ASSIGNMENT 3

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TEST CASES

- The test cases are the number of layers for the tree from $n = 2, 3, 4, \ldots, 20$
- For each layer parameter, both a brute force algorithm and another solution are run on a randomly initialized tree.
- The tree was created using networkx
  - This package used an object class to create and store network related data structures
- A class was created to interact with the randomly generated tree as well.

IMPLEMENTATION – BRUTE FORCE/GREEDY

Initialize binary tree with random integers for weight values

For each layer in tree:

    For each node in previous layer:

        Get edge value and path of previous node → node in current layer

Get max(edge values)

For path in paths from first iteration:

    If edge value < max(edge values), add to edge value the skew

IMPLEMENTATION – ALTERNATIVE SOLUTION

Initialize binary tree with random integers for weight values

For each leaf node

Calculate path from root → leaf and sum the weights of that path

Get max(leaf distances from root)

For each leaf node

Get edge value from leaf node ← root node of previous layer

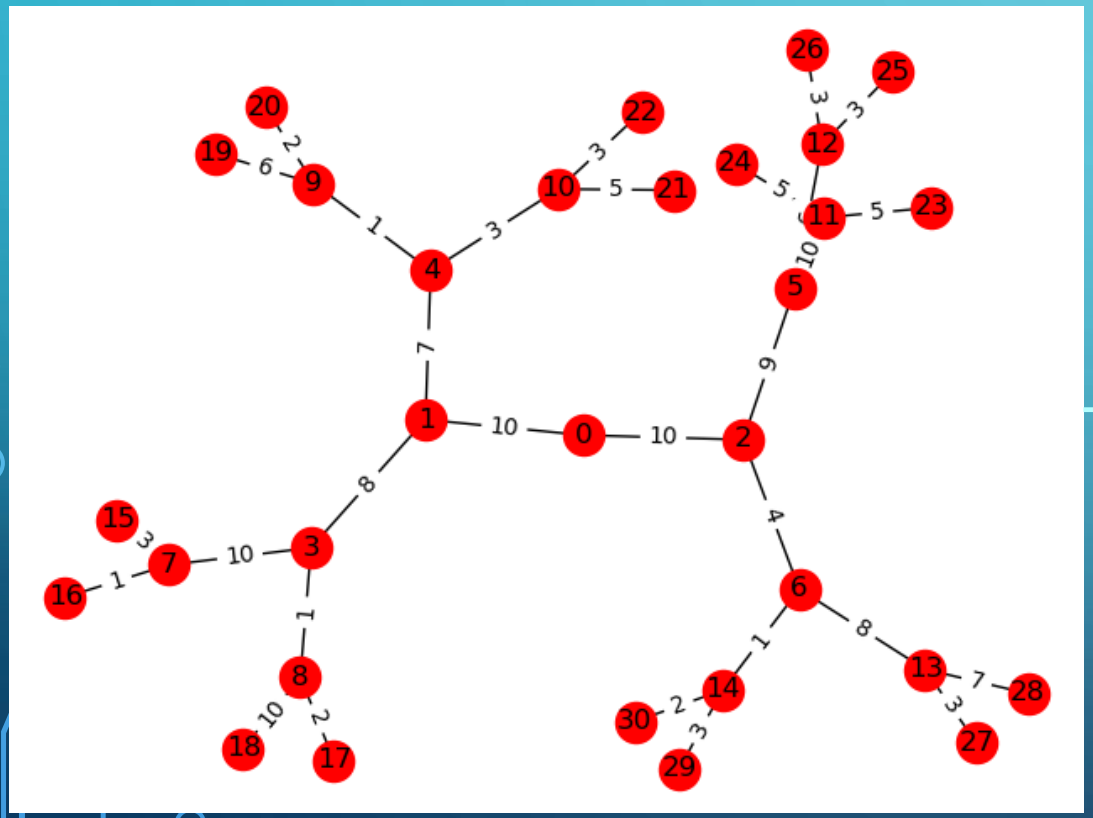
If edge value < max(leaf distances from root), add to edge value the skew

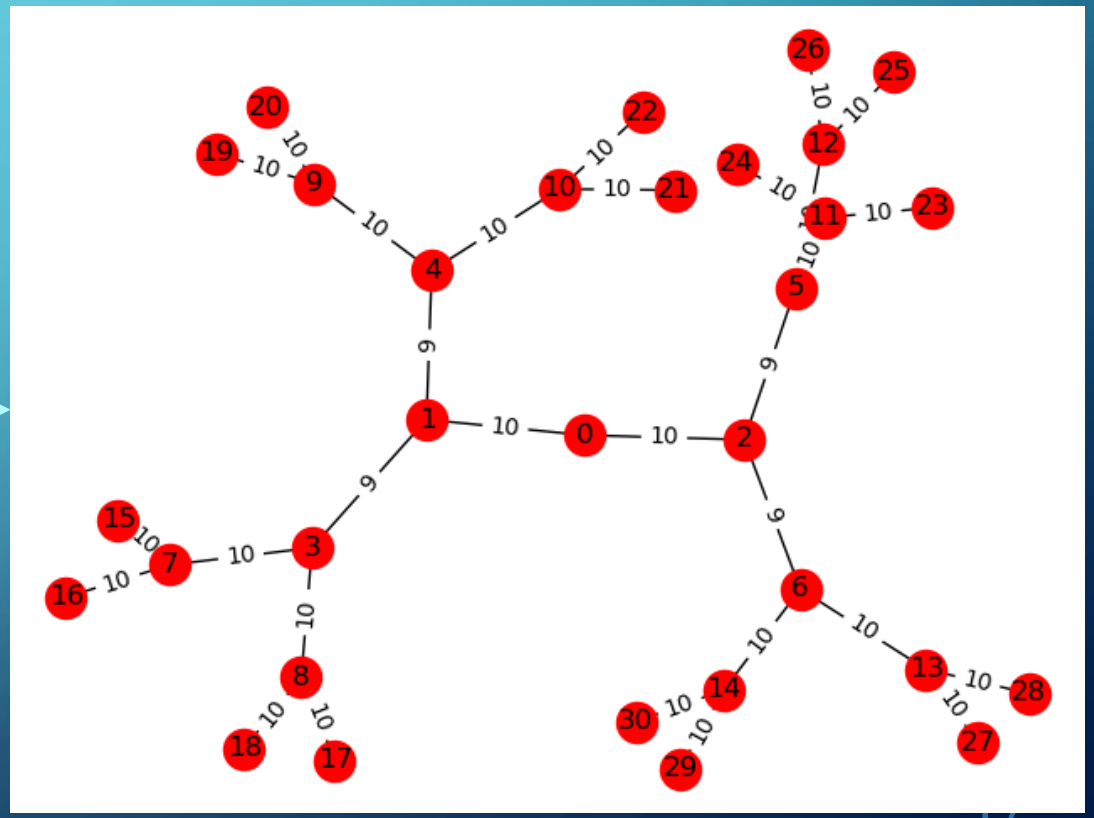
VALIDATION OF CORRECTNESS

- Once the algorithm completes running, all the distances from the root to the leaves are compared to test equivalency
  - We want all path distances from root to leaf to be equivalent

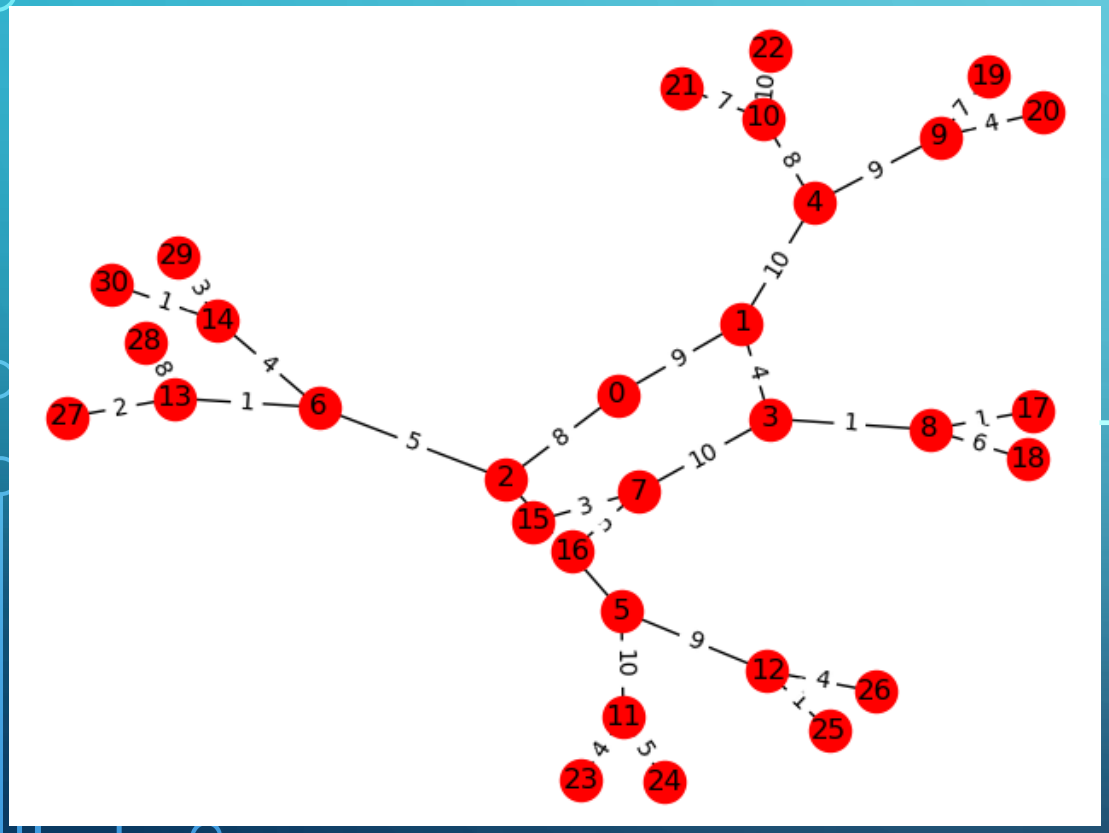
```
def test_results(tree):
    path_lengths = tree.get_path_lengths()
    if len(set(path_lengths.values())) > 1:
        return False
    else:
        return True
```

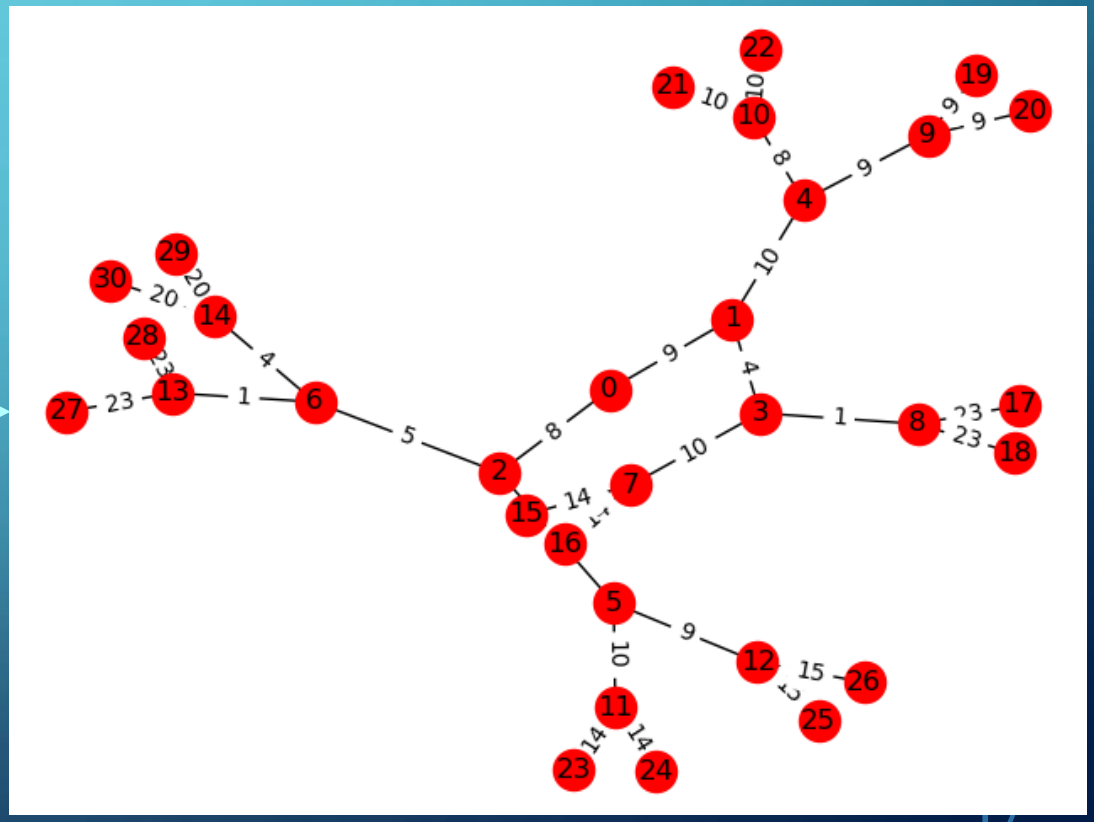
BRUTE FORCE/GREEDY BEFORE AND AFTER





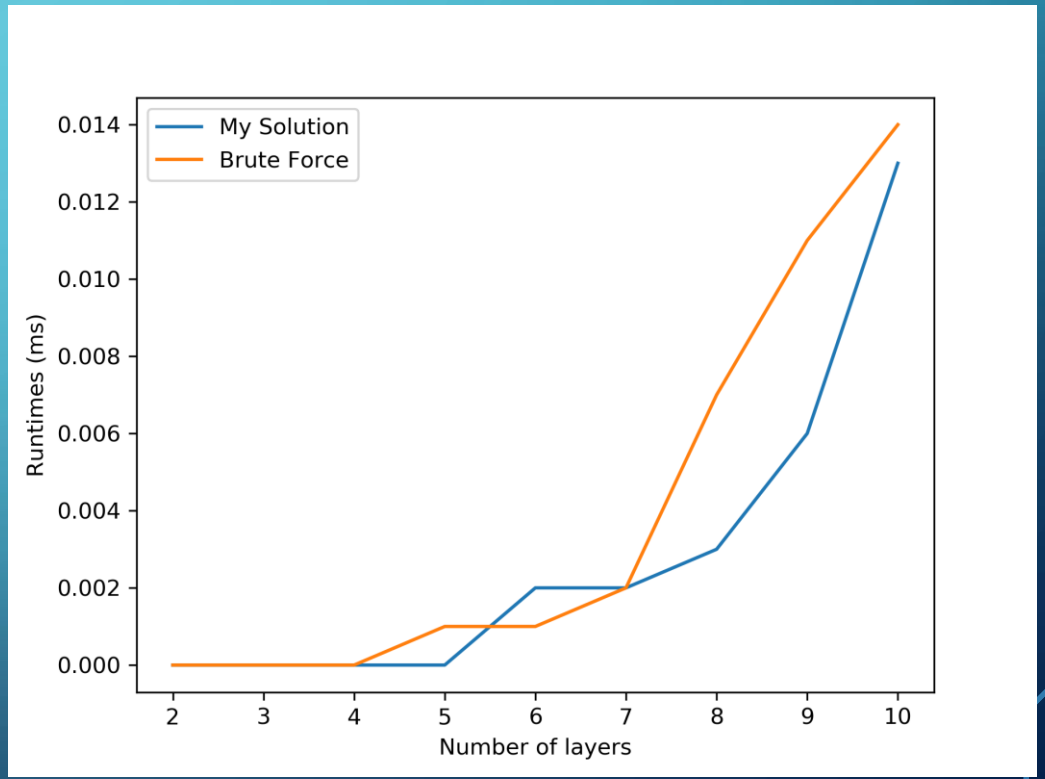
OTHER ALGORITHM BEFORE AND AFTER





VALIDATION OF PERFORMANCE - RUNTIMES

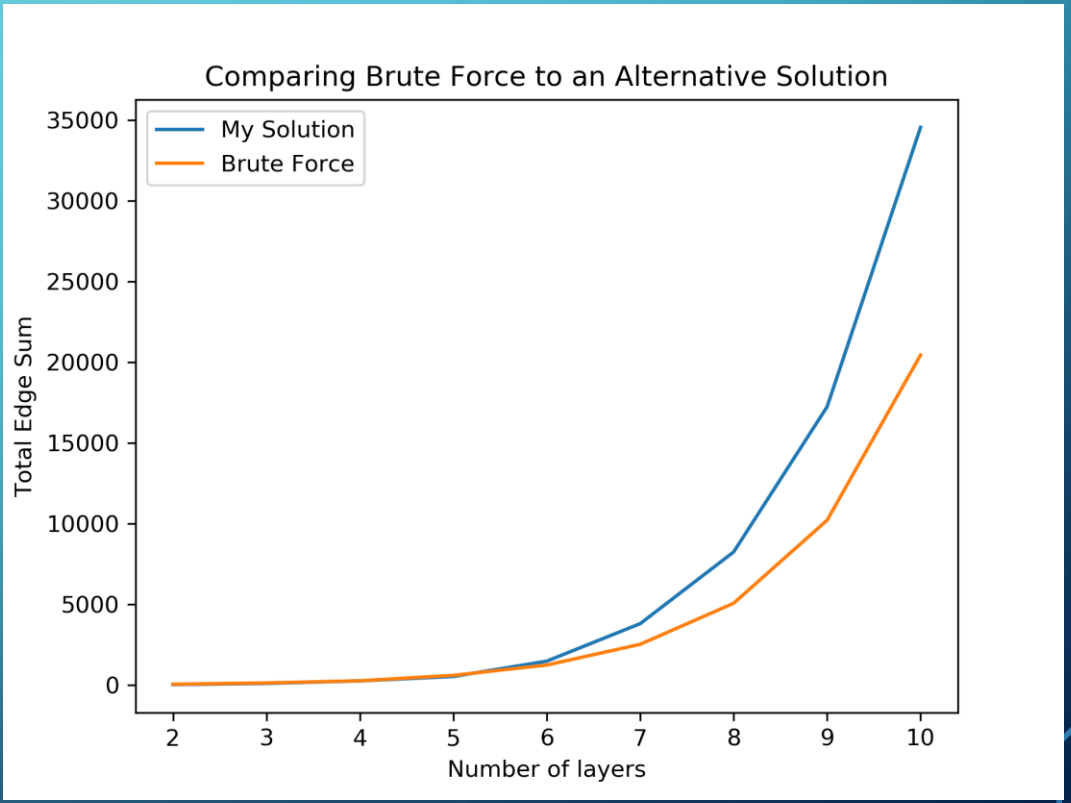
- The runtimes between the two are very similar and seem to converge at layer 10
- Brute force/Greedy method at a glance appears optimal in runtime



VALIDATION OF PERFORMANCE – TOTAL EDGE SUM

The alternative solution works similarly to the brute force/greedy method for some time

Once number of layers > 5, the alternative solution is no longer optimal.



CODE BASE

The code base can be found here:

https://github.com/Maddy12/COT5405G3Fall2018/tree/master/Assignment3