CS 323_33 Programming Language: Java

Project #5 QuadTree

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Due Date:

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Hard copy: 3/12/2020

**********Main**********

Step 0: inFile, outFile1, outFile2 ←open

Step 1: numRows, numCols, minVal, maxVal ←read from inFile

Step 2: squareSize ←computeSquare(numRows, numCols)

Step 3: imgAry ←dynamically allocate the array size of squaresze by squareSide

Step 4: zero2DAry (imgAry)

Step 5: loadImage (inFile, imgAry)

Step 4: QtRoot ←BuildQuadTree (imgAry, 0, 0, squareSize)

Step 5: preOrder (QtRoot, outFile2)

Step 6: postOrder (QtRoot, outFile2)

Step 7: close all files

Source code:

```
import java.util.*;
import java.io.*;


class QtTreeNode{
  int color;
  int upperR;
  int upperC;
  QtTreeNode NWkid = null;
  QtTreeNode NEkid = null;
  QtTreeNode SWkid = null;
  QtTreeNode SEkid = null;

  QtTreeNode(int color, int upperR, int upperC, QtTreeNode NWkid,
QtTreeNode NEkid, QtTreeNode SWkid, QtTreeNode SEkid){
    this.color = color;
    this.upperR = upperR;
    this.upperC = upperC;



    this.NWkid = NWkid;
    this.NEkid = NEkid;
    this.SWkid = SWkid;
    this.SEkid = SEkid;
  }
}

public class Main{
  public static void main(String[] args) {
    // Opening Files
    Scanner inFile = null;
    PrintWriter outFile1 = null;
    PrintWriter outFile2 = null;

    try {
      inFile = new Scanner(new File(args[0]));
    } catch (FileNotFoundException err) {
      System.out.println("Error in opening inputFile: " + err);
    }
    try {
      outFile1 = new PrintWriter(args[1]);
      outFile2 = new PrintWriter(args[2]);
    } catch (FileNotFoundException err) {
      System.out.println("Error in opening outFiles: " + err);
    }

    int numRows, numCols, minVal, maxVal, squareSize;
    numRows = inFile.nextInt();
    numCols = inFile.nextInt();
```

```
    minVal = inFile.nextInt();
    maxVal = inFile.nextInt();

    squareSize = computeSquareSize(numRows, numCols);


    int[][] imgAry = new int[squareSize][squareSize];
    zero2DAry(imgAry); //Is this needed again?


    loadImage(inFile, imgAry, numRows, numCols);


    //deBugOut
    outFile2.println("squareSize: " + squareSize);

    for(int i = 0; i< squareSize; i++){
      for(int j = 0; j < squareSize; j++){
        outFile2.print(imgAry[i][j] + " ");
      }
      outFile2.println();
    }


    QtTreeNode QtRoot = buildQuadTree(imgAry, 0, 0, squareSize);

    outFile1.println("PreOrder Traversal:");
    preOrder(QtRoot, outFile1);

outFile1.println("**************************************************
*******");
    outFile1.println("PostOrder Traversal:");
    postOrder(QtRoot, outFile1);


    inFile.close();
    outFile1.close();
    outFile2.close();
  }
  // Functions
  public static QtTreeNode buildQuadTree(int[][] imgAry, int upR, int
upC, int size){
    QtTreeNode newNode = new QtTreeNode(-1, upR, upC, null, null,
null, null);
    if(size == 1){
      newNode.color = imgAry[upR][upC];
    } else {
      int newSize = size/2;
      newNode.NWkid = buildQuadTree(imgAry,upR,upC,newSize);
      newNode.NEkid = buildQuadTree(imgAry,upR,upC+newSize,newSize);
      newNode.SWkid = buildQuadTree(imgAry,upR+newSize,upC,newSize);
```

```
      newNode.SEkid =
buildQuadTree(imgAry,upR+newSize,upC+newSize,newSize);


      int sumColor = newNode.NWkid.color + newNode.NEkid.color +
newNode.SWkid.color + newNode.SEkid.color;

      if(sumColor == 0){
        newNode.color = 0;
        newNode.NWkid = null;
        newNode.NEkid = null;
        newNode.SWkid = null;
        newNode.SEkid = null;
      } else if (sumColor == 4){
        newNode.color = 1;
        newNode.NWkid = null;
        newNode.NEkid = null;
        newNode.SWkid = null;
        newNode.SEkid = null;
      } else {
        newNode.color = 5;
      }
    }
    return newNode;
  }

  public static void printQNode(QtTreeNode node, PrintWriter outFile){
    String nodeColor = node == null ? "NULL" :
Integer.toString(node.color);
    String nodeR = node == null ? "NULL" :
Integer.toString(node.upperR);
    String nodeC = node == null ? "NULL" :
Integer.toString(node.upperC);

    String nodeNW = node.NWkid == null ? "NULL" :
Integer.toString(node.NWkid.color);
    String nodeNE = node.NEkid == null ? "NULL" :
Integer.toString(node.NEkid.color);
    String nodeSW = node.SWkid == null ? "NULL" :
Integer.toString(node.SWkid.color);
    String nodeSE = node.SEkid == null ? "NULL" :
Integer.toString(node.SEkid.color);

    outFile.println("(" +nodeColor + " " + nodeR + " " + nodeC + " "
+nodeNW + " " +nodeNE + " " +nodeSW + " " +nodeSE + ")");
  }

  public static void postOrder(QtTreeNode node, PrintWriter outFile){
    if(node.NWkid == null && node.NEkid == null && node.SWkid == null
&& node.SEkid == null){
      printQNode(node, outFile);
    } else {
```

```
      postOrder(node.NWkid, outFile);
      postOrder(node.NEkid, outFile);
      postOrder(node.SWkid, outFile);
      postOrder(node.SEkid, outFile);
      printQNode(node, outFile);
    }
  }

  public static void preOrder(QtTreeNode node, PrintWriter outFile){
    if(node.NWkid == null && node.NEkid == null && node.SWkid == null
&& node.SEkid == null){
      printQNode(node, outFile);
    } else {
      printQNode(node, outFile);
      preOrder(node.NWkid, outFile);
      preOrder(node.NEkid, outFile);
      preOrder(node.SWkid, outFile);
      preOrder(node.SEkid, outFile);
    }
  }


  public static void loadImage(Scanner inFile, int[][] Ary, int rows,
int cols){
    int value;
    for (int i = 0; i < rows; i++ ){
      for (int j = 0; j < cols; j++ ) {
        value = inFile.nextInt();
        Ary[i][j] = value;
      }
    }
  }


  public static void zero2DAry(int[][] Ary){
    for(int i = 0; i< Ary.length; i++){
      for(int j = 0; j < Ary[0].length; j++){
        Ary[i][j] = 0;
      }
    }
  }

  public static int computeSquareSize(int numRows, int numCols){
    int square = numRows > numCols ? numRows : numCols;
    int power2 = 2;
    while(square > power2){
      power2 *= 2;
    }
    return power2;
  }

}
```

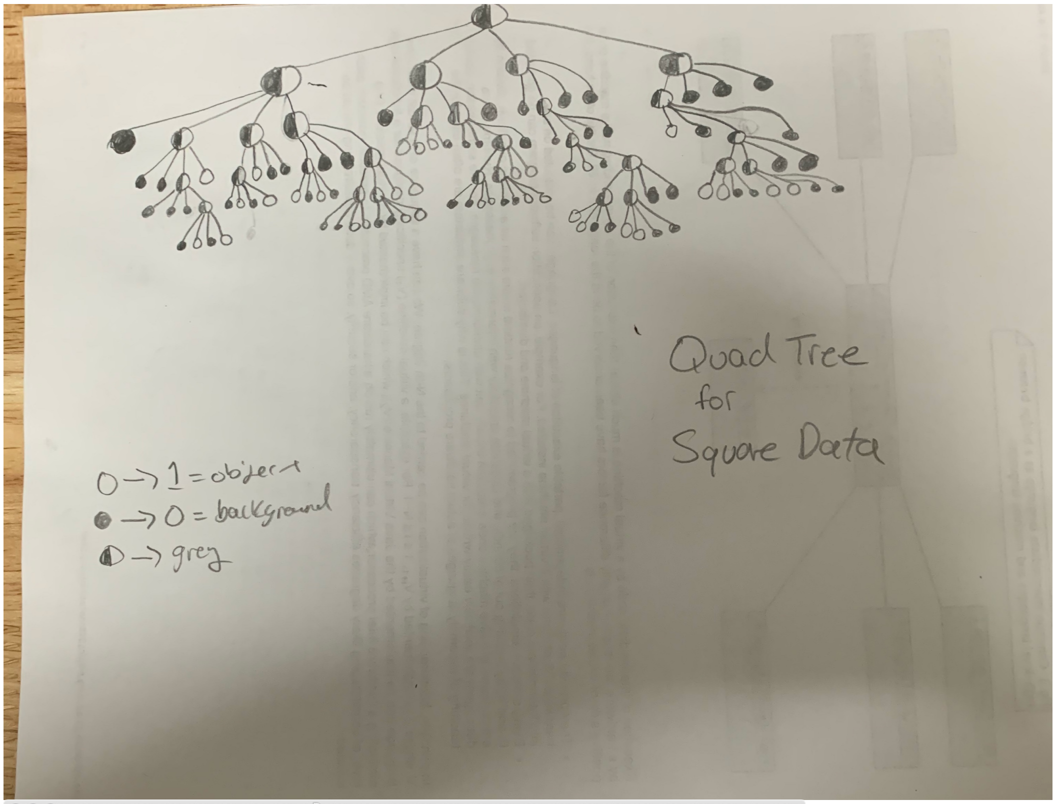
SquareData: OutFile and QuadTree Representation

preANDpostOrder_SqaureData.txt — Edited

```
PreOrder Traversal:
(5 0 0 5 5 5 5)
(5 0 0 0 5 5 5)
(0 0 0 NULL NULL NULL NULL)
(5 0 16 0 0 5 1)
(0 0 16 NULL NULL NULL NULL)
(0 0 24 NULL NULL NULL NULL)
(5 8 16 0 0 0 5)
(0 8 16 NULL NULL NULL NULL)
(0 8 20 NULL NULL NULL NULL)
(0 12 16 NULL NULL NULL NULL)
(5 12 20 0 1 0 1)
(0 12 20 NULL NULL NULL NULL)
(1 12 22 NULL NULL NULL NULL)
(0 14 20 NULL NULL NULL NULL)
(1 14 22 NULL NULL NULL NULL)
(1 8 24 NULL NULL NULL NULL)
(5 16 0 5 1 0 0)
(5 16 0 0 1 0 1)
(0 16 0 NULL NULL NULL NULL)
(1 16 4 NULL NULL NULL NULL)
(0 20 0 NULL NULL NULL NULL)
(1 20 4 NULL NULL NULL NULL)
(1 16 8 NULL NULL NULL NULL)
(0 24 0 NULL NULL NULL NULL)
(0 24 8 NULL NULL NULL NULL)
(5 16 16 5 0 0 5)
(5 16 16 1 0 1 0)
(1 16 16 NULL NULL NULL NULL)
(0 16 20 NULL NULL NULL NULL)
(1 20 16 NULL NULL NULL NULL)
(0 20 20 NULL NULL NULL NULL)
(0 16 24 NULL NULL NULL NULL)
(0 24 16 NULL NULL NULL NULL)
(5 24 24 5 5 1 1)
(5 24 24 0 0 1 1)
(0 24 24 NULL NULL NULL NULL)
(0 24 26 NULL NULL NULL NULL)
(1 26 24 NULL NULL NULL NULL)
(1 26 26 NULL NULL NULL NULL)
(5 24 28 0 0 1 1)
(0 24 28 NULL NULL NULL NULL)
(0 24 30 NULL NULL NULL NULL)
(1 26 28 NULL NULL NULL NULL)
(1 26 30 NULL NULL NULL NULL)
(1 28 24 NULL NULL NULL NULL)
(1 28 28 NULL NULL NULL NULL)
(5 0 32 0 5 5 0)
(0 0 32 NULL NULL NULL NULL)
(5 0 48 0 1 1 0)
(0 0 48 NULL NULL NULL NULL)
(1 0 56 NULL NULL NULL NULL)
(1 8 48 NULL NULL NULL NULL)
(0 8 56 NULL NULL NULL NULL)
(5 16 32 0 0 5 0)
(0 16 32 NULL NULL NULL NULL)
(0 16 40 NULL NULL NULL NULL)
(5 24 32 5 5 1 1)
(5 24 32 0 0 1 1)
(0 24 32 NULL NULL NULL NULL)
(0 24 34 NULL NULL NULL NULL)
(1 26 32 NULL NULL NULL NULL)
(1 26 34 NULL NULL NULL NULL)
(5 24 36 0 0 1 1)
(0 24 36 NULL NULL NULL NULL)
(0 24 38 NULL NULL NULL NULL)
(1 26 36 NULL NULL NULL NULL)
(1 26 38 NULL NULL NULL NULL)
(1 28 32 NULL NULL NULL NULL)
(1 28 36 NULL NULL NULL NULL)
(0 24 40 NULL NULL NULL NULL)
(0 16 48 NULL NULL NULL NULL)
(5 32 0 0 5 0 0)
(0 32 0 NULL NULL NULL NULL)
(5 32 16 0 1 0 5)
(0 32 16 NULL NULL NULL NULL)
(1 32 24 NULL NULL NULL NULL)
(0 40 16 NULL NULL NULL NULL)
(5 40 24 5 5 0 0)
(5 40 24 1 1 0 0)
(1 40 24 NULL NULL NULL NULL)
(1 40 26 NULL NULL NULL NULL)
(0 42 24 NULL NULL NULL NULL)
(0 42 26 NULL NULL NULL NULL)
(5 40 28 1 1 0 0)
(1 40 28 NULL NULL NULL NULL)
(1 40 30 NULL NULL NULL NULL)
(0 42 28 NULL NULL NULL NULL)
(0 42 30 NULL NULL NULL NULL)
(0 44 24 NULL NULL NULL NULL)
(0 44 28 NULL NULL NULL NULL)
(0 48 0 NULL NULL NULL NULL)
(0 48 16 NULL NULL NULL NULL)
(5 32 32 5 0 0 0)
(5 32 32 1 0 5 0)
(1 32 32 NULL NULL NULL NULL)
(0 32 40 NULL NULL NULL NULL)
(5 40 32 5 5 0 0)
(5 40 32 1 1 0 0)
(1 40 32 NULL NULL NULL NULL)
(1 40 34 NULL NULL NULL NULL)
(0 42 32 NULL NULL NULL NULL)
(0 42 34 NULL NULL NULL NULL)
(5 40 36 1 1 0 0)
(1 40 36 NULL NULL NULL NULL)
(1 40 38 NULL NULL NULL NULL)
(0 42 36 NULL NULL NULL NULL)
(0 42 38 NULL NULL NULL NULL)
(0 44 32 NULL NULL NULL NULL)
(0 44 36 NULL NULL NULL NULL)
(0 40 40 NULL NULL NULL NULL)
(0 32 48 NULL NULL NULL NULL)
(0 48 32 NULL NULL NULL NULL)
(0 48 48 NULL NULL NULL NULL)
************************************************************
PostOrder Traversal:
(0 0 0 NULL NULL NULL NULL)
(0 0 16 NULL NULL NULL NULL)
(0 0 24 NULL NULL NULL NULL)
(0 8 16 NULL NULL NULL NULL)
(0 8 20 NULL NULL NULL NULL)
(0 12 16 NULL NULL NULL NULL)
(0 12 20 NULL NULL NULL NULL)
(1 12 22 NULL NULL NULL NULL)
(0 14 20 NULL NULL NULL NULL)
```

preANDpostOrder_SqaureData.txt — Edited

```
(0 32 48 NULL NULL NULL NULL)
(0 48 32 NULL NULL NULL NULL)
(0 48 48 NULL NULL NULL NULL)
************************************************************
PostOrder Traversal:
(0 0 0 NULL NULL NULL NULL)
(0 0 16 NULL NULL NULL NULL)
(0 0 24 NULL NULL NULL NULL)
(0 8 16 NULL NULL NULL NULL)
(0 8 20 NULL NULL NULL NULL)
(0 12 16 NULL NULL NULL NULL)
(0 12 20 NULL NULL NULL NULL)
(1 12 22 NULL NULL NULL NULL)
(0 14 20 NULL NULL NULL NULL)
(1 14 22 NULL NULL NULL NULL)
(5 12 20 0 1 0 1)
(5 8 16 0 0 0 5)
(1 8 24 NULL NULL NULL NULL)
(5 0 16 0 0 5 1)
(0 16 0 NULL NULL NULL NULL)
(1 16 4 NULL NULL NULL NULL)
(0 20 0 NULL NULL NULL NULL)
(1 20 4 NULL NULL NULL NULL)
(5 16 0 0 1 0 1)
(1 16 8 NULL NULL NULL NULL)
(0 24 0 NULL NULL NULL NULL)
(0 24 8 NULL NULL NULL NULL)
(5 16 0 5 1 0 0)
(1 16 16 NULL NULL NULL NULL)
(0 16 20 NULL NULL NULL NULL)
(1 20 16 NULL NULL NULL NULL)
(0 20 20 NULL NULL NULL NULL)
(5 16 16 1 0 1 0)
(0 16 24 NULL NULL NULL NULL)
(0 24 16 NULL NULL NULL NULL)
(0 24 24 NULL NULL NULL NULL)
(0 24 26 NULL NULL NULL NULL)
(1 26 24 NULL NULL NULL NULL)
(1 26 26 NULL NULL NULL NULL)
(5 24 24 0 0 1 1)
(0 24 28 NULL NULL NULL NULL)
(0 24 30 NULL NULL NULL NULL)
(1 26 28 NULL NULL NULL NULL)
(1 26 30 NULL NULL NULL NULL)
(5 24 28 0 0 1 1)
(1 28 24 NULL NULL NULL NULL)
(1 28 28 NULL NULL NULL NULL)
(5 24 24 5 5 1 1)
(5 16 16 5 0 0 5)
(5 0 0 0 5 5 5)
(0 0 32 NULL NULL NULL NULL)
(0 0 48 NULL NULL NULL NULL)
(1 0 56 NULL NULL NULL NULL)
(1 8 48 NULL NULL NULL NULL)
(0 8 56 NULL NULL NULL NULL)
(5 0 48 0 1 1 0)
(0 16 32 NULL NULL NULL NULL)
(0 16 40 NULL NULL NULL NULL)
(0 24 32 NULL NULL NULL NULL)
(0 24 34 NULL NULL NULL NULL)
(1 26 32 NULL NULL NULL NULL)
(1 26 34 NULL NULL NULL NULL)
(5 24 32 0 0 1 1)
(0 24 36 NULL NULL NULL NULL)
(0 24 38 NULL NULL NULL NULL)
(1 26 36 NULL NULL NULL NULL)
(1 26 38 NULL NULL NULL NULL)
(5 24 36 0 0 1 1)
(1 28 32 NULL NULL NULL NULL)
(1 28 36 NULL NULL NULL NULL)
(5 24 32 5 5 1 1)
(0 24 40 NULL NULL NULL NULL)
(5 16 32 0 0 5 0)
(0 16 48 NULL NULL NULL NULL)
(5 0 32 0 5 5 0)
(0 32 0 NULL NULL NULL NULL)
(0 32 16 NULL NULL NULL NULL)
(1 32 24 NULL NULL NULL NULL)
(0 40 16 NULL NULL NULL NULL)
(1 40 24 NULL NULL NULL NULL)
(1 40 26 NULL NULL NULL NULL)
(0 42 24 NULL NULL NULL NULL)
(0 42 26 NULL NULL NULL NULL)
(5 40 24 1 1 0 0)
(1 40 28 NULL NULL NULL NULL)
(1 40 30 NULL NULL NULL NULL)
(0 42 28 NULL NULL NULL NULL)
(0 42 30 NULL NULL NULL NULL)
(5 40 28 1 1 0 0)
(0 44 24 NULL NULL NULL NULL)
(0 44 28 NULL NULL NULL NULL)
(5 40 24 5 5 0 0)
(5 32 16 0 1 0 5)
(0 48 0 NULL NULL NULL NULL)
(0 48 16 NULL NULL NULL NULL)
(5 32 0 0 5 0 0)
(1 32 32 NULL NULL NULL NULL)
(0 32 40 NULL NULL NULL NULL)
(1 40 32 NULL NULL NULL NULL)
(1 40 34 NULL NULL NULL NULL)
(0 42 32 NULL NULL NULL NULL)
(0 42 34 NULL NULL NULL NULL)
(5 40 32 1 1 0 0)
(1 40 36 NULL NULL NULL NULL)
(1 40 38 NULL NULL NULL NULL)
(0 42 36 NULL NULL NULL NULL)
(0 42 38 NULL NULL NULL NULL)
(5 40 36 1 1 0 0)
(0 44 32 NULL NULL NULL NULL)
(0 44 36 NULL NULL NULL NULL)
(5 40 32 5 5 0 0)
(0 40 40 NULL NULL NULL NULL)
(5 32 32 1 0 5 0)
(0 32 48 NULL NULL NULL NULL)
(0 48 32 NULL NULL NULL NULL)
(0 48 48 NULL NULL NULL NULL)
(5 32 32 5 0 0 0)
(5 0 0 5 5 5 5)
```




debug_SquareData.txt — Edited

```
squareSize: 64
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0
0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

Not_SquareData: OutFile and QuadTree Representation

preANDpostOrder_NotSqaureData.txt

```
PreOrder Traversal:
(5 0 0 5 5 0 0)
(5 0 0 0 0 0 5)
(0 0 0 NULL NULL NULL NULL)
(0 0 16 NULL NULL NULL NULL)
(0 16 0 NULL NULL NULL NULL)
(5 16 16 5 5 5 5)
(5 16 16 0 0 0 1)
(0 16 16 NULL NULL NULL NULL)
(0 16 20 NULL NULL NULL NULL)
(0 20 16 NULL NULL NULL NULL)
(1 20 20 NULL NULL NULL NULL)
(5 16 24 0 0 5 1)
(0 16 24 NULL NULL NULL NULL)
(0 16 28 NULL NULL NULL NULL)
(5 20 24 1 1 5 5)
(1 20 24 NULL NULL NULL NULL)
(1 20 26 NULL NULL NULL NULL)
(5 22 24 1 1 0 0)
(1 22 24 NULL NULL NULL NULL)
(1 22 25 NULL NULL NULL NULL)
(0 23 24 NULL NULL NULL NULL)
(0 23 25 NULL NULL NULL NULL)
(5 22 26 1 1 0 0)
(1 22 26 NULL NULL NULL NULL)
(1 22 27 NULL NULL NULL NULL)
(0 23 26 NULL NULL NULL NULL)
(0 23 27 NULL NULL NULL NULL)
(1 20 28 NULL NULL NULL NULL)
(5 24 16 0 1 0 0)
(0 24 16 NULL NULL NULL NULL)
(1 24 20 NULL NULL NULL NULL)
(0 28 16 NULL NULL NULL NULL)
(0 28 20 NULL NULL NULL NULL)
(5 24 24 0 1 0 0)
(0 24 24 NULL NULL NULL NULL)
(1 24 28 NULL NULL NULL NULL)
(0 28 24 NULL NULL NULL NULL)
(0 28 28 NULL NULL NULL NULL)
(5 0 32 0 0 5 0)
(0 0 32 NULL NULL NULL NULL)
(0 0 48 NULL NULL NULL NULL)
(5 16 32 5 0 5 0)
(5 16 32 1 0 1 0)
(1 16 32 NULL NULL NULL NULL)
(0 16 36 NULL NULL NULL NULL)
(1 20 32 NULL NULL NULL NULL)
(0 20 36 NULL NULL NULL NULL)
(0 16 40 NULL NULL NULL NULL)
(5 24 32 1 0 0 0)
(1 24 32 NULL NULL NULL NULL)
(0 24 36 NULL NULL NULL NULL)
(0 28 32 NULL NULL NULL NULL)
(0 28 36 NULL NULL NULL NULL)
(0 24 40 NULL NULL NULL NULL)
(0 16 48 NULL NULL NULL NULL)
(0 32 0 NULL NULL NULL NULL)
(0 32 32 NULL NULL NULL NULL)
************************************************************
PostOrder Traversal:
(0 0 0 NULL NULL NULL NULL)
(0 0 16 NULL NULL NULL NULL)
(0 16 0 NULL NULL NULL NULL)
(0 16 16 NULL NULL NULL NULL)
(0 16 20 NULL NULL NULL NULL)
(0 20 16 NULL NULL NULL NULL)
(1 20 20 NULL NULL NULL NULL)
(5 16 16 0 0 0 1)
(0 16 24 NULL NULL NULL NULL)
(0 16 28 NULL NULL NULL NULL)
(1 20 24 NULL NULL NULL NULL)
(1 20 26 NULL NULL NULL NULL)
(1 22 24 NULL NULL NULL NULL)
(1 22 25 NULL NULL NULL NULL)
(0 23 24 NULL NULL NULL NULL)
(0 23 25 NULL NULL NULL NULL)
(5 22 24 1 1 0 0)
(1 22 26 NULL NULL NULL NULL)
(1 22 27 NULL NULL NULL NULL)
(0 23 26 NULL NULL NULL NULL)
(0 23 27 NULL NULL NULL NULL)
(5 22 26 1 1 0 0)
(5 20 24 1 1 5 5)
(1 20 28 NULL NULL NULL NULL)
(5 16 24 0 0 5 1)
(0 24 16 NULL NULL NULL NULL)
(1 24 20 NULL NULL NULL NULL)
(0 28 16 NULL NULL NULL NULL)
(0 28 20 NULL NULL NULL NULL)
(5 24 16 0 1 0 0)
(0 24 24 NULL NULL NULL NULL)
(1 24 28 NULL NULL NULL NULL)
(0 28 24 NULL NULL NULL NULL)
(0 28 28 NULL NULL NULL NULL)
(5 24 24 0 1 0 0)
(5 16 16 5 5 5 5)
(5 0 0 0 0 0 5)
(0 0 32 NULL NULL NULL NULL)
(0 0 48 NULL NULL NULL NULL)
(1 16 32 NULL NULL NULL NULL)
(0 16 36 NULL NULL NULL NULL)
(1 20 32 NULL NULL NULL NULL)
(0 20 36 NULL NULL NULL NULL)
(5 16 32 1 0 1 0)
(0 16 40 NULL NULL NULL NULL)
(1 24 32 NULL NULL NULL NULL)
(0 24 36 NULL NULL NULL NULL)
(0 28 32 NULL NULL NULL NULL)
(0 28 36 NULL NULL NULL NULL)
(5 24 32 1 0 0 0)
(0 24 40 NULL NULL NULL NULL)
(5 16 32 5 0 5 0)
(0 16 48 NULL NULL NULL NULL)
(5 0 32 0 0 5 0)
(0 32 0 NULL NULL NULL NULL)
(0 32 32 NULL NULL NULL NULL)
(5 0 0 5 5 0 0)
```

debug_NotSquareData.txt

squareSize: 64