CS218- Data Structures
Week 01

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Agenda

- Introduction to Course & Conduct
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  - Objective
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- Data Vs. Information Vs. Knowledge Vs. Wisdom
- Abstract Data Types
- Algorithm + Data Structures = Program
- Man vs. Machine
- Conclusion

Course Description

- Data Structures is a core course in Computer Science curriculum.
- It is an essential building block for solving applied problems with computers.
- The course will introduce the fundamentals of data structures and will provide thorough understanding of how to systematically organize data inside a computer system.

Course Description

- The course discusses basic memory management for efficiently solving problems on both time and space requirements.
- A variety of data structures will be discussed theoretically, their efficient implementations and application cases will also be discussed.
- The student will learn abstraction, encapsulation and structures for efficiently processing information in a variety of scenarios.

Course Objectives

- To understand the design of fundamental data structures and algorithms for problem solving through computer system.
- To study the tradeoff choices in the design and implementation of data structures
- To provide a rigorous “hands-on” experience with implementing different data structures in a high-level programming language
- To analyze time/space tradeoff for different solutions to the same problem.

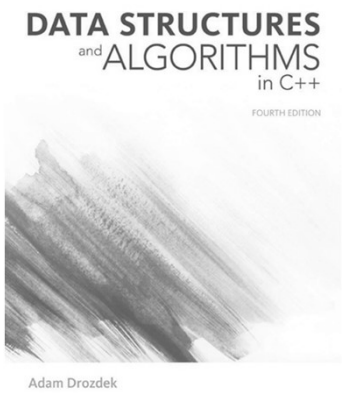
Learning Outcomes

- Student will be able to learn and understand basic/advanced data structures
- Student will be able to perform analysis of data structures choices for any real-world application.
- Student will learn the tradeoff with different choices of data structures
- Student will be able to write computer solutions for efficiently store, retrieve manipulate and update the data stored inside computers.

Grading Scheme

- Programming Assignments 20%
- Quizzes 10%
- Midterm Exam 15%
- Final Exam 40%
- Class Project 10%
- Class Participation 05%

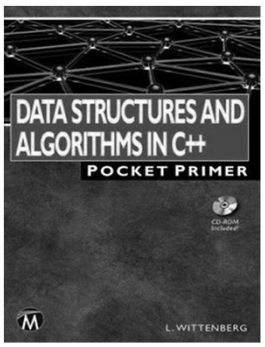
Textbook & References

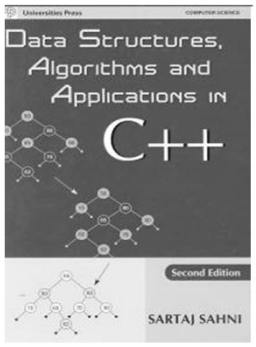


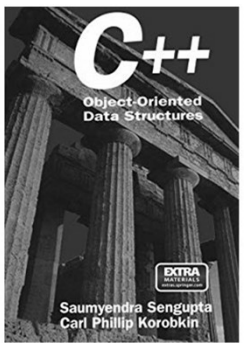
Leading Text in CS

- Strengthen your understanding of data structures and their algorithms for the foundation you need to successfully design, implement and maintain virtually any software system

Some Good References







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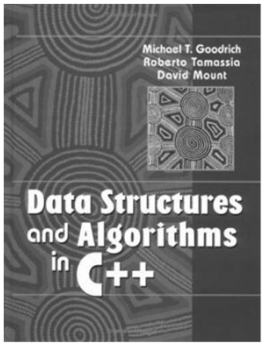

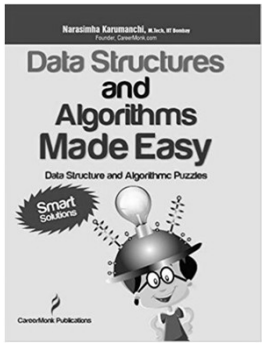

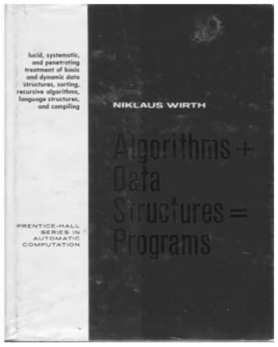

Programming Assignments

- There will be 3 programming assignments, each assignment may contains 2-4 problems.
- These programming assignments will be on Hackerrank through invitation.
- The assignments are for individual, plagiarism will not be tolerated.
- You need to access the platform with your nu mail IDs.

Quizzes

- There will be 4-5 quizzes – all surprise quizzes
- Best n-1 will be counted
- Weightage 10%

Midterm Exam

- Two midterm exams – one hour each as per policy.
- Weight 7.5% each

Final Exam

- There will be a 3 hours exam as per policy.
- Weightage 40%

Class Participation

- Very important instrument for creating an impact.
- I appreciate questioning…
- Weightage 5%

Class Projects

- There will be a class project -You can have 2-3 members- members allow within sections.
- Weightage 10%
- The “Theme” for CS201- Data Structures class project is “Text Oriented Processing”
- We will have 3-4 BOF meeting during the course for the class projects.
- Class project call and schedule will be announced on slate later.

Consultancy Hours

- Consultancy Hours:

  Monday: 2-4 PM in my office – prior appointment required

  Thursday: 2-4 PM in my office – prior appointment required

  Friday: 8-9am at café informal (individual + groups)- this will not be regular, I will announce it on slate but it will be more often.

- Contact me

  email: muhammad<dot>rafi@nu<dot>edu<dot>pk

  Office: 111-128-128 ext: 222

  Cell: 0300-2326840

Data vs. Information vs. Knowledge

- Data
  - Raw – facts
  - Data in electronic form is easy to retrieve, manipulate, fused and remember(recall).
  - Data is not always in a shape to facilitate information and knowledge
- Information
  - Interplay with data in context
- Knowledge
  - Some actionable information for ROI

Information vs. Knowledge vs. Wisdom

- Wisdom
  - Related to the interplay of knowledge and apply some deductive reasoning.
  - The power to make things happen.

Information vs. Knowledge vs. Wisdom

- Data – unprocessed facts, obtained via receptors/instruments
- Information – Processed data, structured data with context (Increases understanding)
- Knowledge – ability to use information, strategic use to achieve certain objectives.
- Wisdom – ability to select best possible objective using knowledge (make to happen)

Abstract Data Types (ADT)

- ADTs are a theoretical concept in computer science.
- An abstract data type (ADT) is basically a logical description or a specification of components of the data and the operations that are allowed, that is independent of the implementation.

Definition – Data Structures

- Logical and formal abstract way to represent and store data in such a way that it will quickly available for processing within the application context.
- It is an organized collection of data which perform a set of operations effectively on the data. These set of operations are formally related to an idea of specific processing related to problem solving.

Definition – Algorithm

- An algorithm is a fancy to-do list for a computer. Algorithms take in zero or more inputs and give back one or more outputs.
- You explicitly need to tell a computer to perform each step that eventually transform some input into a desire output. It should be finite set of instruction.

Algorithm+ Data Structures = Program

- This was title of a very good book by Niklaus Wirth
- Half of the problem is selecting the right data structures and half of the problem is to select the algorithm.

Man Vs. Machine

- Computation -Processing
- Memory
- Abilities
  - Sequential vs. Parallel
  - Optimized vs. Satisfier
  - Algorithmic vs. Non-Algorithmic

Conclusion

- Data structures and algorithm are integral parts of problem solving through computer.
- Human and computer ways of solving problems are different.
- Data, Information, Knowledge and wisdom are distinguishable concepts for representation.