CS 225

#27: Heaps

March 28, 2018 · *Wade Fagen-Ulmschneider*

Analysis of Dictionary-based Data Structures

	Hash Table		AVL	List
	SUHA	Worst Case		
Find				
Insert				
Storage Space				

Data Structures in std library:

- std::map
- std::unordered_map

A Secret, Mystery Data Structure:

ADT:

insert

remove

isEmpty

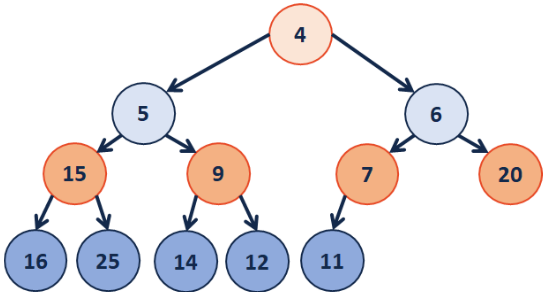
Implementation of ________________

insert	removeMin	Implementation
O(n)	O(n)	Unsorted Array
O(1)	O(n)	Unsorted List
O(lg(n))	O(1)	Sorted Array
O(lg(n))	O(1)	Sorted List

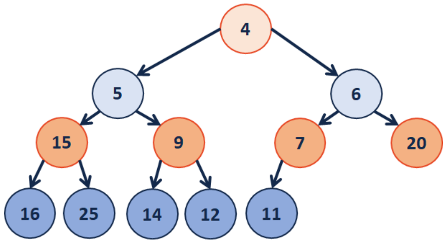
Q1: What errors exist in this table? (Fix them!)

Q2: Which algorithm would we use?

A New Tree-like Structure:



Implementing a (min)Heap as an Array



4	5	6	15	9	7	20	16	25	14	12	11			

leftChild(index):

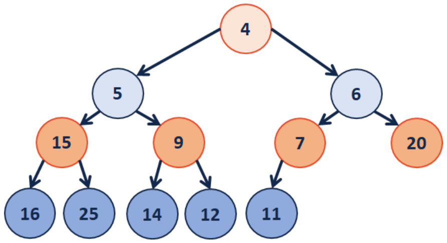
rightChild(index):

parent(index):

A complete binary tree T is a min-heap if:

-
-

Insert:



-	4	5	6	15	9	7	20	16	25	14	12	11			

Heap.cpp (partial)

```
template <class T>
void Heap<T>::_insert(const T & key) {
  // Check to ensure there’s space to insert an element
  // ...if not, grow the array
  if ( size_ == capacity_ ) { _growArray(); }

  // Insert the new element at the end of the array
  item_[++size] = key;

  // Restore the heap property
  _heapifyUp(size);
}
```

```
template <class T>
void Heap<T>::_heapifyUp( _________________ ) {
  if ( index > _________ ) {
    if ( item_[index] < item_[ parent(index) ] ) {
      std::swap( item_[index], item_[ parent(index) ]
);
      _heapifyUp( ________________ );
    }
  }
}
```

CS 225 – Things To Be Doing:

1. Theory Exam 3 starts next week (Tuesday, April 3rd)
2. MP5 deadline is Monday, April 2nd
3. lab_hash released today; due Sunday, April 1st
4. Daily POTDs are ongoing!