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CSCI 360

Lab 1 Extra Credit

In [1]:
```
from lab1 import breadth_first_search, depth_first_search
from lab1_utils import TextbookStack

def orderHelper(n, numbers, order, orders):
    if len(order) == n:
        orders.append(order)
        return
    for number in numbers:
        cpy = [i for i in order]
        cpy.append(number)
        orderHelper(n, set({i for i in numbers if i != number}), cpy, orders)

def generateOrder(n):
    orders = []
    numbers = set({})
    for i in range(n):
        numbers.add(i)
    orderHelper(n, numbers, [], orders)
    return orders

def orientationHelper(n, numbers, orientation, orientations):
    if len(orientation) == n:
        orientations.append(orientation)
        return
    for number in numbers:
        cpy = [i for i in orientation]
        cpy.append(number)
        orientationHelper(n, numbers, cpy, orientations)

def generateOrientation(n):
    orientations = []
    numbers = set({0, 1})
    orientationHelper(n, numbers, [], orientations)
    return orientations

def generateStacks(n):
    textbooks = []
    orders = generateOrder(n)
    orientations = generateOrientation(n)
    for i in orders:
        for j in orientations:
            textbooks.append(TextbookStack(i, j))
    return textbooks
```

In [2]:
```
n = []
avgs_bfs = []
avgs_dfs = []
for i in range(5):
    n.append(i+1)
    textbooks = generateStacks(i+1)
    print('n =', i+1)
    print('Number of initial stacks:', len(textbooks))
    n_bfs = 0
    n_dfs = 0
    for textbook in textbooks:
        seq_bfs = breadth_first_search(textbook)
        seq_dfs = depth_first_search(textbook)
        n_bfs += len(seq_bfs)
        n_dfs += len(seq_dfs)
    avgs_bfs.append(n_bfs / len(textbooks))
    avgs_dfs.append(n_dfs / len(textbooks))
    print('Avg number of flips (bfs) = ', avgs_bfs[i])
    print('Avg number of flips (dfs) = ', avgs_dfs[i])
```

```
n = 1
Number of initial stacks: 2
Avg number of flips (bfs) =  0.5
Avg number of flips (dfs) =  0.5
n = 2
Number of initial stacks: 8
Avg number of flips (bfs) =  2.0
Avg number of flips (dfs) =  2.75
n = 3
Number of initial stacks: 48
Avg number of flips (bfs) =  3.4375
Avg number of flips (dfs) =  11.520833333333334
n = 4
Number of initial stacks: 384
Avg number of flips (bfs) =  4.796875
Avg number of flips (dfs) =  72.0546875
n = 5
Number of initial stacks: 3840
Avg number of flips (bfs) =  6.1171875
Avg number of flips (dfs) =  587.6971354166667
```

It seems like as n gets larger, DFS requires exponentially more flips than BFS. This is probably due to the fact that BFS finds a 'shortest path' and thus looks at less number of states whereas DFS simply finds a path.