

Main ideas from today: Kruskal details, disjoint set datatype, complexity intro

1. What are the operations for the Disjoint Set datatype?
 - a.
 - b.
 - c.
2. Outline Kruskal's algorithm in terms of the disjoint set ADT.

makeset (1)
makeset (2)
makeset (3)
makeset (4)
makeset (5)
makeset (6)
union(4, 6)
union (1,3)
union(4, 5)
findset(2)
findset(5)

3. Based on the high-level code, what can we say about efficiency of Kruskal algorithm (in terms of $n= |V|$ and $m= |E|$)?
4. What is the simple representation we can use for a DisjointSet datatype?

5. (4) Using the above representation, write

makeset(i):

findset(i):

mergetrees(i,j):

union(i, j):

6. Suppose we always make shorter trees subtrees of taller trees.

Write new versions of makeset and mergetrees

7. Show that the max height of a k-node tree is $\lfloor \lg k \rfloor$.

8. What is the run-time for n makeset operations and m union&find operations?

9. How can we further reduce the running time for findset?

Intro to computational complexity

10. Polynomial good, exponential bad.

11. Tractable vs. intractable. What do we mean by a “polynomial-time problem”?

12. Polynomial time is closed under standard operations.

13. What is a decision problem?
An instance of the problem?

14. Decision problem examples:

Clique:

k-Clique

Graph-coloring

Bin-packing

15. What does “p is reducible to q” mean? It can also be written as $p \leq q$.