CS130B – Data Structures And Algorithms II

Discussion Section Week 4

Programming Assignment 2

Program 2

- **Due 11:59 PM, May 7, 2017**
- /usr/bin/turnin prog2@cs130b [list of files]
- Written in C++
- Again, must be able to compile and run on CSIL
- Makefile required to create executable named **prog2** (do not name it something else)
- Input and output very similar to program 1

Input

Input from `stdin`
Format:

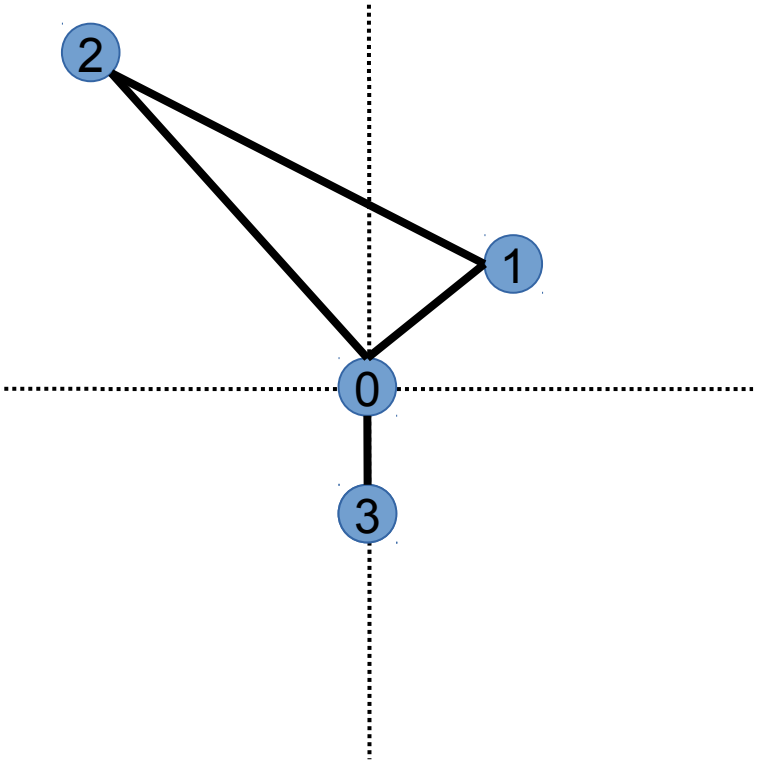
n	← Number of vertices
$x_0\ y_0$	← 0^{th} vertex, vertices labeled from 0 to n - 1
$x_1\ y_1$	
. . .	
$x_{n-1}\ y_{n-1}$	
m	← Number of edges
$v(0)_0\ v(0)_1$	← Ex. 2 4 means an edge exists between
$v(1)_0\ v(1)_1$	between vertex 2 and vertex 4
. . .	
$v(m-1)_0\ v(m-1)_1$	← Use Euclidean distance as edge Weight

If m = 0, then assume a fully connected graph.

Input

Example:

```
4
0 0
1.5 1.5
-2.5 3.5
0 -1
4
0 1
1 2
2 0
0 3
```



Output

Output to `stdout`
Format:

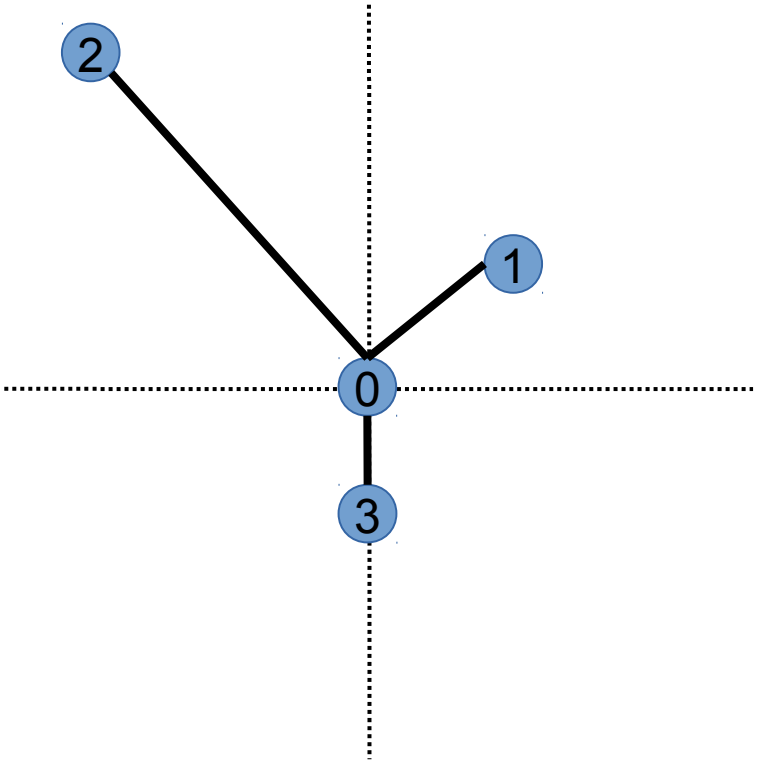
$v(0)_0$ $v(0)_1$
$v(1)_0$ $v(1)_1$
. . .
$v(n-1)_0$ $v(n-1)_1$

← List the edges in the minimum cost spanning tree, each edge ordered in increasing order, and the list in increasing order by the first vertex; use second vertex as tie breaker

Output

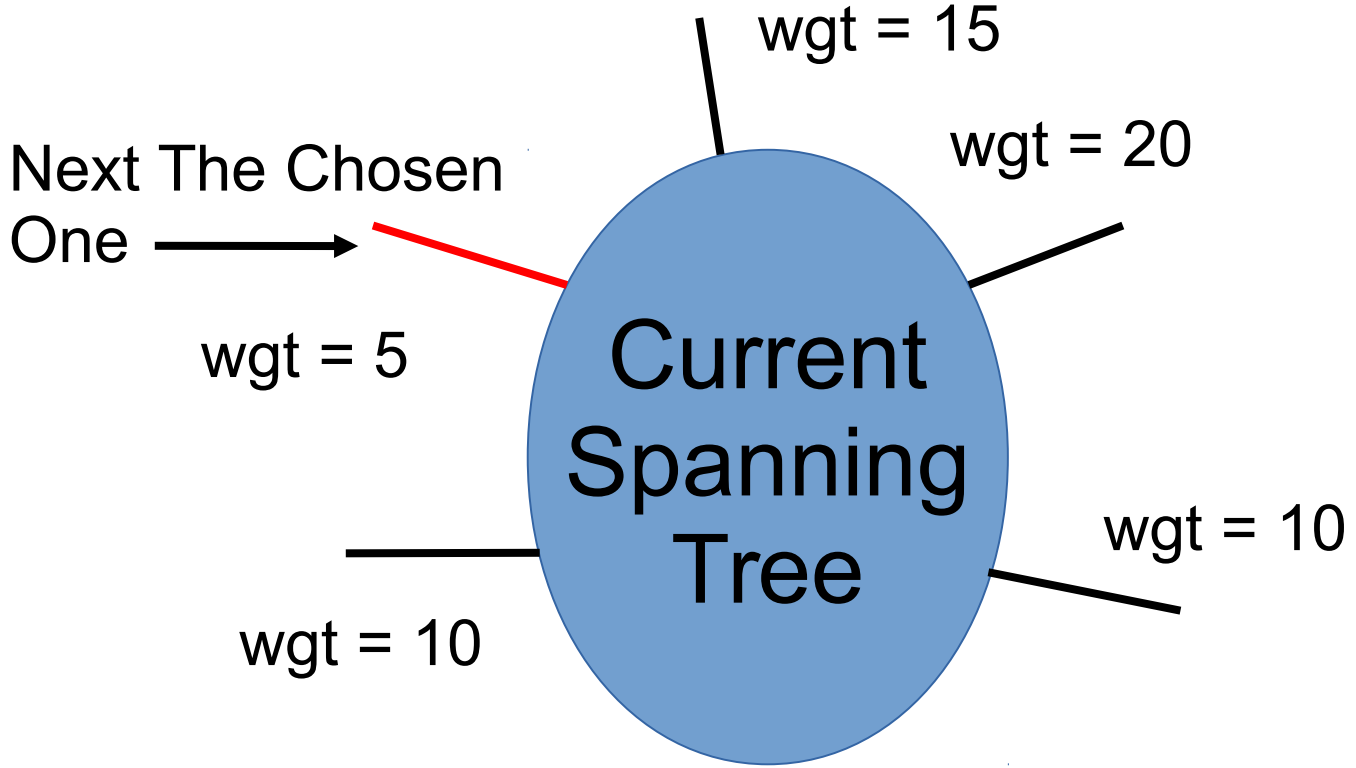
Example:

```
0 1
0 2
0 3
```



Prim's Algorithm

Greedy Choice: Select the lowest weight edge that expands the current tree (ignore edges that lead to a cycle)

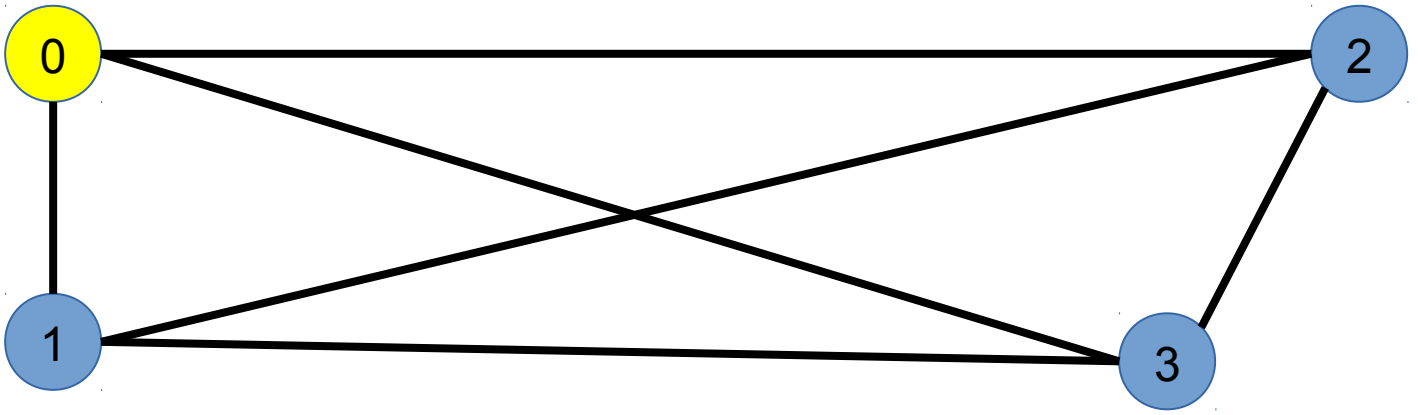


Prim's Algorithm

Concrete Example:

Start at arbitrary node (e.g. 0)

N = {0}

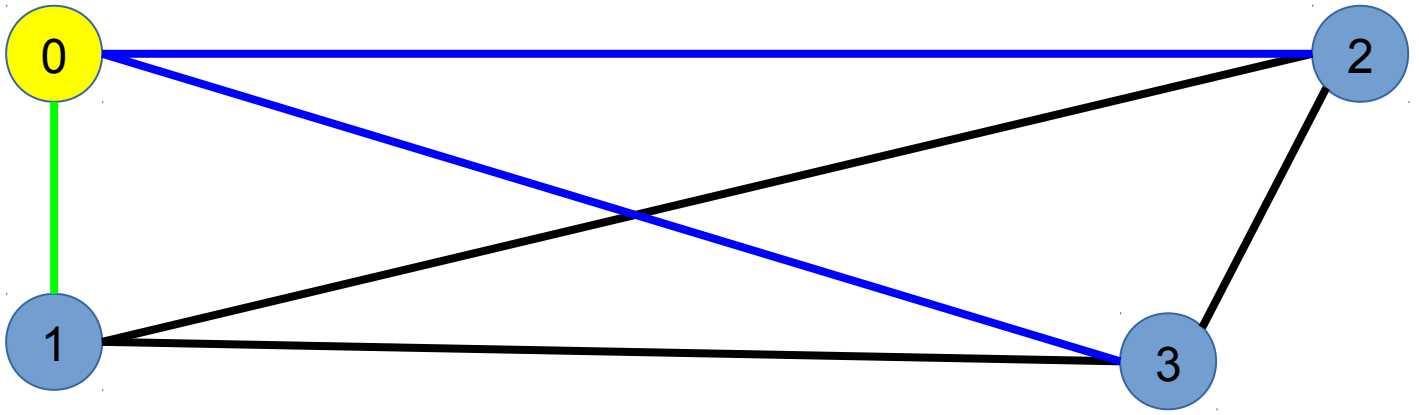


Prim's Algorithm

Concrete Example:

Look at edges leaving from vertices in N (blue);

Add least weight edge to tree T ← {(0,1)}



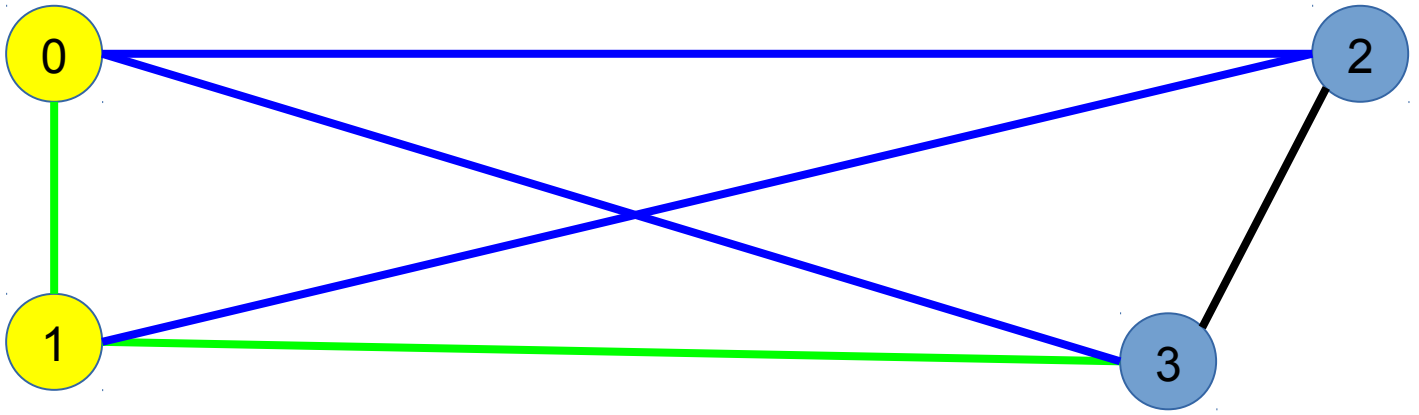
Update N ← {0, 1}

Prim's Algorithm

Concrete Example:

Repeat

T ← {(0,1), (1,3)}

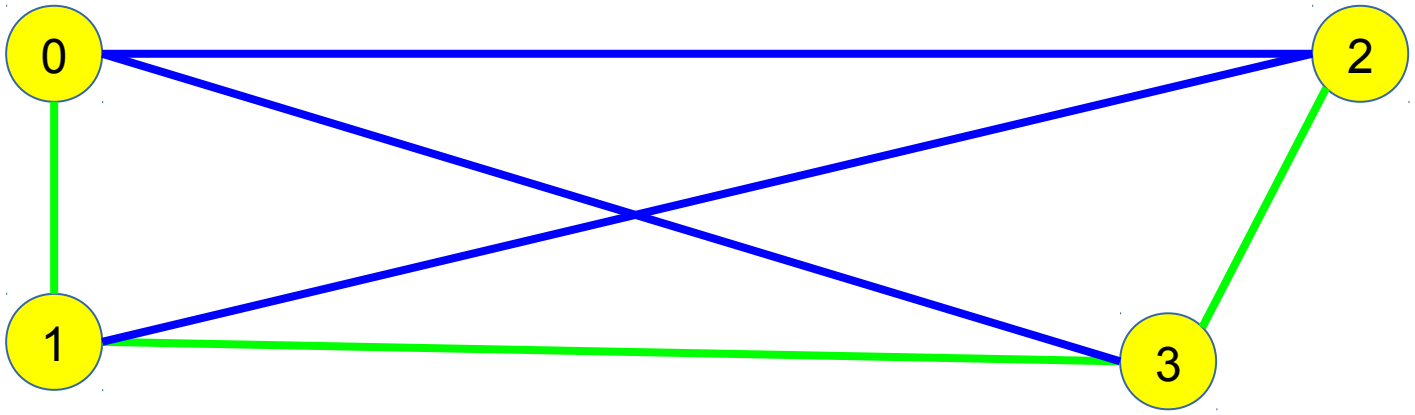


N ← {0, 1, 3}

Prim's Algorithm

Concrete Example:

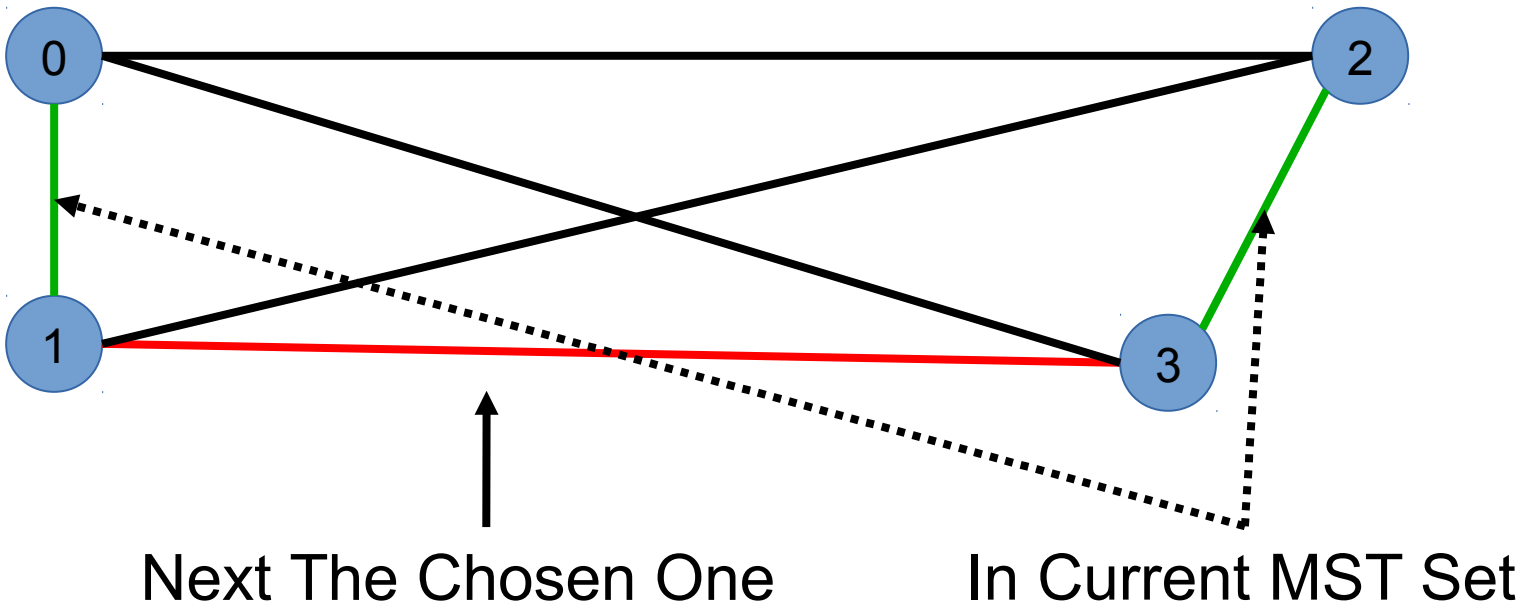
$T \leftarrow \{(0,1), (1,3), (2, 3)\}$



$N \leftarrow \{0, 1, 2, 3\}$ DONE

Kruskal's Algorithm

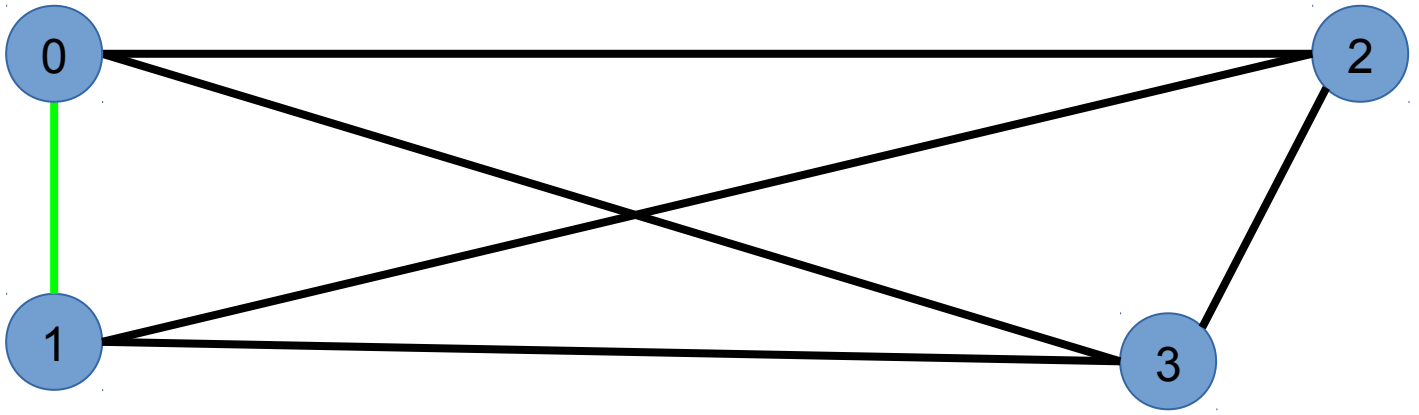
Greedy Choice: Select the lowest weight edge from the set of remaining edges that does not form a cycle with the current edge set



Kruskal's Algorithm

Concrete Example:

Select least weight edge that doesn't form a cycle to current edge set T = { }

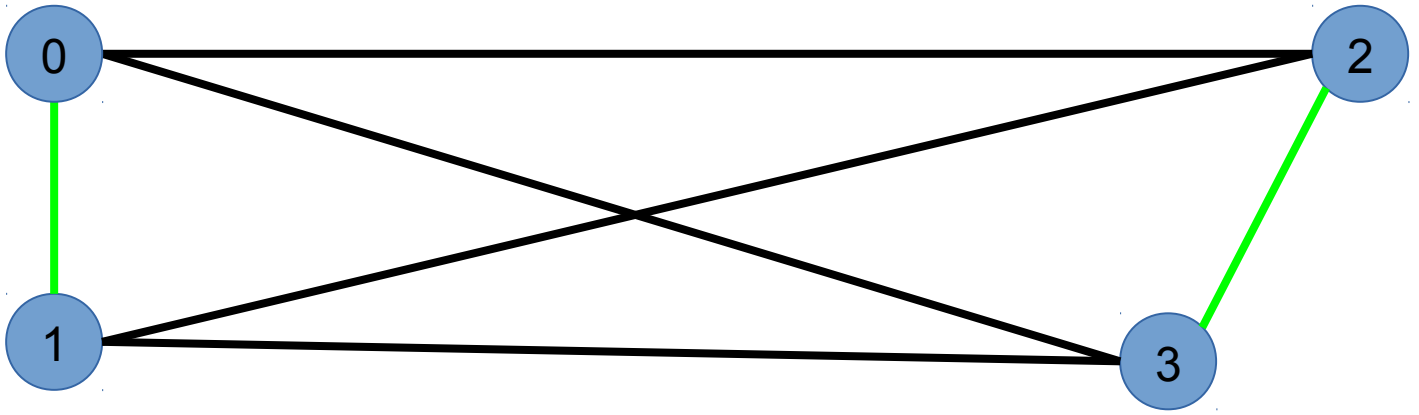


T ← {(0, 1)}

Kruskal's Algorithm

Concrete Example:

Select least weight edge that doesn't form a cycle to current edge set T = {(0, 1)}

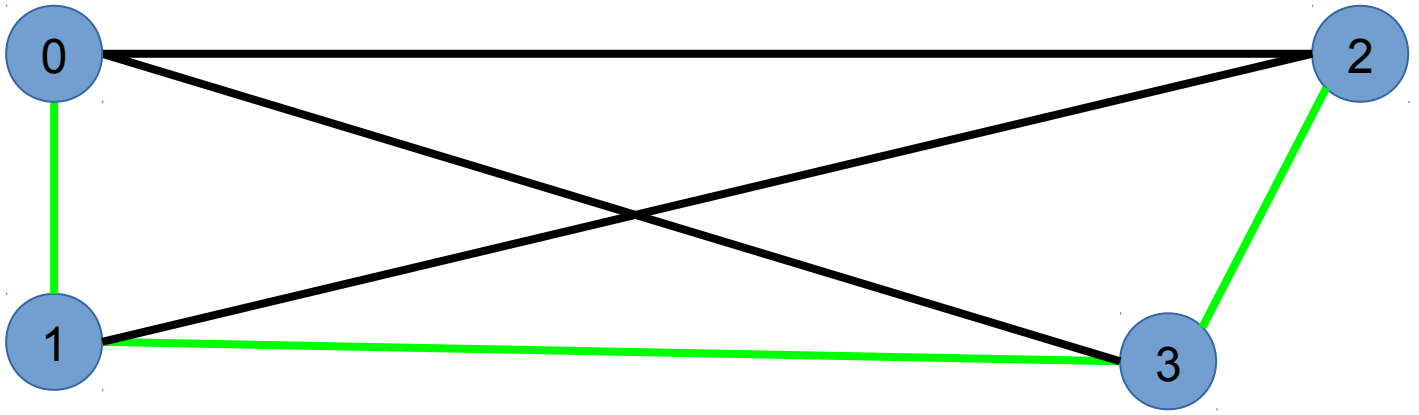


T = {(0, 1), (2, 3)}

Kruskal's Algorithm

Concrete Example:

Select least weight edge that doesn't form a cycle to current edge set T = {(0, 1), (2, 3)}



T = {(0, 1), (1, 3), (2, 3)} DONE