http://www.cs.unh.edu/~ruml/cs758

2 handouts: slides, asst 9
Spanning Trees

- Problems
- Basic Approach

Kruskal's Algorithm

Prim's Algorithm
network connectivity
power, water distribution
wiring, VLSI
image segmentation

number of edges?
cycles?
Basic Approach

starting from $\emptyset$, grow spanning tree by adding edges
Basic Approach

spanning trees

Kruskal's Algorithm

Prim's Algorithm

starting from $\emptyset$, grow spanning tree by adding edges

Theorem: take any cut that respects the nascent tree. A lightest edge crossing the cut can be added to the tree.
starting from $\emptyset$, grow spanning tree by adding edges

Theorem: take any cut that respects the nascent tree. A lightest edge crossing the cut can be added to the tree.

Proof: if a MST $T$ includes our edge, fine. Otherwise, consider an edge in $T$ that crosses cut. Replace it with ours. Still a spanning tree. Cost can't go up, so still minimum.
Kruskal’s Algorithm
connect separate components until spanned
connect separate components until spanned

1. $T \leftarrow \emptyset$
2. for each vertex $v$, MAKE-SET($v$)
3. for each edge $(u, v)$ in nondecreasing order of weight
4. if $\text{FIND-SET}(u) \neq \text{FIND-SET}(v)$
5. add edge to $T$
6. UNION($u, v$)
7. return $T$

correctness? running time?
Break

- midterm
- grades
- asst 8
- asst 9
Prim’s Algorithm
grow tree until connected
The Algorithm

Spanning Trees
Kruskal’s Algorithm
Prim’s Algorithm
\[ \text{Algorithm} \]
EOLQs

Wheeler Ruml (UNH)
For example:

- What’s still confusing?
- What question didn’t you get to ask today?
- What would you like to hear more about?

Please write down your most pressing question about algorithms and put it in the box on your way out.

Thanks!