Binary Trees

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Agenda

• Binary Trees
• Traversals
• Reminders
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• Traversals
• Reminders
Trees in Computer Science
Trees in Computer Science

- Implementation for TreeMap / TreeSet
- Decision Trees
- How files / folders are represented
- Family Trees, Org Charts
- Parse trees
  - \( a = (b + c) \times d \)
  - Natural language processing
Trees Defined

• **Tree:** Nodes linked together in some hierarchical fashion

• **Binary Tree:** A tree where each node has at most 2 children

**Recursive Definition:**

• A tree is either:
  1. Empty
  2. A node with data, and a left and right subtree
Trees Defined

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Trees Defined

A tree is either:

1. Empty
2. A node with data, and a left and right subtree
Printing Trees

- Want to print out the contents of the tree
- Our intended output:

```
48 21 5 10 8 6
```
Printing Trees

- Want to print out the contents of the tree

Different ways to do so:

<table>
<thead>
<tr>
<th></th>
<th>48</th>
<th>21</th>
<th>5</th>
<th>10</th>
<th>8</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-order</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-order</td>
<td>5</td>
<td>21</td>
<td>48</td>
<td>8</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Post-order</td>
<td>5</td>
<td>21</td>
<td>8</td>
<td>6</td>
<td>10</td>
<td>48</td>
</tr>
</tbody>
</table>
What’s the in-order traversal of this tree?

root

12

16

10

5

23

6

4

42

8

slido.com
code: #su_cse123
What’s the in-order traversal of this tree?

Answer: 5 4 16 12 42 23 10 6 8
Practice: pathSum

• Given a number, print out all sums that have value greater than or equal to the given number for a tree in a pre-order fashion.

• For the tree pictured, the call pathSum(13) would result in the following:

```
pathSum(13)
Output:
13
23
13
```