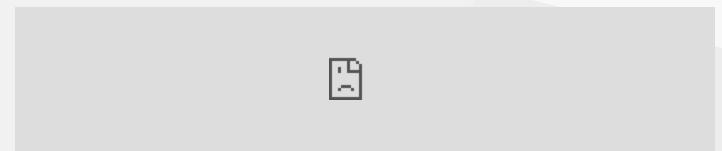
# **CE205 Data Structures**

# Week-10

Advaced Tree Data Structures (Binary Search Tree, AVL Tree, B Trees and derivations, Red-Black trees, Splay Trees and Augmented Data Structures, van Emde Boas Trees, Binomial and Minimax Trees) and Comparisons.

Download PDF, DOCX, SLIDE, PPTX



- Trees
  - Binary Search Tree
    - Search and Insertion
    - Delete
    - BST over Hash Table
    - Construction and Conversions
    - Check Smallest/Largest Element



- Trees
  - Red Black Tree and Threaded Binary Tree
  - AVL Trees
  - B Trees
    - Defitinion of B Trees
    - Basic operations on B tree
    - Deleting a key from a B tree
  - o 2 3 4 Trees
  - o 2 3 Trees
  - B+ Trees



- Trees
  - R Trees
  - Red Black Tree Datastructure
  - Splay Tree Datastructure
  - Augmenting Data Structures
    - Dynamic order statistics
    - How to augment a data structure



- Trees
  - Interval trees
  - van Emde Boas Trees
    - Preliminary approaches
    - A recursive structure
    - The van Emde Boas tree
  - Binomial Trees
  - Comparison of Search Trees
  - Minimax Tree



# **Binary Search Tree**

- http://www.btechsmartclass.com/data\_structures/binary-search-tree.html
- https://visualgo.net/en/bst?slide=1 (Select BINARY SEARCH TREE)
- https://www.cs.usfca.edu/~galles/visualization/BST.html
- Search and Insertion
- Delete



#### **BST** over Hash Table

- https://www.geeksforgeeks.org/advantages-of-bst-over-hash-table/?ref=lbp
- Construction and Conversions
- Check Smallest/Largest Element



# Red Black Tree and Threaded Binary Tree

https://www.geeksforgeeks.org/threaded-binary-tree/



## **AVL Trees**

- http://www.btechsmartclass.com/data\_structures/avl-trees.html
- https://visualgo.net/en/bst (Select AVL)
- https://www.cs.usfca.edu/~galles/visualization/AVLtree.html



#### **B** Trees

- http://www.btechsmartclass.com/data\_structures/b-trees.html
- https://www.cs.usfca.edu/~galles/visualization/BTree.html



## **Defitinion of B Trees**

• https://www.geeksforgeeks.org/introduction-of-b-tree-2/



## Basic operations on B tree

- https://www.geeksforgeeks.org/insert-operation-in-b-tree/
- https://www.guru99.com/b-tree-example.html



# Deleting a key from a B tree

• https://www.geeksforgeeks.org/delete-operation-in-b-tree/



# 2 3 4 Trees

• https://en.wikipedia.org/wiki/2-3-4\_tree



# 2 3 Trees

• https://en.wikipedia.org/wiki/2-3\_tree



#### **B+ Trees**

- https://www.geeksforgeeks.org/introduction-of-b-tree/
- https://www.cs.usfca.edu/~galles/visualization/BPlusTree.html
- https://www.geeksforgeeks.org/difference-between-b-tree-and-b-tree/?ref=rp



## **R** Trees

• https://www.geeksforgeeks.org/introduction-to-r-tree/?ref=rp



#### **Red - Black Tree Datastructure**

- http://www.btechsmartclass.com/data\_structures/red-black-trees.html
- https://www.geeksforgeeks.org/red-black-tree-set-1-introduction-2/?ref=rp
- https://www.geeksforgeeks.org/red-black-tree-set-2-insert/
- https://www.geeksforgeeks.org/red-black-tree-set-3-delete-2/



# **Splay Tree Datastructure**

- http://www.btechsmartclass.com/data\_structures/splay-trees.html
- https://www.geeksforgeeks.org/splay-tree-set-1-insert/?ref=rp
- https://www.geeksforgeeks.org/splay-tree-set-2-insert-delete/
- https://www.geeksforgeeks.org/splay-tree-set-3-delete/?ref=rp



## **Augmenting Data Structures**

- http://cs.bilkent.edu.tr/~ugur/teaching/cs502/material/cs502\_2\_ADS.pdf
- https://iq.opengenus.org/augmented-data-structures/
- http://staff.ustc.edu.cn/~csli/graduate/algorithms/book6/chap15.htm
- http://www.facweb.iitkgp.ac.in/~sourav/Lecture-11.pdf



# **Dynamic order statistics**

• http://www.facweb.iitkgp.ac.in/~sourav/Lecture-11.pdf



# How to augment a data structure

• http://www.facweb.iitkgp.ac.in/~sourav/Lecture-11.pdf



# **Interval trees**

https://www.geeksforgeeks.org/interval-tree/



#### van Emde Boas Trees

- https://www.geeksforgeeks.org/van-emde-boas-tree-set-1-basics-andconstruction/
- https://web.stanford.edu/class/archive/cs/cs166/cs166.1146/lectures/14/Small14.p
  df
- Preliminary approaches
- A recursive structure



## **Binomial Trees**

• https://www.geeksforgeeks.org/binomial-heap-2/#:~:text=What is a Binomial Tree,as leftmost child or other.



# **Comparison of Search Trees**

• http://www.btechsmartclass.com/data\_structures/comparison-of-search-trees.html



## **Minimax Tree**

https://www.geeksforgeeks.org/minimax-algorithm-in-game-theory-set-1-introduction/



$$End-Of-Week-10$$

