CSC 381-34: Proj5A (JAVA)

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```
III. Algorithms
*******************************
step 0: inFile ← open input file
      - numRows, numCols, minVal, maxVal ← read from inFile
      - dynamically allocate zeroFramedAry and
        skeletonAry with extra 2 rows and 2 cols
      - open outFile_1, outFile_2, outFile_3, outFile_4

step 1: zeroFramed (ZeroFramedAry)

Step 2: loadImage (ZeroFramedAry)

step 3: fistPass_4Distance (ZeroFramedAry)

step 4: prettyPrintDistance (ZeroFramedAry, outFile_4)
           // with proper caption i.e., Pass-1 result

step 5: secondPass_4Distance  (ZeroFramedAry)
      // Note** In second pass, you need
      // to keep track the newMinVal and newMaxVal

Step 6: prettyPrintDistance (ZeroFramedAry, outFile_4)
           // with proper caption i.e., Pass-2 result

Step 7: output newMinVal and newMaxVal to outFile_1
        output newMinVal and newMaxVal to outFile_2
        output newMinVal and newMaxVal to outFile_3

Step 8:  outputDistance(ZeroFramedAry, outFile_1)
           // output the result of Pass-2 to outFile_1
           //(begin at ZeroFramedAry(1,1)
           // i.e., *without* the 2 extra rows and columns)

Step 9: prettyPrintDistance (ZeroFramedAry, outFile_4)
           // with proper caption i.e., Pass-2 result

step 10: compute_localMaxima(ZeroFramedAry, skeletonAry, outFile_3)
           // SEE the modification of this method in the above

Step 11:  outputSkelton(skeletonAry, outFile_2)
           // output the result of skeleton to outFile_2
           //(begin at ZeroFramedAry(1,1)
           // i.e., *without* the 2 extra rows and columns)

Step 12: prettyPrintSkeleton (skeletonAry, outFile_4)

Step 13: close all files
```

SOURCE CODE

```
/**
 * Project 5
 * Author: Swrajit Paul
 */

import java.io.*;
import java.util.Scanner;

public class Project5 {

	static int numRows;
	static int numCols;
	static int minVal;
	static int maxVal;
	static int newMinVal = 0;
	static int newMaxVal = 0;
	static int[][] zeroFramedAry;
	static int[][] skeletonAry;

   static FileInputStream fInput = null;
   static FileOutputStream fOutputone;
   static FileOutputStream fOutputtwo;
   static FileOutputStream fOutputthree;
   static FileOutputStream fOutputfour;

   static Scanner inputfile;

   public Project5() {

   }

   private static void loadImage(int[][] imgAry) {
		for(int i = 1; i < numRows+1; i++) {
			for(int j = 1; j < numCols+1; j++) {
				imgAry[i][j] = inputfile.nextInt();
			}
		}
	}

   private static void zeroFrame(int[][] imgAry) {
		for(int j = 0; j < numCols+2; j++) {
			imgAry[0][j] = 0;
			imgAry[numRows+1][j] = 0; }

		for(int j = 0; j < numRows+2; j++) {
			imgAry[j][0] = 0;
			imgAry[j][numCols+1] = 0;
		}
	}
```

```
private static void fistPass_4Distance (int[][] imgAry) {
	for(int i = 1; i < numRows+1; i++) {
			for(int j = 1; j < numCols+1; j++) {
				if (imgAry[i][j] > 0){
					int[] tempAry = new int[2];
					tempAry[0] = imgAry[i-1][j];
					tempAry[1] = imgAry[i][j-1];
					int min = 20000000;

					for(int k =0; k < 2; k++){
						if(tempAry[k] + 1 < min){
						min = tempAry[k] + 1; } }

					imgAry[i][j] = min;
				}
			}
		}
	}

private static void secondPass_4Distance (int[][] imgAry) {
	for(int i = numRows+1; i > 0; i--) {
			for(int j = numCols+1; j > 0; j--) {
				if (zeroFramedAry[i][j] > 0){
					int[] tempAry = new int[2];
					tempAry[0] = imgAry[i+1][j];
					tempAry[1] = imgAry[i][j+1];

					int min = 20000000;

					for(int k =0; k < 2; k++){
						if(tempAry[k] + 1 < min){
							min = tempAry[k] + 1;
						}
					}
					if (imgAry[i][j] > min){

						imgAry[i][j] = min;
					}
					if(imgAry[i][j] >= newMaxVal){
						newMaxVal = imgAry[i][j];
					}
				}
			}
		}
	}

private static int is_maxima (int[][] imgAry, int i, int j){

	int[] tempAry = new int[4];
		tempAry[0] = imgAry[i-1][j];
		tempAry[1] = imgAry[i][j-1];
```

```
                tempAry[2] = imgAry[i][j+1];
                tempAry[3] = imgAry[i+1][j];

                for(int k =0; k < 4; k++){
                        if (imgAry[i][j] < tempAry[k]){
                                return 0;
                        }
                }
          return 1;
        }

private static void compute_localMaxima(int[][] imgAry, int[][] skAry){
        PrintStream print = new PrintStream(fOutputthree);
        for(int i = 1; i < numRows+1; i++) {
                        for(int j = 1; j < numCols+1; j++) {
                                if (imgAry[i][j] > 0){
                                        if(is_maxima(imgAry, i,j) ==1){
                                                skeletonAry[i][j] = 1;
                                                print.println(i + " " + j + " " + imgAry[i][j]);
                                        }
                                        else{
                                                skeletonAry[i][j] = 0;
                                        }
                                }
                        }
                }
        }

private static void outputDistance(int[][] imgAry,  FileOutputStream oFile) {
        PrintStream print = new PrintStream(oFile);
        for(int i = 1; i < numRows+1; i++) {
                        for(int j = 1; j < numCols+1; j++) {
                                print.print(imgAry[i][j] + " ");
                        }
                        print.println();
                }
        }

private static void outputSkeleton(int[][] imgAry,  FileOutputStream oFile) {
        PrintStream print = new PrintStream(oFile);
        for(int i = 1; i < numRows+1; i++) {
                        for(int j = 1; j < numCols+1; j++) {
                                print.print(imgAry[i][j] + " ");
                        }
                        print.println();
                }
        }

private static void prettyPrintDistance (int[][] imgAry, String pass) {
        PrintStream print = new PrintStream(fOutputfour);
        print.println(pass);
```

```
            for(int i = 0; i < numRows+1; i++) {
                    for(int j = 1; j < numCols+1; j++) {
                            if (imgAry[i][j] == 0)
                                    print.print("   ");
                            else {
                                    if(imgAry[i][j] / 10 == 0)
                                            print.print(imgAry[i][j] + "  ");
                                    else
                                            print.print(imgAry[i][j] + " ");
                            }
                    }
                    print.println();
            }
            print.println();
    }

private static void prettyPrintSkeleton (int[][] imgAry) {
    PrintStream print = new PrintStream(fOutputfour);
            for(int i = 1; i < numRows+1; i++) {
                    for(int j = 1; j < numCols+1; j++) {
                            if (imgAry[i][j] == 0)
                                    print.print(".");
                            else {
                                    print.print("9");
                            }
                    }
                    print.println();
            }
            print.println();
    }

    public static void main(String[] args) {

            try {

                    String inputone = args[0];
                    String outputone = args[1];
                    String outputtwo = args[2];
                    String outputthree = args[3];
                    String outputfour = args[4];
                    fInput = new FileInputStream(inputone);
                    fOutputone = new FileOutputStream(outputone);
                    fOutputtwo = new FileOutputStream(outputtwo);
                    fOutputthree = new FileOutputStream(outputthree);
                    fOutputfour = new FileOutputStream(outputfour);

            } catch (IOException e) {
                    System.out.println("one of the arguments in missing or wrong");
            }
```

```
		inputfile = new Scanner(fInput);
		numRows = inputfile.nextInt();
		numCols = inputfile.nextInt();
		minVal = inputfile.nextInt();
		maxVal = inputfile.nextInt();

		zeroFramedAry = new int[numRows+2][numCols+2];
		skeletonAry = new int[numRows+2][numCols+2];

		zeroFrame(zeroFramedAry);

		loadImage(zeroFramedAry);

		fistPass_4Distance (zeroFramedAry);

		prettyPrintDistance(zeroFramedAry, "pass-1");

		secondPass_4Distance(zeroFramedAry);

		prettyPrintDistance(zeroFramedAry, "pass-2");

		PrintStream print = new PrintStream(fOutputone);
	print.println(numRows + " " + numCols + " " + newMinVal + " " + newMaxVal );
	PrintStream print1 = new PrintStream(fOutputtwo);
	print1.println(numRows + " " + numCols + " " + newMinVal + " " + newMaxVal );
	PrintStream print11 = new PrintStream(fOutputthree);
	print11.println(numRows + " " + numCols + " " + newMinVal + " " + newMaxVal );

	outputDistance(zeroFramedAry, fOutputone);
		compute_localMaxima(zeroFramedAry, skeletonAry);
		outputSkeleton(skeletonAry, fOutputtwo);
		prettyPrintSkeleton(skeletonAry);

		inputfile.close();
		try {
			fInput.close();
			fOutputone.close();
			fOutputtwo.close();
			fOutputthree.close();
			fOutputfour.close();
		} catch (IOException e) {

			e.printStackTrace();
		}
	}

}
```

INPUT

INPUT 1

```
25 40 0 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 0 0 0 0 0 0 0 0 0
0 0 0 0 0 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 0 0 0 0 0 0 0 0
0 0 0 0 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 0 0 0 0 0 0 0
0 0 0 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 0 0 0 0 0 0
0 0 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 0 0 0 0 0
0 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 0 0 0 0
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 0 0 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 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 1 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 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 1 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 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 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 1 1 1 1 1 1 1 1 1 1 1 1 1 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 1 1 1 1 1 1 1 1 1 1 1 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 1 1 1 1 1 1 1 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 1 1 1 1 1 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 1 1 1 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 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 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 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 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 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 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
```

INPUT 2

```
40 22 0 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 1 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 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 0 0 0 0 0 0 0
0 0 0 0 0 0 0 1 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 0 0 0 0 0
0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0
0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0
0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0
0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0
0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0
0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0
0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0
0 0 0 0 0 0 1 1 1 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 0 0 0 0 0 0
0 0 0 0 0 0 0 0 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 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 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 0 0 0 0 0 0 0
0 0 0 0 0 0 0 1 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 0 0 0 0 0
```

```
0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0
0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0
0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0
0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0
0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0
0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0
0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0
0 0 0 0 0 0 1 1 1 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 0 0 0 0 0 0
0 0 0 0 0 0 0 0 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 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 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
```

OUTPUT

OUTPUT For DATA 1

Output file one

```
25 40 0 9
0 0 0 0 0 0 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 0 0 0 0 0 0 0 0 0
0 0 0 0 0 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 2 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 1 2 3 2 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 1 2 3 4 3 2 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 2 3 4 5 4 3 2 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 2 3 4 5 6 5 4 3 2 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 1 2 3 4 5 6 7 6 5 4 3 2 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 1 2 3 4 5 6 7 8 7 6 5 4 3 2 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 2 3 4 5 6 7 8 9 8 7 6 5 4 3 2 1 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 2 3 4 5 5 6 7 8 9 8 7 6 5 5 4 3 2 1
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 2 3 4 4 5 6 7 8 7 6 5 4 4 3 2 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 2 3 3 4 5 6 7 6 5 4 3 3 2 1 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 1 2 2 3 4 5 6 5 4 3 2 2 1 0 0 0
0 0 0 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 0 0 0 0 0 0 1 1 2 3 4 5 4 3 2 1 1 0 0 0 0
0 0 0 1 2 3 3 3 3 3 3 3 3 3 3 3 3 2 1 0 0 0 0 0 0 0 0 1 2 3 4 3 2 1 0 0 0 0 0 0
0 0 0 1 2 3 4 4 4 4 4 4 4 4 4 4 3 2 1 0 0 0 0 0 0 0 0 0 1 2 3 2 1 0 0 0 0 0 0 0
0 0 0 1 2 3 4 5 5 5 5 5 5 5 5 4 3 2 1 0 0 0 0 0 0 0 0 0 0 1 2 1 0 0 0 0 0 0 0 0
0 0 0 1 2 3 4 5 6 6 6 6 6 6 5 4 3 2 1 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0
0 0 0 1 2 3 4 5 6 6 6 6 6 6 5 4 3 2 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 2 3 4 5 5 5 5 5 5 5 5 4 3 2 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 2 3 4 4 4 4 4 4 4 4 4 4 3 2 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 2 3 3 3 3 3 3 3 3 3 3 3 3 2 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 2 2 2 2 2 2 2 2 2 2 2 2 2 2 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 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
```

Output file two

```
25 40 0 9
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

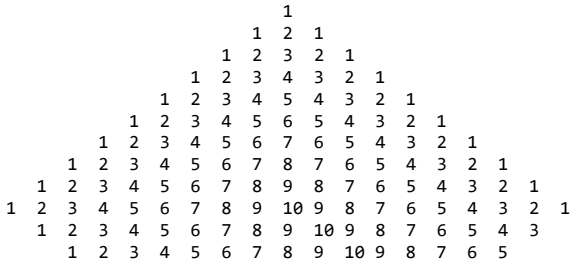
```
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 1 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 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 1 0 0 0 0 0 0 0 0 0 0 0 0 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 1 0 0 0 0 0 0 0 0 0 0 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 1 0 0 0 0 0 0 0 0 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 1 0 0 0 0 0 0 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 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 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 1 0 0 0 0 0 0 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 1 0 0 0 0 0 0 0 0 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 1 0 0 0 0 0 0 0 0 0 0 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 1 0 0 0 0 0 0 0 0 0 0 0 0 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 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 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
```

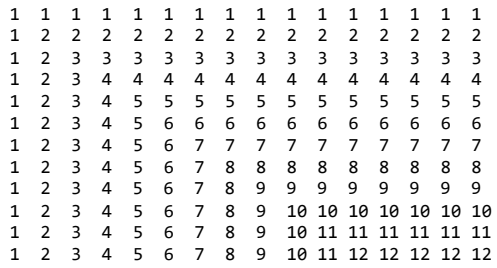
Output file three

```
25 40 0 9
9 31 9
10 26 5
10 31 9
10 36 5
13 4 1
13 19 1
14 5 2
14 18 2
15 6 3
15 17 3
16 7 4
16 16 4
17 8 5
17 15 5
18 9 6
18 10 6
18 11 6
18 12 6
18 13 6
18 14 6
19 9 6
19 10 6
19 11 6
19 12 6
19 13 6
19 14 6
20 8 5
20 15 5
21 7 4
21 16 4
22 6 3
22 17 3
23 5 2
23 18 2
24 4 1
24 19 1
```

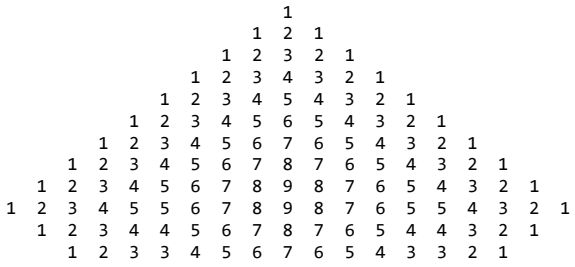
Output file four

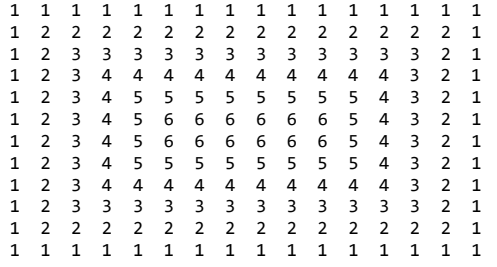
```
pass-1
```

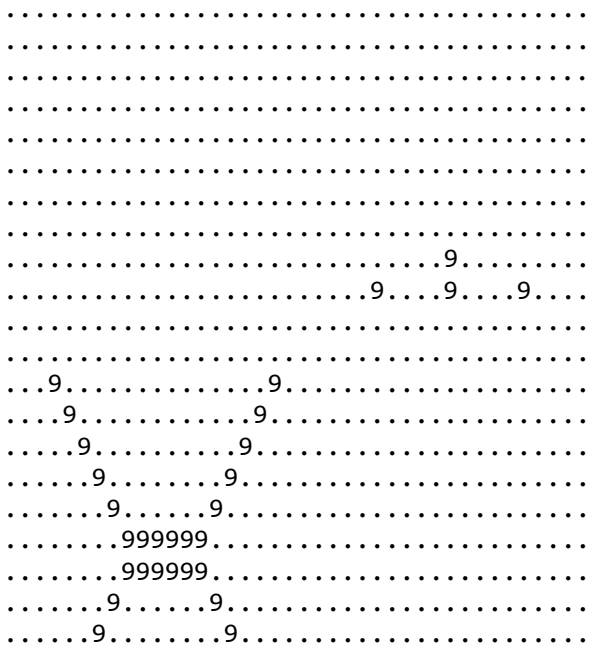




pass-2







```
.....9..........9.......................
....9............9......................
...9..............9.....................
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```

<u>Output for Data 2</u>

<u>Output file one</u>

```
40 22 0 10
0 0 0 0 0 0 0 0 0 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 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 1 2 1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 1 2 3 2 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1 2 3 4 3 2 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 1 2 3 4 5 4 3 2 1 0 0 0 0 0 0
0 0 0 0 0 0 1 2 3 4 5 6 5 4 3 2 1 0 0 0 0 0
0 0 0 0 0 1 2 3 4 5 6 7 6 5 4 3 2 1 0 0 0 0
0 0 0 0 1 2 3 4 5 6 7 8 7 6 5 4 3 2 1 0 0 0
0 0 0 1 2 3 4 5 6 7 8 9 8 7 6 5 4 3 2 1 0 0
0 0 1 2 3 4 5 6 7 8 9 10 9 8 7 6 5 4 3 2 1 0
0 0 0 1 2 3 4 5 6 7 8 9 8 7 6 5 4 3 2 1 0 0
0 0 0 0 1 2 3 4 5 6 7 8 7 6 5 4 3 2 1 0 0 0
0 0 0 0 0 1 2 3 4 5 6 7 6 5 4 3 2 1 0 0 0 0
0 0 0 0 0 0 1 2 3 4 5 6 5 4 3 2 1 0 0 0 0 0
0 0 0 0 0 0 0 1 2 3 4 5 4 3 2 1 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1 2 3 4 3 2 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 1 2 3 2 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 1 2 1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 1 2 1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 1 2 3 2 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1 2 3 4 3 2 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 1 2 3 4 5 4 3 2 1 0 0 0 0 0 0
0 0 0 0 0 0 1 2 3 4 5 6 5 4 3 2 1 0 0 0 0 0
0 0 0 0 0 1 2 3 4 5 6 7 6 5 4 3 2 1 0 0 0 0
0 0 0 0 1 2 3 4 5 6 7 8 7 6 5 4 3 2 1 0 0 0
0 0 0 1 2 3 4 5 6 7 8 9 8 7 6 5 4 3 2 1 0 0
0 0 1 2 3 4 5 6 7 8 9 10 9 8 7 6 5 4 3 2 1 0
0 0 0 1 2 3 4 5 6 7 8 9 8 7 6 5 4 3 2 1 0 0
0 0 0 0 1 2 3 4 5 6 7 8 7 6 5 4 3 2 1 0 0 0
0 0 0 0 0 1 2 3 4 5 6 7 6 5 4 3 2 1 0 0 0 0
0 0 0 0 0 0 1 2 3 4 5 6 5 4 3 2 1 0 0 0 0 0
0 0 0 0 0 0 0 1 2 3 4 5 4 3 2 1 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1 2 3 4 3 2 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 1 2 3 2 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 1 2 1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 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
```

<u>Output file two</u>

```
40 22 0 10
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

```
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 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 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 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 0 0
0 0 0 0 0 0 0 0 0 0 0 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
```

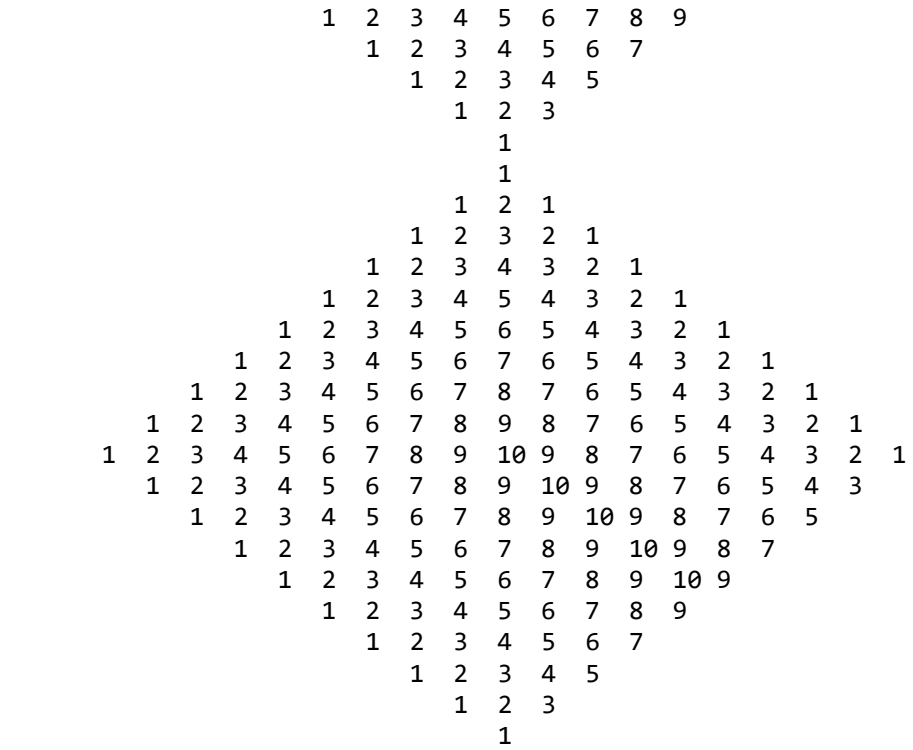
Output file three

```
40 22 0 10
11 12 10
30 12 10
```

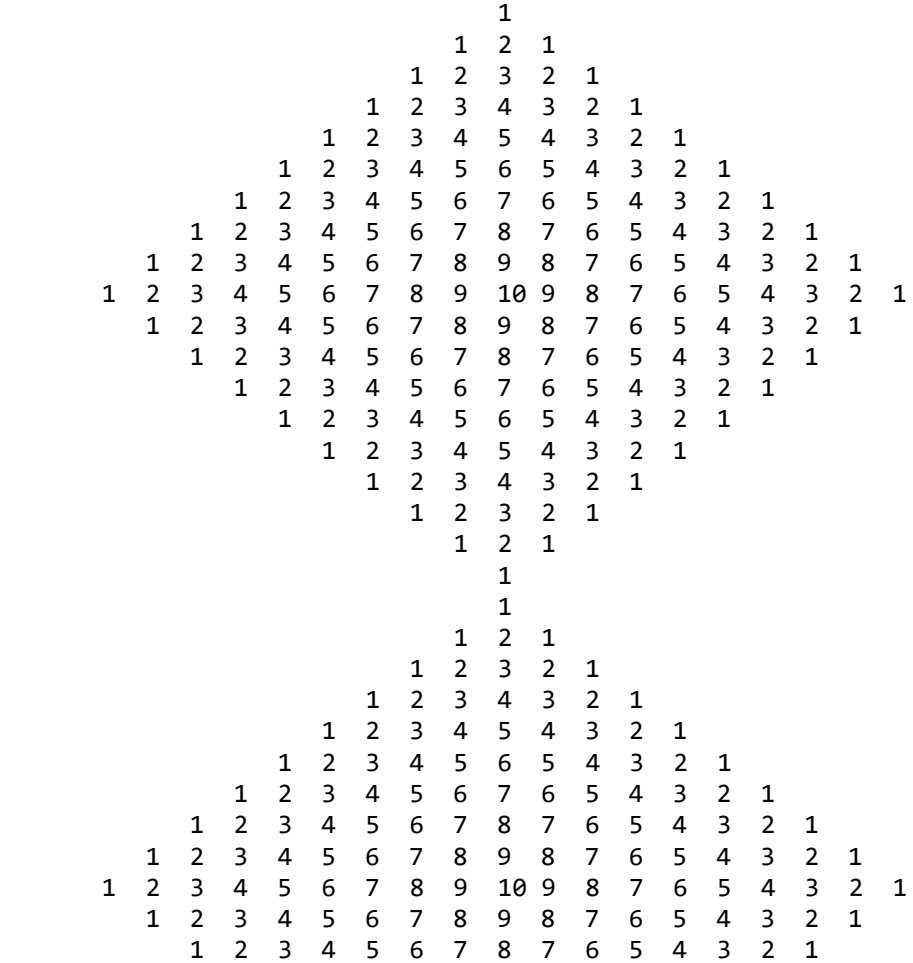
Output file four

```
pass-1

                           1
                        1  2  1
                     1  2  3  2  1
                  1  2  3  4  3  2  1
               1  2  3  4  5  4  3  2  1
            1  2  3  4  5  6  5  4  3  2  1
         1  2  3  4  5  6  7  6  5  4  3  2  1
      1  2  3  4  5  6  7  8  7  6  5  4  3  2  1
   1  2  3  4  5  6  7  8  9  8  7  6  5  4  3  2  1
1  2  3  4  5  6  7  8  9  10 9  8  7  6  5  4  3  2  1
   1  2  3  4  5  6  7  8  9  10 9  8  7  6  5  4  3
      1  2  3  4  5  6  7  8  9  10 9  8  7  6  5
         1  2  3  4  5  6  7  8  9  10 9  8  7
            1  2  3  4  5  6  7  8  9  10 9
```



pass-2



```
            1  2  3  4  5  6  7  6  5  4  3  2  1
               1  2  3  4  5  6  5  4  3  2  1
                  1  2  3  4  5  4  3  2  1
                     1  2  3  4  3  2  1
                        1  2  3  2  1
                           1  2  1
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