AMRITA VISHWA VIDYAPEETHAM

Data Structures and Algorithms

(19CSE212)

Anoop S Babu
Faculty Associate
Dept. of Computer Science & Engineering
bsanoop@am.amrita.edu
+91 9400119939

Prerequisites

- 19CSE111 : Fundamentals of Data Structures.
- Familiarity with Python Programming.

Syllabus

Unit 1

Refresher of Data Structures - Abstract Data Types and Data Structures - Principles, and Patterns. Basic complexity analysis – Best, Worst, and Average Cases - Asymptotic Analysis - Analyzing Programs – Space Bounds, recursion-linear, binary, and multiple recursions. Sorting and Selection – Linear Sorting – Divide and Conquer based sorting – Analysis using Recurrence Tree based Method - Merge Sort - Quick Sort - Studying Sorting through an Algorithmic Lens. Arrays, Linked Lists and Recursion: Using Arrays - Lists - Array based List Implementation – Linked Lists – LL ADT – Singly Linked List – Doubly Linked List – Circular Linked List Stacks and Queues: Stack ADT - Array based Stacks, Linked Stacks – Implementing Recursion using Stacks, Stack Applications. Queues - ADT, Array based Queue, Linked Queue, Double-ended queue, Circular queue, applications.

Unit 2

Trees: Tree Definition and Properties – Tree ADT - Basic tree traversals - Binary tree - Data structure for representing trees – Linked Structure for Binary Tree – Array based implementation. Priority queues: ADT –Implementing Priority Queue using List – Heaps. Maps and Dictionaries: Map ADT – List based Implementation – Hash Tables - Dictionary ADT. Skip Lists - Implementation - Complexity.

Unit 3

Search trees – Binary search tree, AVL tree, Trees – Segment Trees - B-Trees. Implementation. External Memory Sorting and Searching. Graphs: ADT - Data structure for graphs - Graph traversal – Transitive Closure - Directed Acyclic graphs - Weighted graphs – Shortest Paths - Minimum spanning tree – Greedy Methods for MST.

Evaluation Pattern

Assessment	Internal	External
Periodical 1 o Online Exam – 5 o Viva – 5	10	
Periodical 2 o Online Exam – 5 o Viva – 5	10	
Continuous Assessment (Theory) o Quiz – 15	15	
Continuous Assessment (Lab) o Lab Assignment – 20 o Lab Examination - 10	30	
End Semester o Online Exam – 15 o Viva - 20		35

Textbooks & References

Text Book(s)

1. Goodrich MT, Tamassia R, Goldwasser MH. Data structures and algorithms in Python. John Wiley & Sons Ltd; 2013. (Download)

Reference(s)

1. Goodrich MT, Tamassia R, Goldwasser MH. Data structures and algorithms in Java. Fifth edition, John Wiley & Sons Ltd; 2010. (Download)
2. Tremblay JP, Sorenson PG. An introduction to data structures with applications. Second Edition, Tata McGraw-Hill; 2002. (Googlebook Link)
3. Shaffer CA. Data Structures and Algorithm Analysis. Third Edition, Dover Publications; 2012. (Download)
4. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning, ISBN: 978-1111822705.

Python Programming Environment

- **IDE**
  - PyCharm (https://www.jetbrains.com/pycharm/)
    - Python 3 - Setting up Python using pycharm. You can use any 3.x version of Python. Please do not use 2.x as it is deprecated.
    - Pycharm debugging - Learn how to use a debugger.
  - Jupyter (https://programminghistorian.org/en/lessons/jupyter-notebooks)
- **Online Compiler**
  - https://colab.research.google.com/
  - https://repl.it/new/python3