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COSC 2203: Data Structures

9/27/20

## Contrast Equalization: Component A

### Input/Output Analysis:

#### Description:

This project enters the world of computer visualization and image processing as an excuse to work with Binary Search Trees (BST). An image whose visual characteristics are poor can often be improved by performing a process called contrast equalization. This assignment uses a BST as the storage structure for the contrast equalization process.

The program will do the following:

- 1.) Load the BST with the image's intensity values, keeping count for each intensity value.
- 2.) Determine the cumulative sum for each contrast value (number of pixels having intensities less than or equal to). Determine a new distributed intensity value.

Formula for calculating the new distributed intensity value:

**New Intensity = ((cumulative number of pixels with intensity i) / (total number of pixels) ) \* (number of possible intensity values)**

- 3.) Output the equalized image intensity values in the same format as the source image.

#### Input variables:

<u>Type:</u>	<u>Name:</u>	<u>Description:</u>
int	row	number of rows in our "picture"
int	col	number of columns in our "picture"
int	intensityVal	intensity at the [row, col]th position of the "picture"

### Example of Input:

```
4 4
0 1 3 4
1 2 2 3
1 3 4 4
3 2 5 2
```

### Output:

Output the number of rows and columns in the new image along with a listing of the new pixel intensity values, one per line (this is the result of the contrast equalization, in the same format as the input).

Output a histogram of the intensity values over the entire range of intensity values. The histogram displays the intensity values in groups of 16 for a total of 16 rows, and the histogram shows the number of pixels at an intensity grouping with markers representing quantities of 20 pixels each. Also output the height and number of nodes in the binary tree.

\*Disclaimer: This example uses 7 as the number of possible intensity values but the actual project will use the value 255 (since the range of grey color values is [0,...,255]). The range and markers have also been modified for demo purposes.

### Example of Output:

Height: 4

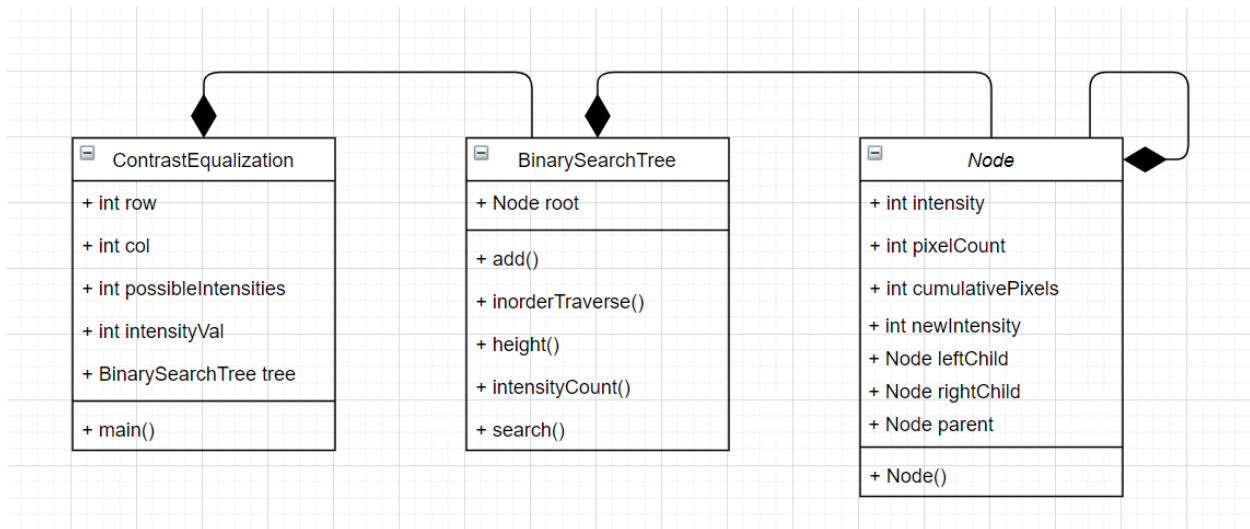
Number of Nodes: 6

#### INTENSITY HISTOGRAM:

Intensity Pixel Range	Count	Markers
0	1	*
1	0	
2	3	***
3	0	
4	4	****
5	4	****
6	0	
7	4	****

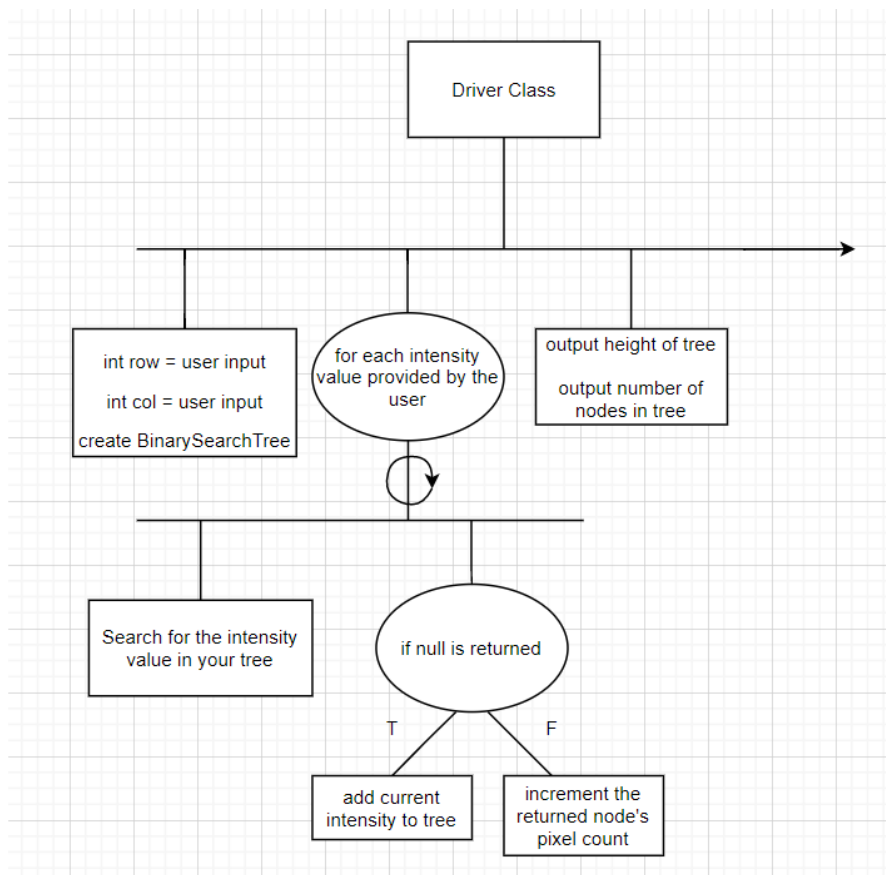
```
4 4
0 2 5 7
2 4 4 5
2 5 7 7
5 4 7 4
```

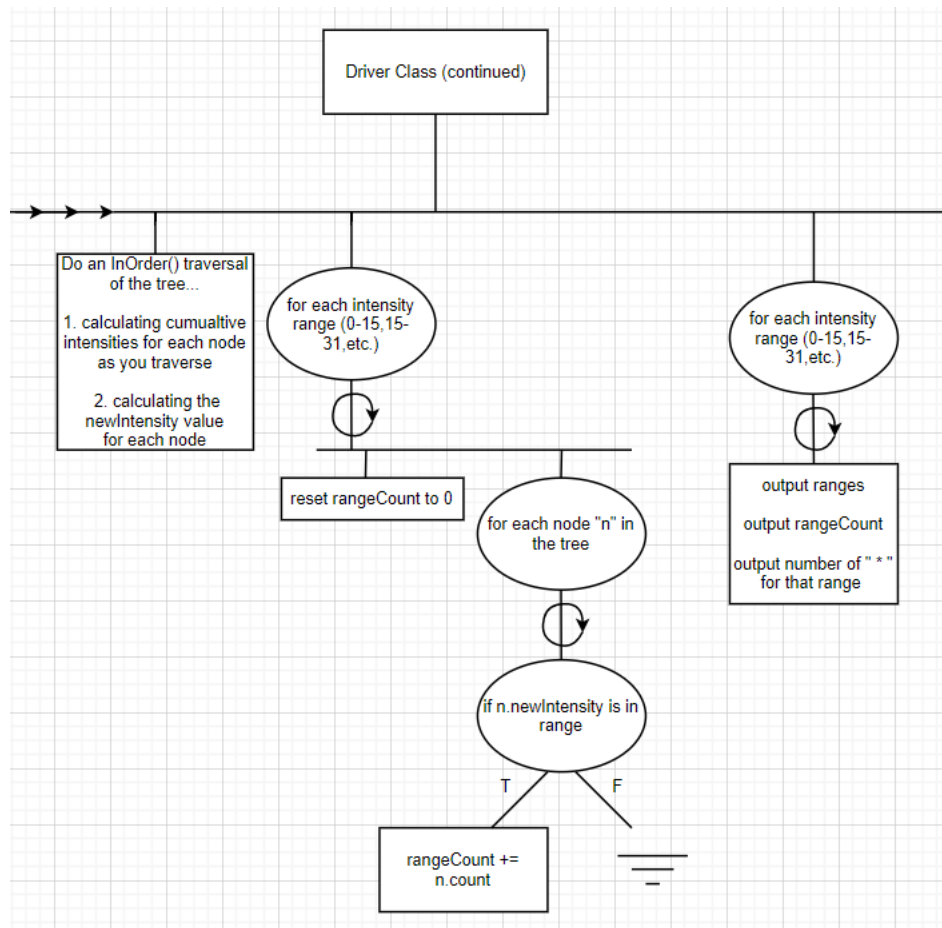
## UML Design:



## Design Chart:

### Driver Class:





### Methods in Binary Search Tree Class:

