6. USACO reminder
1. Trees WO TH virtual this week and next
2. Trees

Binary Tree

Data: [ ]
left: [ ]
right: [ ]

10
 13
   1
     6
       5
         8
           12

10
 8, 5, 12, 6, 22, 19

[13, 10]

1) Rec( [13, 10], [8, 5, 12, 6, 22, 19] )
2) Rec( [8, 5, 12, 6, 22, 19], [22, 6, 5, 8, 10, 19] )
3) Print 10

f(int s1I, int e1I)
  int s2I, int e2I)
  if (s1I == e1I) {
    print(); return;
  }

Many Solutions

\[
\begin{aligned}
\text{if (root == null)} & \text{ guard null case} \\
(\text{if (root.left == null \&\& root.right == null)}) \\
& \text{f(root.left)} \text{ ? rec calls to node } \\
& \text{f(root.right)} \text{ ? sometimes both, O(n)} \\
& \text{sometimes one, O(h)} \\
\end{aligned}
\]
### Rooted Trees

**Node:**
- Data
- List of node (ptr)

Each node is assigned a number from 0 to n-1.

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

**Tree:**
- **Data:**
- **List of:**
- **Empty:**
- **Children:** 2, 3, 7

**Node:**
- Sum everyone below:
  - Node 1: $+10$
  - Node 5: $+10$
  - Node 2: $+10$
  - Node 3: $+10$
  - Node 7: $+10$

**Arbitrary # of children:**
- Node 1: 2, 3, 7
- Data: arbitrary