#32: Disjoint Sets Finale + Graphs Intro

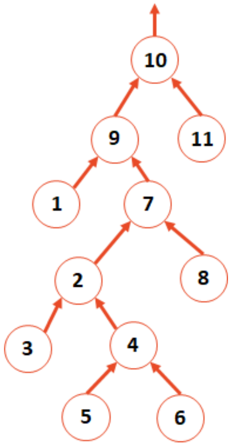
November 9, 2018 · *Wade Fagen-Ulmschneider*

Smart Union Options:

- Union by Height (root := **-h - 1**)
- Union by Size (root := **-n**)
- Union by Rank (root := #union ops)

In <u>all</u> smart unions:

....height of UpTree: _____________.



How do we improve this?

```
DisjointSets.cpp (partial)
int DisjointSets::find(int i) {
  if ( arr_[i] < 0 ) { return i; }
  else { return _find( arr_[i] ); }
}
```

```
DisjointSets.cpp (partial)
void DisjointSets::unionBySize(int root1, int root2) {
  int newSize = arr_[root1] + arr_[root2];

  // If arr_[root1] is less than (more negative), it is the
  // larger set; we union the smaller set, root2, with root1.
  if ( arr_[root1] < arr_[root2] ) {
    arr_[root2] = root1;
    arr_[root1] = newSize;
  }
  // Otherwise, do the opposite:
  else {
    arr_[root1] = root2;
    arr_[root2] = newSize;
  }
}
```

Running Time:

- Worst case running time of find(k)**:**
- Worst case running time of union(r1, r2), given roots:
- New function: "Iterated Log":

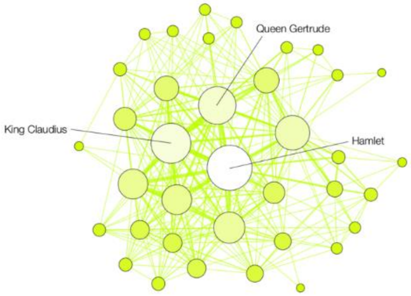
  log*(n) :=

- Overall running time:
  - A total of **m** union/find operation runs in:

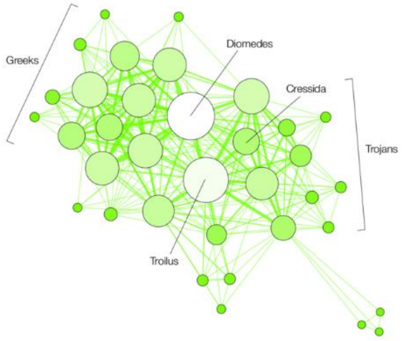
A Review of Major Data Structures so Far

Array-based	List/Pointer-based
- Sorted Array	- Singly Linked List
- Unsorted Array	- Doubly Linked List
- Stacks	- Skip Lists
- Queues	- Trees
- Hashing	- BTree
- Heaps	- Binary Tree
- Priority Queues	- Huffman Encoding
- UpTrees	- kd-Tree
- Disjoint Sets	- AVL Tree

An Introduction to Graphs



HAMLET



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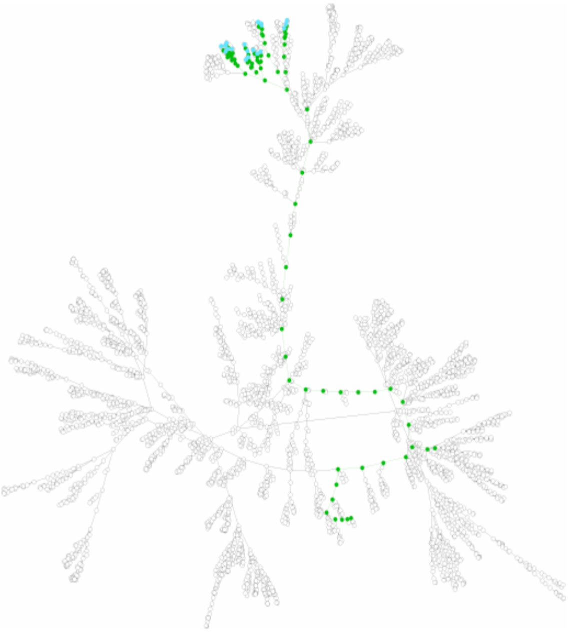

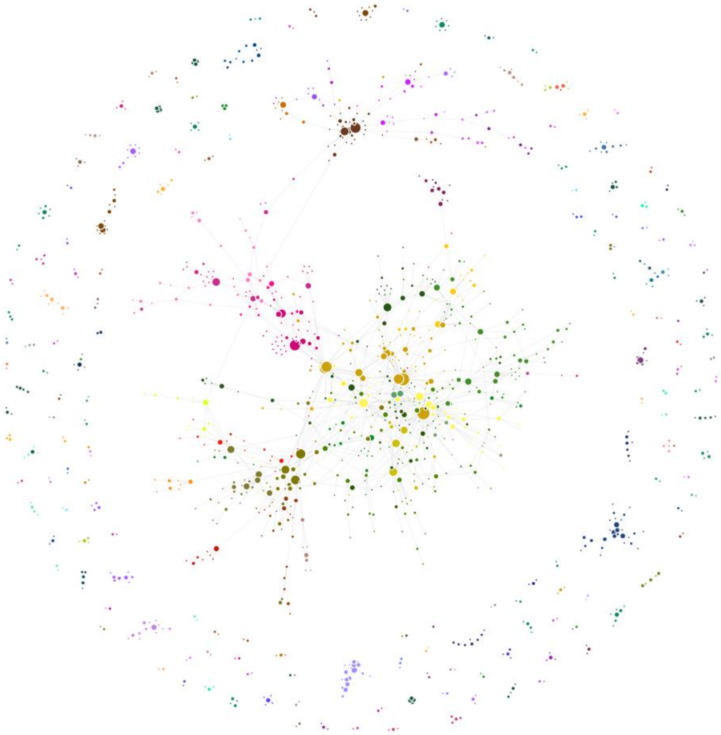

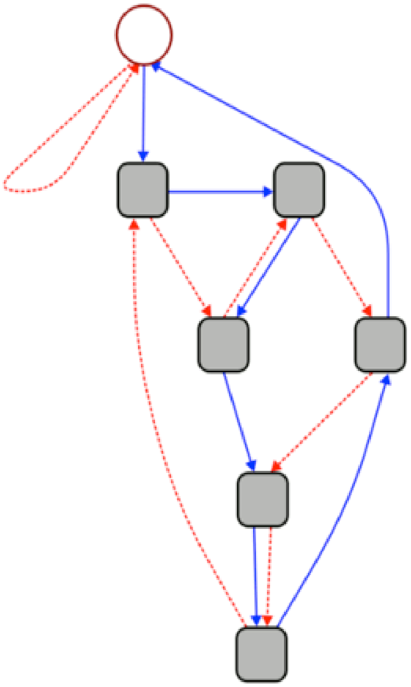

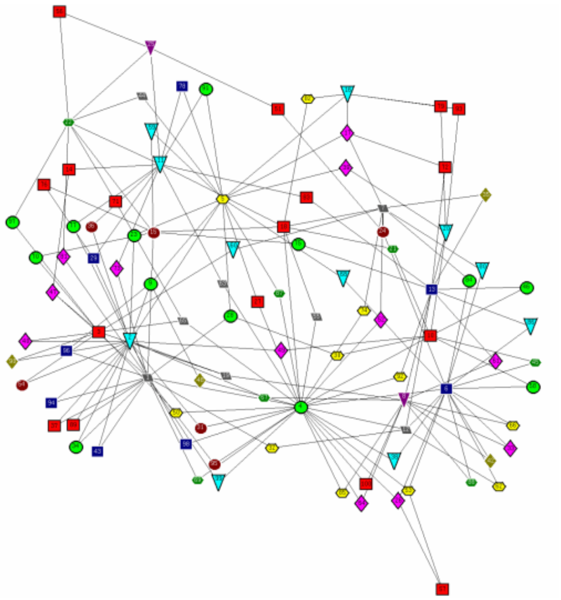

Motivation:
Graphs are awesome data structures that allow us to represent an enormous range of problems. To study these problems, we need:

1. A common vocabulary to talk about graphs
2. Implementation(s) of a graph
3. Traversals on graphs
4. Algorithms on graphs

CS 225 – Things To Be Doing:

1. Theory Exam 3 is ongoing!
2. lab_heaps due Sunday, November 11th
3. MP6 released; Extra Credit +7 deadline November 12th
4. Daily POTDs are ongoing!