

CE205 Data Structures

Week-10

Advanced 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.

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Outline

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

Outline

- 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
 - 2 3 4 Trees
 - 2 3 Trees
 - B+ Trees

Outline

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

Outline

- 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>

Defitininon 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/~csl/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-and-construction/>
- <https://web.stanford.edu/class/archive/cs/cs166/cs166.1146/lectures/14/Small14.pdf>
- 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