprint, 2001.
2. S.E. Goodman, S.T. Hedetniemi. Introduction to the Design and Analysis of Algorithms. Fifth Printing, 1988.
3. Sartaj Sahni. Data Structures, Algorithms and Applications in Java. Second Edition.
4. Horowitz E., Sahni S. and Anderson-Freed S. Fundamentals of Data Structures in C. Second Edition.
5. Problem Solving with Algorithms and Data Structures – interactive book content available at Runestone