CS 225

#12: List: Implementation (Array)

February 14, 2022 · *G Carl Evans*

Circler Queue

Example 1

```
Queue<int> q;
q.enqueue(3);
q.enqueue(8);
q.enqueue(4);
q.dequeue();
q.enqueue(7);
q.dequeue();
q.dequeue();
q.enqueue(2);
q.enqueue(1);
q.enqueue(3);
q.enqueue(5);
q.dequeue();
q.enqueue(9);
```

Example 2

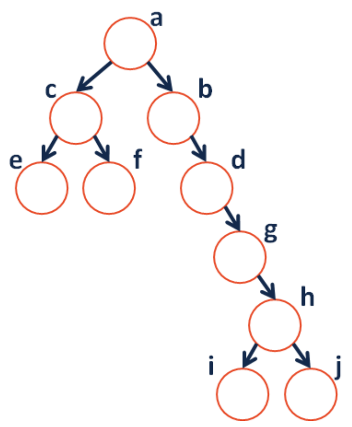
```
Queue<char> q;
q.enqueue('m');
q.enqueue('o');
q.enqueue('n');
…
q.enqueue('d');
q.enqueue('a');
q.enqueue('y');
q.enqueue('i');
q.enqueue('s');
q.dequeue();
q.enqueue('h');
q.enqueue('a');
```

Trees!

"The most important non-linear data structure in computer science."
- David Knuth, The Art of Programming, Vol. 1

We will primarily talk about **binary trees:**

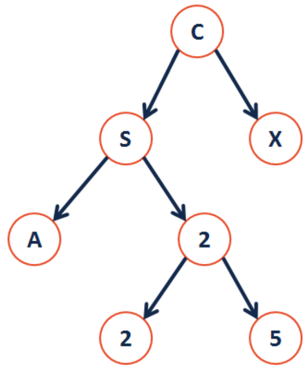
- How many parents does each vertex have?
- Which vertex has the fewest **children**?
- Which vertex has the most **ancestors**?
- Which vertex has the most **descendants**?
- List all the vertices is b's left **subtree**.
- List all the **leaves** in the tree.



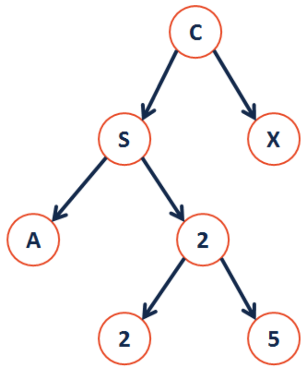
<u>Definition</u>: Binary Tree

<u>A *binary tree* **T** is:</u>

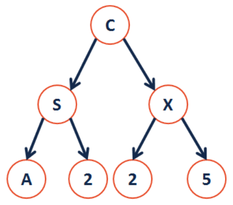
<u>The height of a tree **T** is:</u>



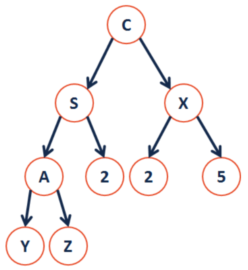
<u>Tree Property:</u> Full



Tree Property: Perfect



Tree Property: Complete



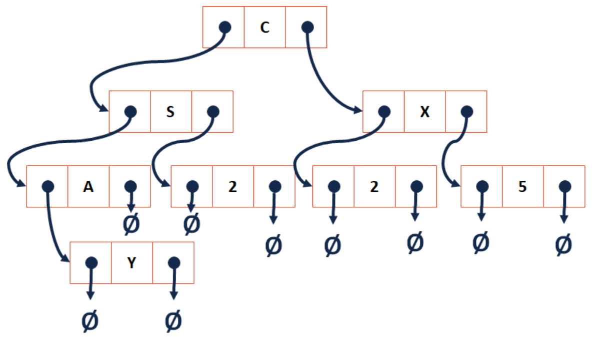
Towards a Tree Implementation – Tree ADT:

ADT Functionality (English Description)	Function Call

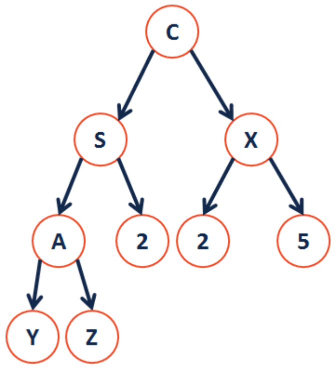
Tree Class

```
BinaryTree.h
#pragma once

template <typename T>
class BinaryTree {
  public:
    /* ... */
  private:




};
```

Trees are nothing new – they're fancy linked lists:



Theorem: If there are n data items in our representation of a binary tree, then there are ______________ NULL pointers.



CS 225 – Things To Be Doing:

1. exam1 starts tomorrow in CBTF
2. mp_list extra credit part1 due Today
3. Daily POTDs