CV Project 1: Histogram. C++

**Student:** Pawan Bhatta

**Project Due Date:** 02/14/2021

**Algorithm for Computing Histogram:**

Step 1: Input← given gray-scale image (input file)

Output ← open output files (for histogram)

Step 2: numRows, numCols, minVal, maxVal ← get from input

hist[maxVal] ← dynamically allocate the hist array and initialize to 0

Step 3: Process the input file from Left→Right , Top→Bottom

Pixel P(x, y).value ← read from input

hist[P(x, y).value] + +

Step 4: Repeat step 3 until the file is empty

Step 5: Output ← histogram array to output file

Step 6: Close input file and output file

**Algorithm for Applying Threshold Operation:**

Step 1: minVal←0

maxVal←1

Step 2: outFile3, outFile4 ← output numRows, numCols, minVal, and maxVal

Step 3: pixelVal ← read from inFile one integer at a time

Step 4: if pixelVal >=thrVal

outFile3←write ”1 ”

outFile4←write ”1 ”

else

outFile3←write ”0 ”  
 outFile4←write ”. ”

Step 5: Repeat step 3 to 4 until the inFile is empty

**Source Code:**

#include <iostream>

#include <fstream>

using namespace std;

const int MAX\_PLUS = 70;

int toInt(string input)

{

return stoi(input);

}

string getPlus(int numberOfPlus)

{

string returnVal = "";

if (numberOfPlus > MAX\_PLUS)

{

numberOfPlus = MAX\_PLUS;

}

for (int k = 0; k < numberOfPlus; k++)

{

returnVal = returnVal + "+";

}

return returnVal;

}

class Image

{

public:

int numRows, numCols, minVal, maxVal;

int \*histAry;

int thresholdValue;

void computeHist(ifstream &input)

{

for (int i{0}; i < this->numRows; ++i)

{

for (int j{0}; j < this->numCols; ++j)

{

int pixelValue;

input >> pixelValue;

histAry[pixelValue]++;

}

}

}

void printHist(ofstream &output)

{

output << this->numRows << " " << this->numCols << " " << this->minVal << " " << this->maxVal << endl;

for (int i = 0; i < maxVal + 1; ++i)

{

output << i << " " << histAry[i] << endl;

}

}

void dispHist(ofstream &output)

{

output << numRows << " " << numCols << " " << minVal << " " << maxVal << " " << endl;

for (int i = 0; i < maxVal + 1; ++i)

{

output << i << " "

<< "(" << histAry[i] << ") "

<< ": " << getPlus(histAry[i]) << endl;

}

}

void threshold(ifstream &input, ofstream &output3, ofstream &output4, int thrVal)

{

Image binaryImg;

binaryImg.minVal = 0;

binaryImg.maxVal = 1;

int anon;

input >> binaryImg.numRows >> binaryImg.numCols >> anon >> anon;

output3 << binaryImg.numRows << " " << binaryImg.numCols << " " << binaryImg.minVal << " " << binaryImg.maxVal << " " << endl;

output4 << binaryImg.numRows << " " << binaryImg.numCols << " " << binaryImg.minVal << " " << binaryImg.maxVal << " " << endl;

for (int i{0}; i < this->numRows; ++i)

{

for (int j{0}; j < this->numCols; ++j)

{

int pixelValue;

input >> pixelValue;

if (pixelValue >= thrVal)

{

output3 << "1 ";

output4 << "1 ";

}

else

{

output3 << "0 ";

output4 << ". ";

}

}

output3 << endl;

output4 << endl;

}

};

};

int main(int argc, const char \*argv[])

{

//READ

string inputName = argv[1]; //(1) get the input file

ifstream input; //(2) instantiate the input

input.open(inputName); //(3) tell the input object

//WRITES

string outputName1{argv[3]}, outputName2{argv[4]}, outputName3{argv[5]}, outputName4{argv[6]};

ofstream output1, output2, output3, output4;

output1.open(outputName1);

output2.open(outputName2);

output3.open(outputName3);

output4.open(outputName4);

if (input.is\_open())

{

if (output1.is\_open() && output2.is\_open() && output3.is\_open() && output4.is\_open())

{

Image img;

input >> img.numRows >> img.numCols >> img.minVal >> img.maxVal;

img.histAry = new int[img.maxVal + 1](); //dynamically alloacted and initialized to zero

img.computeHist(input);

img.printHist(output1);

img.dispHist(output2);

input.close();

input.open(inputName);

int thrVal = toInt(argv[2]);

output3 << "The threshold value uses is " << thrVal << endl;

output4 << "The threshold value uses is " << thrVal << endl;

img.threshold(input, output3, output4, thrVal);

}

else

{

cout << "Error: Some output files couldnt be opened" << endl;

}

}

else

{

cout << "Error: " << inputName << endl;

};

output1.close();

output2.close();

output3.close();

output4.close();

return 0;

}

Output outFile1 for data 1:

31 40 0 9

0 309

1 288

2 194

3 64

4 0

5 2

6 12

7 106

8 124

9 141

Output outFile2 for data 1:

31 40 0 9

0 (309) : ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

1 (288) : ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

2 (194) : ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

3 (64) : ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

4 (0) :

5 (2) : ++

6 (12) : ++++++++++++

7 (106) : ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

8 (124) : ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

9 (141) : ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

Output outFile3 for data 1:

The threshold value uses is 5

31 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 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 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 1 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 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 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 1 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 0 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 0 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 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 1 1 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 1 1 1 1 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 1 1 1 1 1 1 1 1 1 1 1 1 1 0 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 1 1 1 1 1 1 1 1 1 1 1 1 1 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 1 1 1 1 1 1 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 1 0 0 0 0 0 1 1 1 1 1 0 0 1 1 1 1 1 1 1 1 1 0 0 1 1 1 1 1 0 0 0 0 1 0 0 0

0 0 1 0 0 0 0 0 0 0 1 1 1 1 0 0 1 1 1 1 1 1 1 1 1 0 0 1 1 1 1 0 0 0 0 0 1 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 1 1 1 1 1 1 1 0 0 1 1 0 0 0 0 0 0

0 0 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 1 0 0 0 1 1 0 0 0 0 0 0

0 0 0 1 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 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 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 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 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 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 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0

0 0 1 1 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 1 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 1 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 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 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

Output outFile4 for data 1:

The threshold value uses is 5

31 40 0 1

. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

. . . 1 . . . . . 1 . . . . . . . . . . 1 . . . . . . . . . . . . 1 1 . . 1 . .

. . . . . . . . . . . . . . . . . . . 1 1 1 . . . . . . . . . . . . . . . . . .

. . . . . 1 . . . . . . . . . . . . 1 1 1 1 1 . . . . . . . . . . . . . . . . .

. . . . . . . . . . . . . . . . . 1 1 1 1 1 1 1 . . . . . . . . . . . . . . . .

. . . . . . . . . . . . . . . . 1 1 1 1 1 1 . 1 1 . . . . . . . . . . . . . . .

. . . . . . . . . . . . . . . 1 1 1 1 1 1 . 1 1 1 1 . . . . . . . . . . . . . .

. . . . . . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . . .

. . . . . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . .

. . . . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . .

. . . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 . . 1 1 1 1 1 1 . . . . . . . . . .

. . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . . . . . . . .

. . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . . . . . . .

. . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 . 1 1 1 1 1 1 1 1 1 1 1 . . . . . . .

. . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . .

. . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . . . . . .

. . . 1 . . . . . 1 1 1 1 1 . . 1 1 1 1 1 1 1 1 1 . . 1 1 1 1 1 . . . . 1 . . .

. . 1 . . . . . . . 1 1 1 1 . . 1 1 1 1 1 1 1 1 1 . . 1 1 1 1 . . . . . 1 . . .

. . . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 . 1 1 1 1 1 1 1 . . 1 1 . . . . . .

. . 1 . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . . 1 1 . . . . . .

. . . 1 . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 . 1 1 1 . . . . . . . . . . . .

. . . . . . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . . .

. . . . . . . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . . . .

. . . . . . . . . . . . . . . . 1 1 1 1 1 1 1 1 1 . . . . . . . . 1 1 . . . . .

. . . . . . . . . . . . . . . . . 1 1 1 1 1 1 1 . . . . . . . . . 1 1 . . . . .

. . 1 1 . . . . . . . . . . . . . . 1 1 1 1 1 . . . . . . . . . . . . . . . . .

. . . 1 . . . . . . . . . . . . . . . 1 1 1 . . . . . . . . . . 1 . . . . . . .

. . . . . . . . . . . . 1 . . . . . . . 1 . . . . . . . . . . . . . . 1 . . . .

. . . . . . . . . 1 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

Output outFile1 for data 2:

46 46 1 63

0 0

1 277

2 278

3 270

4 319

5 278

6 7

7 6

8 35

9 4

10 5

11 7

12 8

13 6

14 9

15 3

16 3

17 0

18 12

19 1

20 3

21 4

22 7

23 3

24 7

25 3

26 0

27 3

28 15

29 3

30 7

31 7

32 7

33 2

34 10

35 10

36 0

37 0

38 25

39 1

40 7

41 19

42 18

43 18

44 13

45 8

46 2

47 2

48 313

49 0

50 0

51 8

52 2

53 1

54 2

55 11

56 0

57 0

58 25

59 0

60 9

61 1

62 2

63 10

Output outFile2 for data 2:

46 46 1 63

0 (0) :

1 (277) : ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

2 (278) : ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

3 (270) : ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

4 (319) : ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

5 (278) : ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

6 (7) : +++++++

7 (6) : ++++++

8 (35) : +++++++++++++++++++++++++++++++++++

9 (4) : ++++

10 (5) : +++++

11 (7) : +++++++

12 (8) : ++++++++

13 (6) : ++++++

14 (9) : +++++++++

15 (3) : +++

16 (3) : +++

17 (0) :

18 (12) : ++++++++++++

19 (1) : +

20 (3) : +++

21 (4) : ++++

22 (7) : +++++++

23 (3) : +++

24 (7) : +++++++

25 (3) : +++

26 (0) :

27 (3) : +++

28 (15) : +++++++++++++++

29 (3) : +++

30 (7) : +++++++

31 (7) : +++++++

32 (7) : +++++++

33 (2) : ++

34 (10) : ++++++++++

35 (10) : ++++++++++

36 (0) :

37 (0) :

38 (25) : +++++++++++++++++++++++++

39 (1) : +

40 (7) : +++++++

41 (19) : +++++++++++++++++++

42 (18) : ++++++++++++++++++

43 (18) : ++++++++++++++++++

44 (13) : +++++++++++++

45 (8) : ++++++++

46 (2) : ++

47 (2) : ++

48 (313) : ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

49 (0) :

50 (0) :

51 (8) : ++++++++

52 (2) : ++

53 (1) : +

54 (2) : ++

55 (11) : +++++++++++

56 (0) :

57 (0) :

58 (25) : +++++++++++++++++++++++++

59 (0) :

60 (9) : +++++++++

61 (1) : +

62 (2) : ++

63 (10) : ++++++++++

Output outFile3 for data 2:

The threshold value uses is 38

46 46 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 1 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 1 1 0 0 0 0 0 0 0 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 1 1 0 0 0 0 0 0 0 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 1 0 0 0 0 0 0 0 0 0 0 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 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 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 1 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 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 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 0 0 0 0 1 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 1 0 1 1 1 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 1 0 0 0 1 1 1 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 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 0 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 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 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 0 0 0 0 0 0 0 0 0 1 1 1 1 0 1 1 1 0 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 1 1 1 0 1 1 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 1 1 1 1 1 1 0 1 1 1 1 1 1 1 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 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 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 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 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 1 1 1 0 1 1 1 0 1 1 1 1 1 0 1 1 1 1 0 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0

0 0 1 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 1 1 0 1 1 0 1 1 1 1 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 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 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 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0

0 0 0 1 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 1 0 1 1 1 0 1 1 1 1 1 1 0 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 1 1 1 0 0 1 1 1 1 1 0 1 1 1 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 1 1 0 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 0 0 1 1 1 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 1 1 1 0 0 0 1 1 1 1 1 1 1 1 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 1 1 1 1 1 1 1 0 0 1 1 1 1 1 1 0 1 1 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 1 1 1 1 0 1 1 1 1 1 1 0 1 1 1 1 1 1 1 0 0 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 0 0 0 0 0 0 0 0 0 0 0 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 1 1 1 1 1 1 1 1 1 0 1 1 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 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 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0

0 0 0 0 1 1 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 1 1 1 0 0 0 0 0 1 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 1 0 1 0 0 0 1 1 0 1 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 1 1 1 1 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 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 0 0 0 0 0 0 0 0 1 1 0 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 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 1 0 0 0 0 1 0 0 0 0 0

0 0 0 0 1 0 0 0 0 0 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 0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 1 1 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 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 1 0 0 0 1 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 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

Output outFile4 for data 2:

The threshold value uses is 38

46 46 0 1

. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

. . . . . 1 . . . . . . . . . . . . . . . . . . . . . . 1 . . . . . . . . . . . . . . . . .

. . . . . . . . . . 1 1 . . . . . . . . . . . 1 . . . . 1 . . . . . . . . . . . . . . . . .

. . . . . . . . . . 1 1 . . . . . . . . . . . 1 . . . . 1 . . . . . . . . . . . . . . . . .

. . . . . . . . 1 . . . . . . . . . . . . . . 1 . . . . 1 . . . . . . . . . . . . . . . . .

. . . . . . . . . 1 . . . . . . . . . . . . . 1 . . . . . 1 . . . . . . . . . . . . . . . .

. . . . . . . . . 1 . . . . . . . . . . . . . 1 . . . . . 1 . . . . . . . . . . . . . . . .

. . . . . . . . 1 . . . . . . . . . . . . . . . . . . . . . 1 . . . . 1 . . . . . . . . . .

. . . . . . . . . . . . . . . . . . . . . . 1 1 1 . . . . 1 . . . . . . . . . . . . . . . .

. . . 1 . . . . . . . . . . . . . . . . . 1 . 1 1 1 . . 1 . . . . . . . . . . . . . . . . .

. . . . . . . . . . . . . . . . . . . . 1 . . . 1 1 1 . . 1 . . . . . . . . . . . . . . . .

. . . . . 1 1 . . . . . . . . . . . . 1 1 1 . . 1 1 1 1 . . . . . . . . . . . . . . . . . .

. . . . . 1 1 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1 . . . . . .

. . . . . . . . . . . . . . . 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . . . . . . . . . . . .

. . . . . . . . . . . . . . . . . 1 1 1 1 . 1 1 1 . 1 1 1 1 . . . . . . . . . . . . . . . .

. . . . . . . . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 1 . 1 1 . . . . . . . . . 1 . . . . .

. . . . . . . . . . . . . . . 1 1 1 1 1 1 1 1 1 . 1 1 1 1 1 1 1 . . . 1 . . . . . . . . . .

. . . . . . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . 1 . . . . . . . . . . . . .

. . . . . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . 1 1 1 . . . . . . . . . . . .

. . . . . . . . . . . . 1 1 1 . 1 1 1 . 1 1 1 1 1 . 1 1 1 1 . 1 1 1 1 . . . . . . . . . . .

. . 1 . . . . . . . . 1 1 1 1 1 1 1 1 1 . 1 1 1 1 1 1 1 . 1 1 . 1 1 1 1 . . . . . . . . . .

. . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . . 1 1 1 1 1 1 1 . . . . . . . .

. . . . . . . . . . . . . . . 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . . . . . . . . . . . .

. . . . . . . . 1 1 1 1 1 1 . 1 1 1 1 1 1 1 1 1 1 1 1 1 . . . 1 1 1 1 1 1 1 1 . . . . . . .

. . . 1 1 1 1 1 1 . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . 1 . 1 1 1 . 1 1 1 1 1 1 . 1 1 . .

. . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . 1 1 1 . . 1 1 1 1 1 . 1 1 1 . . . . . . .

. . . . . . . . . 1 1 . 1 1 1 1 1 . 1 1 1 1 1 1 1 1 1 1 1 . . 1 1 1 . 1 1 1 . . . . . . . .

. . . . . . . . . . 1 1 1 1 1 1 1 1 . . . 1 1 1 1 1 1 1 1 . . . 1 1 1 1 1 . . . . . . . . .

. . . . . . . . . . . 1 1 1 1 1 1 1 . . 1 1 1 1 1 1 . 1 1 . . . . 1 1 1 . . . . . . . . . .

. . . . . . . . . . . . 1 1 1 1 . 1 1 1 1 1 1 . 1 1 1 1 1 1 1 . . 1 1 . . . . . . . . . . .

. . . . . . . . . . . . . . . 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . . . . . . . . . . . .

. . . . . . . . . . . . . 1 1 1 1 1 . 1 1 1 1 1 1 1 1 1 . 1 1 . . 1 . . . . . . . . . . . .

. . . . . . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . . . . .

. . . . . . . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . 1 1 . . . . . . . . 1 . . . . .

. . . . 1 1 . 1 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

. . . . . . . . . . . . . . . . . 1 1 1 . . . . . 1 . . . 1 . . . . . . . . . . . . . . . .

. . . . . . . . . . . . . . . . . . 1 1 . 1 . . . 1 1 . 1 . . . . . . . . . . . . . . . . .

. . . . . 1 . . . . . . . . . . . . . 1 1 1 1 . . 1 1 1 . . . . . . . . . . . . . . . . . .

. . . . . . . . . . . . . . . . . . . . 1 1 1 1 1 1 1 . . . . . . . . . . . . . . . . . . .

. . . . . . . . . . . . . . . . . . . . . 1 1 . 1 1 . . . . . . . . . . . . . . . . . . . .

. . . . 1 . . . . . . . . . . . . . . . . . 1 1 1 . . . . . . . . . . 1 . . . . 1 . . . . .

. . . . 1 . . . . . 1 1 . . . . . . . . . . . 1 . . . . . . . . . . . . . . . . . . . . . .

. . . . . 1 1 . . . . . . . . . . . . . . . . 1 . . . . . . . . . . 1 . . . . . . . . . . .

. . . . . . . . . . . . . . . . . . . . . . . 1 . . . . . . . . . 1 1 . . . 1 . . . . . . .

. . . . . . . . . 1 . . . . . . . . . . . . . 1 . . . . . . . . . . . . . . . . . . . . . .

. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .