

HW 2

1. The rename function should access a two dimensional array of size $n \times n$. We assign each index in the first row of this array a unique value in the range $1..M$. For each index in the first row except for the right-most index, we also add an instance of splitter. For the second row in the array, we assign another unique value in the range $1..M$ (that also has not been used in the previous row) to each index except for the right-most index. For the second row, we also add an instance of splitter for all but the last two indices. We continue this pattern of assigning unique values in the range $1..M$ for all indices in row i except for indices $n-i..n$ and splitters for row i except for indices $n-i-1..n$ (with the index of the first row being 0) until there are no more unique values in the range $1..M$ to assign to an index in the array. The resulting array should be an upper-left triangular grid filled with a value and/or splitter. Thus in total, there are $m = n*(n+1)/2$ unique values and $n(n-1)/2$ instances of splitter assigned to indices in the array.

All processes that call `rename()` should first enter the splitter at row 0 column 0. When entering a splitter if a process returns with “Down” the process can return from the function with the unique value assigned to the index in the array corresponding to the instance of splitter that returned down for the process. If a process returns with “Left” the process should call the instance of splitter located at the index that is directly 1 row below its current index. If a process returns with “Right” the process should call the instance of splitter located at the index that is directly 1 row to the right of its current index. If a process ever attempts to access an index in the array that contains just a value and no instance of splitter, the process can return from the function with that value.

This method of assigning unique names to processes terminates because at most $k-1$ processes can return “Left” and at most $k-1$ processes can return “Right” from an instance of splitter that had a total of k processes that called it. Thus once any of the splitters located at the right-most index in each row is called, the maximum number of processes that could return as “Left” or “Right” is 1 resulting in the final value returned by such processes to be the value assigned to an index in the array that is not associated with an instance of splitter. This fact, in addition to the fact that the max number of processes that can return as “Down” from splitter is 1 proves that each process will return with a unique value in the range $1..M$.