CE205 Data Structures Week-4

Tree Data Structure Types and Applications (Binary Tree, Tree Traversals, Heaps)

Author: Asst. Prof. Dr. Uğur CORUH

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1 CE205 Data Structures

2 Week-4

2.0.1 Tree Data Structure Types and Applications (Binary Tree, Tree Traversals, Heaps)

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[1] ce205-week-4-tree-structures.md_doc.pdf
[2] ce205-week-4-tree-structures.md_slide.pdf
[3] ce205-week-4-tree-structures.md_slide.pptx

2.0.2 Outline

- Graph Representation Tools
- Tree Structures and Binary Tree and Traversals (In-Order, Pre-Order, Post-Order)
- Heaps (Max, Min, Binary , Binomial, Fibonacci, Leftist, K-ary) and Priority Queue
- Heap Sort
- Huffman Coding

2.0.3 Graph Representation Tools

- Microsoft Automatic Graph Layout
  - https://www.microsoft.com/en-us/download/details.aspx?id=52034
  - https://github.com/microsoft/automatic-graph-layout
- Graphviz
  - https://graphviz.org/resources/
- Plantuml
  - https://ucoruh.github.io/ce204-object-oriented-programming/week-5/ce204-week-5/#calling-plantuml-from-java_1

2.0.4 Tree - Terminology

- Btech Smart Class
  - http://www.btechsmartclass.com/data_structures/tree-terminology.html

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2.0.5 Tree Representations

- Btech Smart Class
  - http://www.btechsmartclass.com/data_structures/tree-representations.html

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2.0.6 Binary Tree Datastructure

1. Construction and Conversion
2. Checking and Printing
3. Summation
4. Longest Common Ancestor

- Btech Smart Class
  - http://www.btechsmartclass.com/data_structures/binary-tree.html
- William Fiset
  - https://www.youtube.com/watch?v=sD1IoalFomA&ab_channel=WilliamFiset

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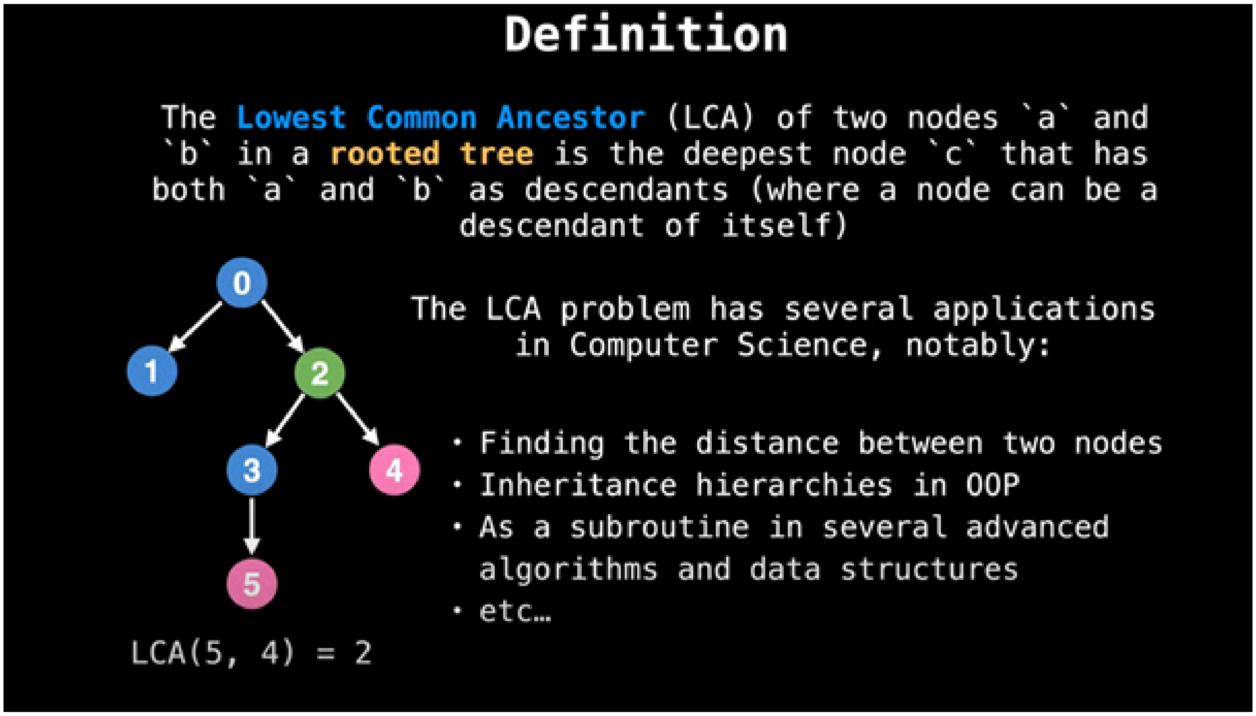
2.0.7 Longet Common Ancestor



Definition

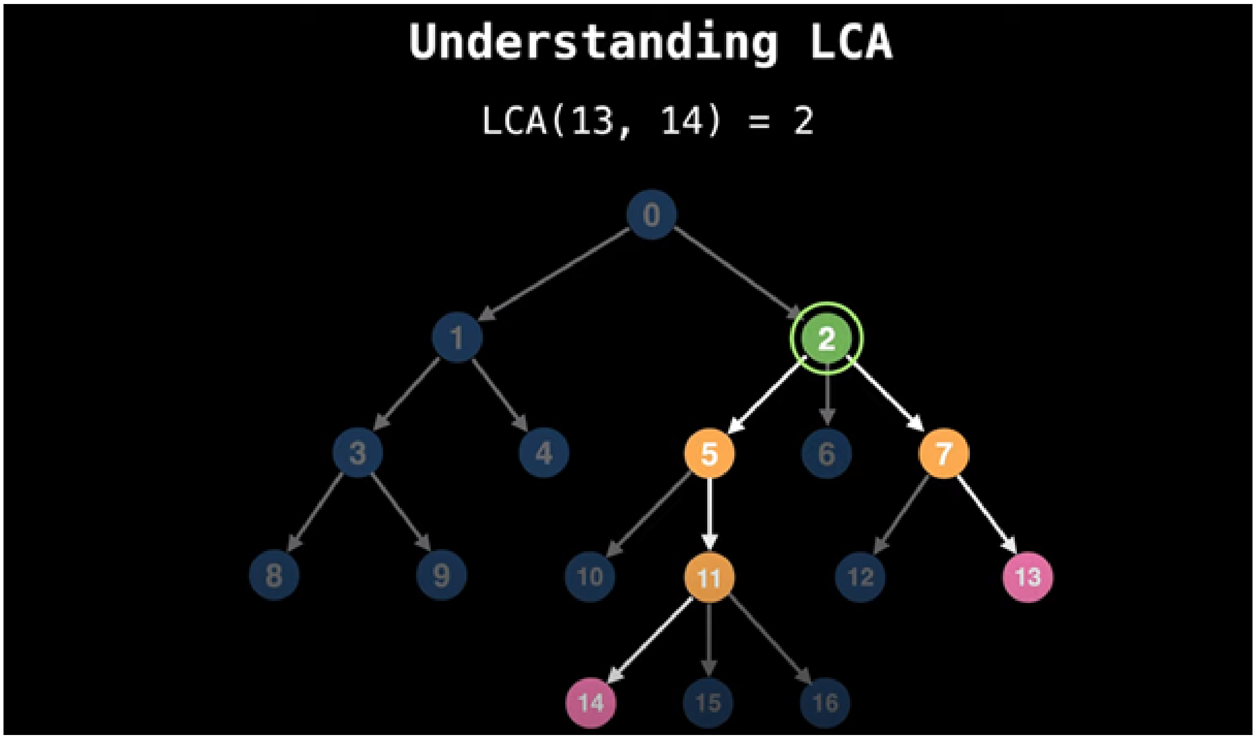
The Lowest Common Ancestor (LCA) of two nodes `a` and `b` in a rooted tree is the deepest node `c` that has both `a` and `b` as descendants (where a node can be a descendant of itself)

LCA(5, 4) = 2

The LCA problem has several applications in Computer Science, notably:

- Finding the distance between two nodes
- Inheritance hierarchies in OOP
- As a subroutine in several advanced algorithms and data structures
- etc…

2.0.8 Longet Common Ancestor



Understanding LCA

LCA(13, 14) = 2

2.0.9 Binary Tree Representations

- Btech Smart Class

    - http://www.btechsmartclass.com/data_structures/binary-tree-representations.html

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2.0.10 Binary Tree Traversals

- Btech Smart Class
    - http://www.btechsmartclass.com/data_structures/binary-tree-traversals.html
        - In-Order
        - Pre-Order
        - Post-Order

2.0.11 Threaded Binary Trees

- Btech Smart Class
    - http://www.btechsmartclass.com/data_structures/threaded-binary-trees.html

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2.0.12 Max Priority Queue

- Btech Smart Class
    - http://www.btechsmartclass.com/data_structures/max-priority-queue.html
- William Fiset
    - https://www.youtube.com/watch?v=wptevk0bshY&t=0s&ab_channel=WilliamFiset
    - https://github.com/williamfiset/Algorithms/tree/master/src/main/java/com/williamfiset/algorithms/datastructu

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2.0.13 Heap Data Structure

- Heap Sort
    - https://ucoruh.github.io/ce100-algorithms-and-programming-II/week-4/ce100-week-4-heap/

2.0.14 Heap Data Structure

- Programiz
    - https://www.programiz.com/dsa/heap-data-structure
- Btech Smart Class
    - Max-Heap
        - http://www.btechsmartclass.com/data_structures/max-heap.html
- Geeks for Geeks
    - Binary Heap
        - https://www.geeksforgeeks.org/binary-heap/?ref=lbp
        - https://www.geeksforgeeks.org/difference-between-binary-heap-binomial-heap-and-fibonacci-heap/?ref=rp

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2.0.15 Heap Data Structure

- Binomial Heap
    - Geeks for Geeks
        - https://www.geeksforgeeks.org/binomial-heap-2/

2.0.16 Heap Data Structure

1. Structure of Fibonacci Heaps
2. Mergeable-heap operations

- Fibonacci Heap
  - William Fiset
    - https://github.com/williamfiset/Algorithms/tree/master/src/main/java/com/williamfiset/algorithms/datastr
  - Geeks for Geeks
    - https://www.geeksforgeeks.org/fibonacci-heap-set-1-introduction/?ref=lbp

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2.0.17 Heap Data Structure

1. Decreasing a key and deleting a node
2. Bounding the maximum degree

- Heap Operations
  - https://www.geeksforgeeks.org/fibonacci-heap-insertion-and-union/?ref=lbp
  - https://www.geeksforgeeks.org/fibonacci-heap-deletion-extract-min-and-decrease-key/?ref=lbp

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2.0.18 Heap Data Structure

- Leftist Heap
  - Geeks for Geeks
    - https://www.geeksforgeeks.org/leftist-tree-leftist-heap/?ref=lbp
  - Toronto
    - https://www.dgp.toronto.edu/public_user/JamesStewart/378notes/10leftist/

2.0.19 Heap Data Structure

- Geeks for Geeks
  - https://www.geeksforgeeks.org/k-ary-heap/?ref=lbp

2.0.20 Heap Data Structure

- Heap Sort
  - https://ucoruh.github.io/ce100-algorithms-and-programming-II/week-4/ce100-week-4-heap/

2.0.21 Heap Data Structure

- Huffman Coding
  - https://ucoruh.github.io/ce100-algorithms-and-programming-II/week-9/ce100-week-9-huffman/
  - Geeks for Geeks
    - https://www.geeksforgeeks.org/difference-between-binary-heap-binomial-heap-and-fibonacci-heap/?ref=rp

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$$End - Of - Week - 4$$