CV Project 4 Connected Components
Java
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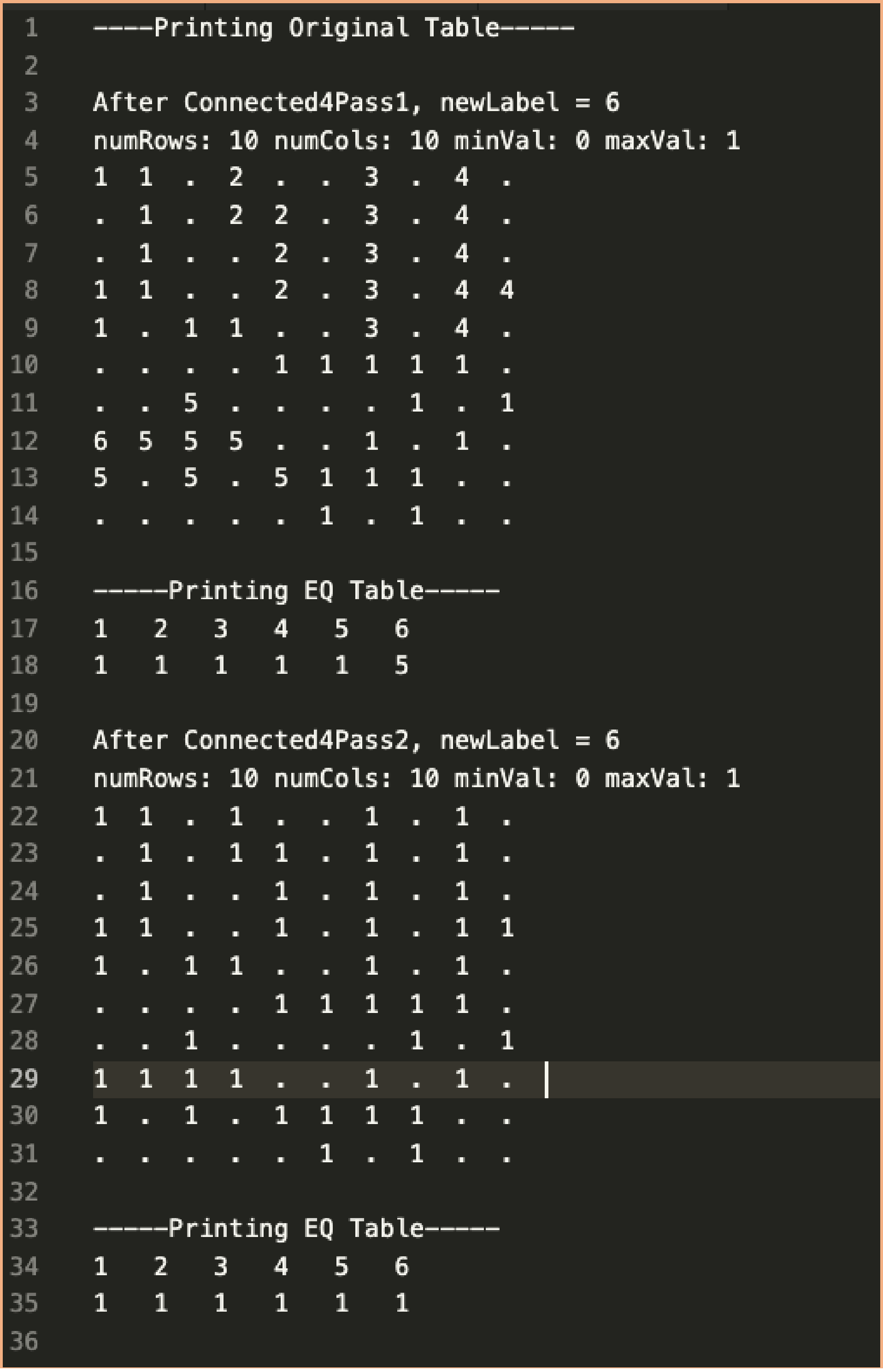
Project Due 03/19/23

Algorithm Steps

```
step 0: inFile-->open the input file from argv [1]
Connectness-->argv [2]  option-->argv [3]  RFprettyPrintFile, labelFile, propertyFile, deBugFile-->open
from argv []
numRows, numCols, minVal, maxVal-->read from inFile zeroFramedAry-->dynamically allocate.
newLabel --> 0
step 1: zero2D (zeroFramedAry)  step 2: loadImage (inFile, zeroFramedAry)
step 3: if option == ‘y’ or ‘Y’
conversion (zeroFramedAry)
step 4: if connectness == 4
connected4 (zeroFramedAry, newLabel, EQAry, RFprettyPrintFile, deBugFile)
step 5: if connectness == 8
connected4 (zeroFramedAry, newLabel, EQAry, RFprettyPrintFile, deBugFile)
step 6: labelFile-->output numRows, numCols, newMin, newMax to labelFile
step 7: printImg (zeroFramedAry, labelFile) // Output the result of pass3 inside of zeroFramedAry
step 8: printCCproperty (propertyFile) // print cc properties to propertyFile  step 9: drawBoxes
(zeroFramedAry, CCproperty, trueNumCC) // draw on zeroFramed image. step 10: imgReformat
(zeroFramedAry, RFprettyPrintFile)
step 11: print trueNumCC to RFprettyPrintFile with proper caption
step 12: close all files
```

CONN 8 Data 1.txt

PrettyPrint.txt



```
----Printing Original Table-----

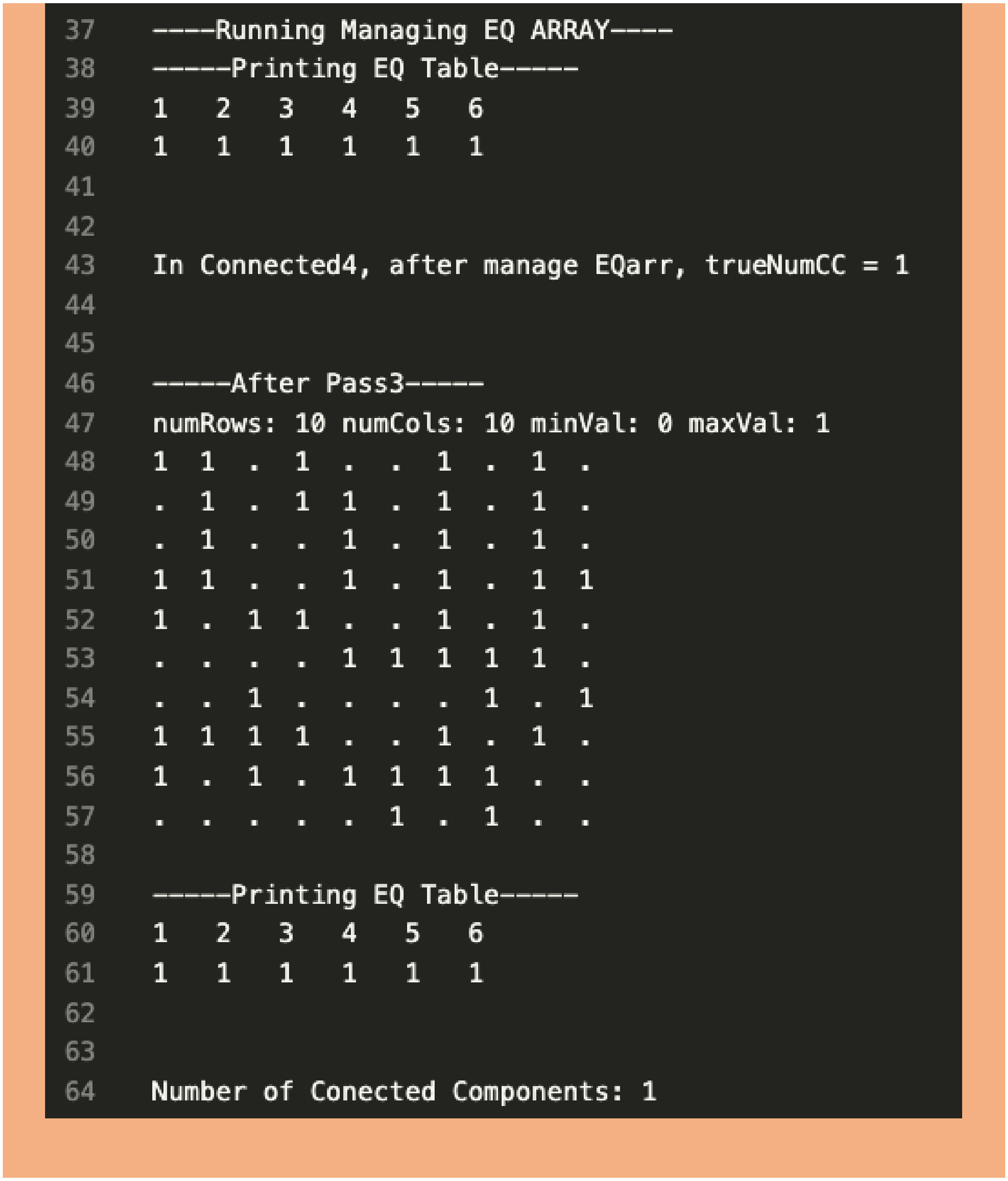
After Connected4Pass1, newLabel = 6
numRows: 10 numCols: 10 minVal: 0 maxVal: 1
1  1  .  2  .  .  3  .  4  .
.  1  .  2  2  .  3  .  4  .
.  1  .  .  2  .  3  .  4  .
1  1  .  .  2  .  3  .  4  4
1  .  1  1  .  .  3  .  4  .
.  .  .  .  1  1  1  1  1  .
.  .  5  .  .  .  .  1  .  1
6  5  5  5  .  .  1  .  1  .
5  .  5  .  5  1  1  1  .  .
.  .  .  .  .  1  .  1  .  .

-----Printing EQ Table-----
1   2   3   4   5   6
1   1   1   1   1   5

After Connected4Pass2, newLabel = 6
numRows: 10 numCols: 10 minVal: 0 maxVal: 1
1  1  .  1  .  .  1  .  1  .
.  1  .  1  1  .  1  .  1  .
.  1  .  .  1  .  1  .  1  .
1  1  .  .  1  .  1  .  1  1
1  .  1  1  .  .  1  .  1  .
.  .  .  .  1  1  1  1  1  .
.  .  1  .  .  .  .  1  .  1
1  1  1  1  .  .  1  .  1  .
1  .  1  .  1  1  1  1  .  .
.  .  .  .  .  1  .  1  .  .

-----Printing EQ Table-----
1   2   3   4   5   6
1   1   1   1   1   1

```



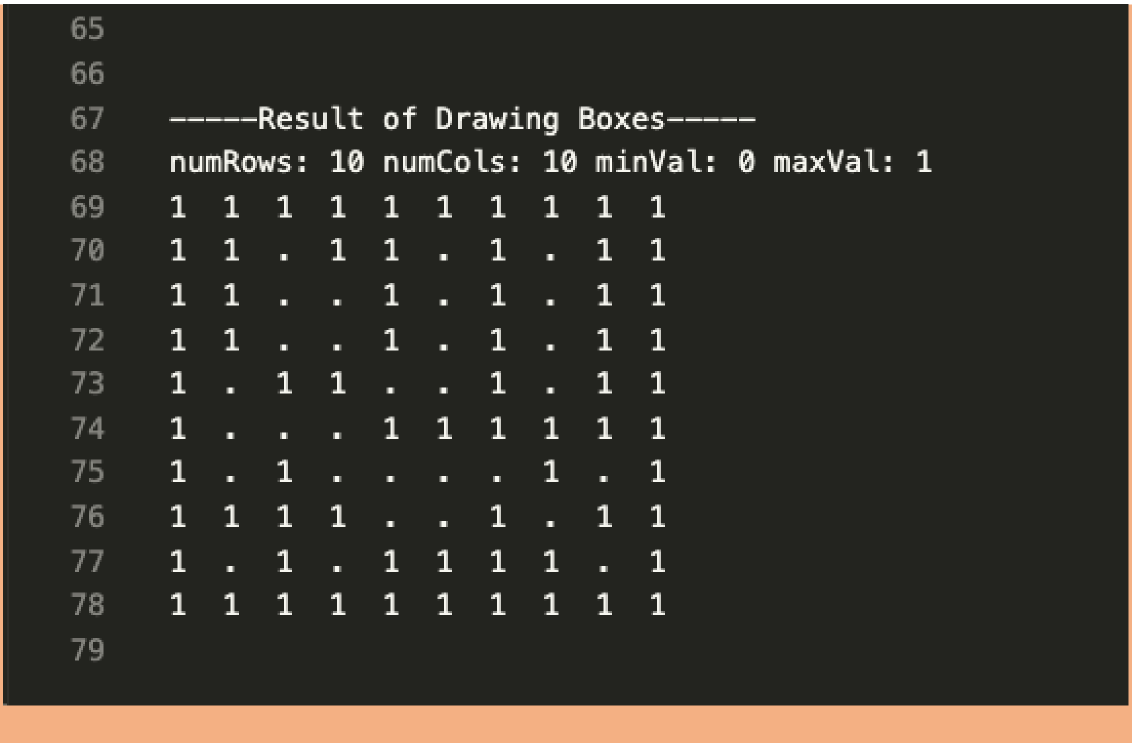
```
----Running Managing EQ ARRAY----
-----Printing EQ Table-----
1   2   3   4   5   6
1   1   1   1   1   1


In Connected4, after manage EQarr, trueNumCC = 1


-----After Pass3-----
numRows: 10 numCols: 10 minVal: 0 maxVal: 1
1  1  .  1  .  .  1  .  1  .
.  1  .  1  1  .  1  .  1  .
.  1  .  .  1  .  1  .  1  .
1  1  .  .  1  .  1  .  1  1
1  .  1  1  .  .  1  .  1  .
.  .  .  .  1  1  1  1  1  .
.  .  1  .  .  .  .  1  .  1
1  1  1  1  .  .  1  .  1  .
1  .  1  .  1  1  1  1  .  .
.  .  .  .  .  1  .  1  .  .

-----Printing EQ Table-----
1   2   3   4   5   6
1   1   1   1   1   1


Number of Conected Components: 1
```

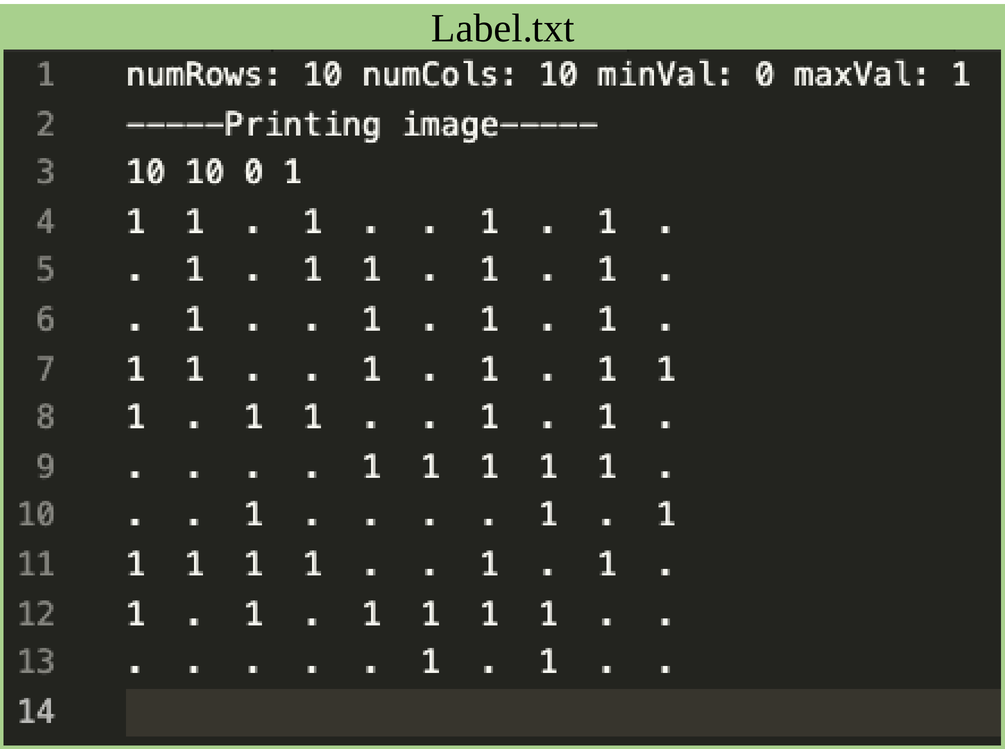


```


-----Result of Drawing Boxes-----
numRows: 10 numCols: 10 minVal: 0 maxVal: 1
1  1  1  1  1  1  1  1  1  1
1  1  .  1  1  .  1  .  1  1
1  1  .  .  1  .  1  .  1  1
1  1  .  .  1  .  1  .  1  1
1  .  1  1  .  .  1  .  1  1
1  .  .  .  1  1  1  1  1  1
1  .  1  .  .  .  .  1  .  1
1  1  1  1  .  .  1  .  1  1
1  .  1  .  1  1  1  1  .  1
1  1  1  1  1  1  1  1  1  1

```

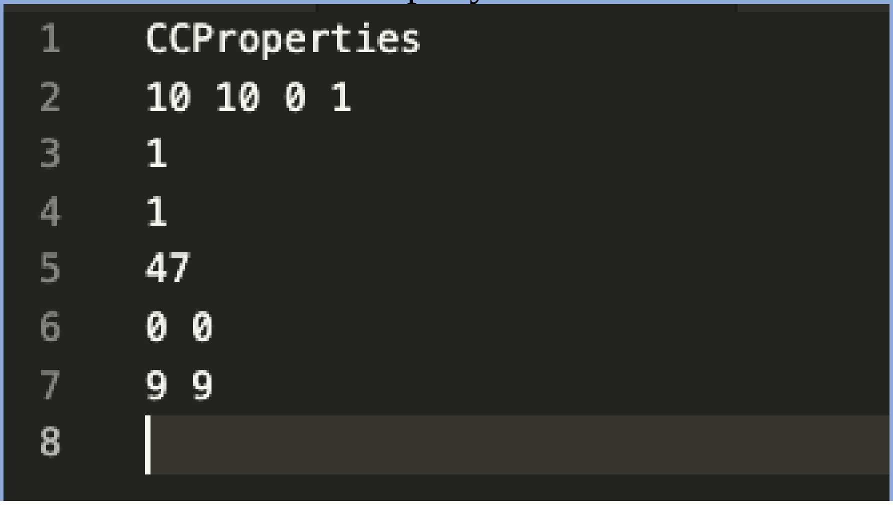
Label.txt



```
numRows: 10 numCols: 10 minVal: 0 maxVal: 1
-----Printing image-----
10 10 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  .  .

```

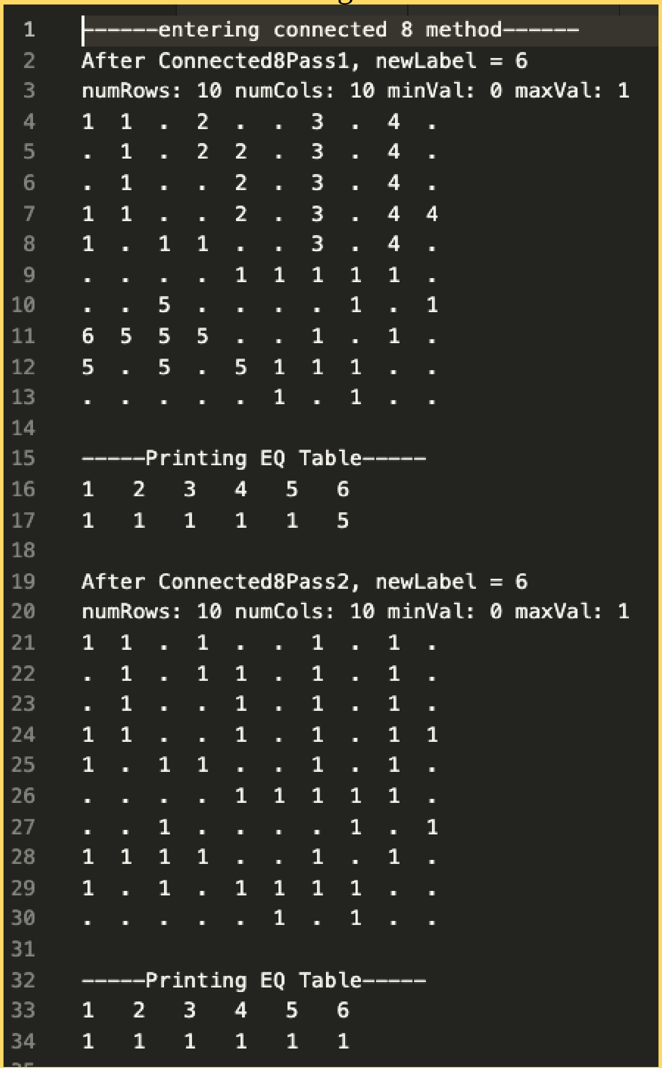
Property.txt



```
CCProperties
10 10 0 1
1
1
47
0 0
9 9

```

Debug.txt

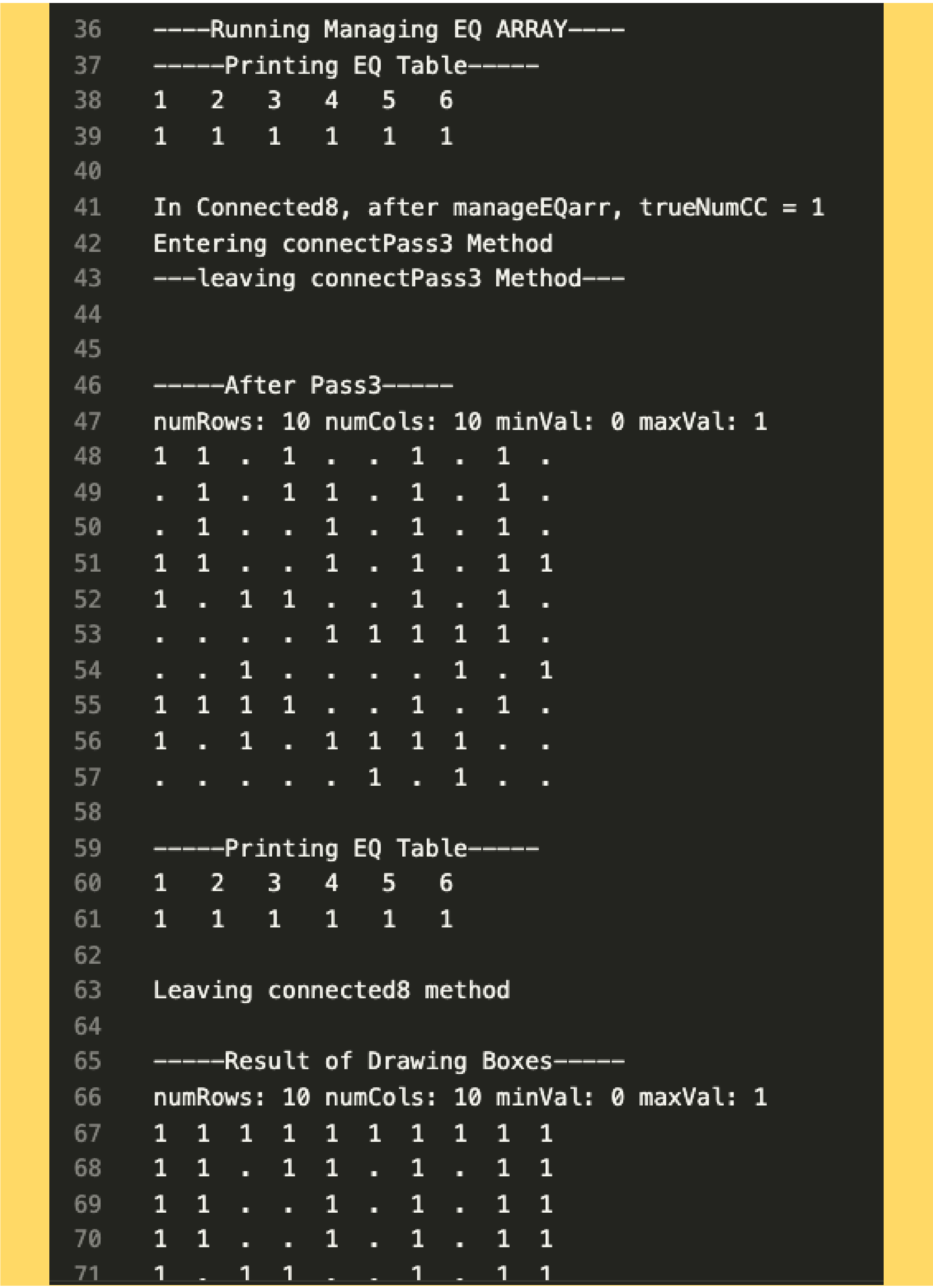


```
------entering connected 8 method------
After Connected8Pass1, newLabel = 6
numRows: 10 numCols: 10 minVal: 0 maxVal: 1
1  1  .  2  .  .  3  .  4  .
.  1  .  2  2  .  3  .  4  .
.  1  .  .  2  .  3  .  4  .
1  1  .  .  2  .  3  .  4  4
1  .  1  1  .  .  3  .  4  .
.  .  .  .  1  1  1  1  1  .
.  .  5  .  .  .  .  1  .  1
6  5  5  5  .  .  1  .  1  .
5  .  5  .  5  1  1  1  .  .
.  .  .  .  .  1  .  1  .  .

-----Printing EQ Table-----
1   2   3   4   5   6
1   1   1   1   1   5

After Connected8Pass2, newLabel = 6
numRows: 10 numCols: 10 minVal: 0 maxVal: 1
1  1  .  1  .  .  1  .  1  .
.  1  .  1  1  .  1  .  1  .
.  1  .  .  1  .  1  .  1  .
1  1  .  .  1  .  1  .  1  1
1  .  1  1  .  .  1  .  1  .
.  .  .  .  1  1  1  1  1  .
.  .  1  .  .  .  .  1  .  1
1  1  1  1  .  .  1  .  1  .
1  .  1  .  1  1  1  1  .  .
.  .  .  .  .  1  .  1  .  .

-----Printing EQ Table-----
1   2   3   4   5   6
1   1   1   1   1   1
```



```
----Running Managing EQ ARRAY----
-----Printing EQ Table-----
1   2   3   4   5   6
1   1   1   1   1   1

In Connected8, after manageEQarr, trueNumCC = 1
Entering connectPass3 Method
---leaving connectPass3 Method---


-----After Pass3-----
numRows: 10 numCols: 10 minVal: 0 maxVal: 1
1  1  .  1  .  .  1  .  1  .
.  1  .  1  1  .  1  .  1  .
.  1  .  .  1  .  1  .  1  .
1  1  .  .  1  .  1  .  1  1
1  .  1  1  .  .  1  .  1  .
.  .  .  .  1  1  1  1  1  .
.  .  1  .  .  .  .  1  .  1
1  1  1  1  .  .  1  .  1  .
1  .  1  .  1  1  1  1  .  .
.  .  .  .  .  1  .  1  .  .

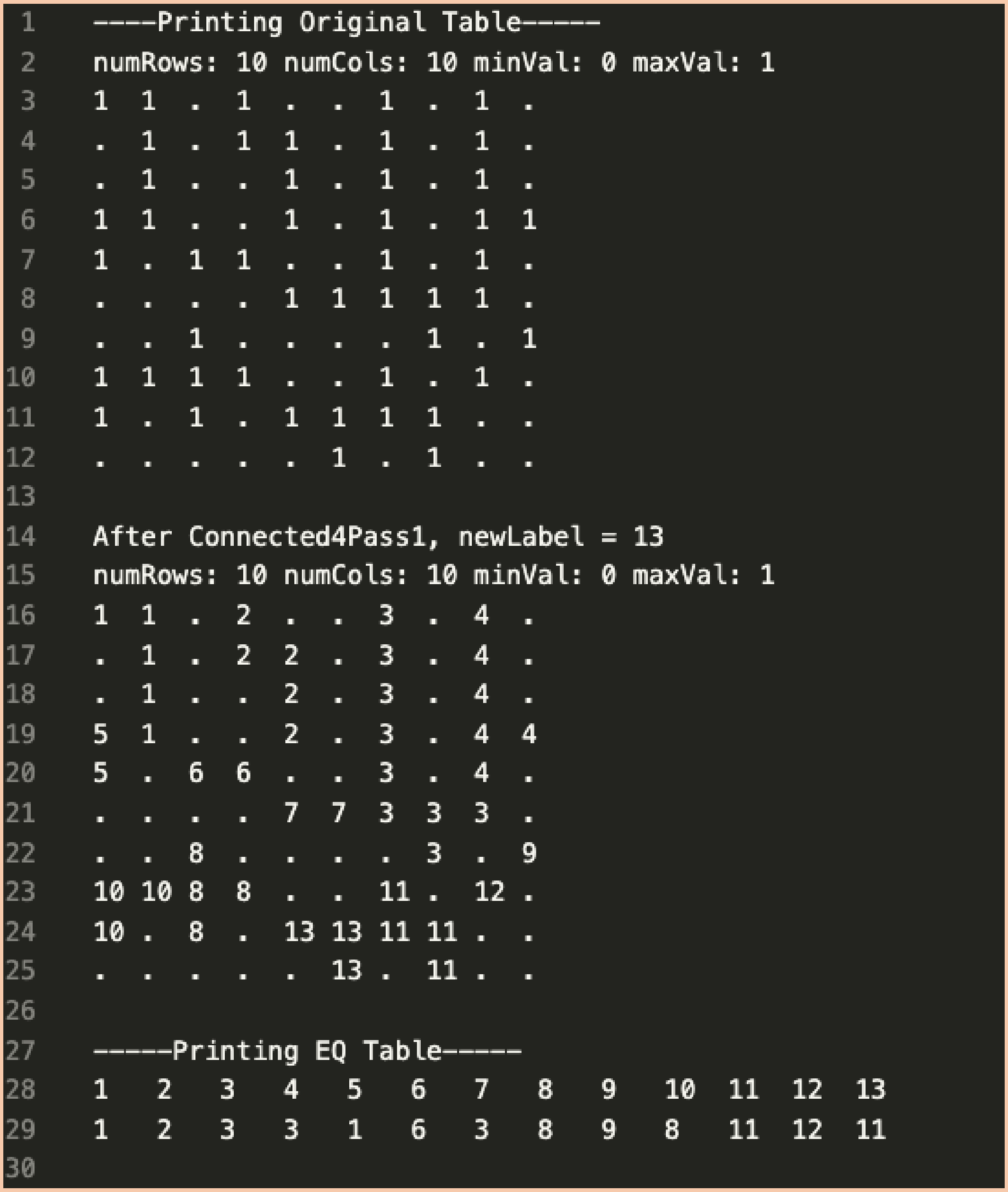
-----Printing EQ Table-----
1   2   3   4   5   6
1   1   1   1   1   1

Leaving connected8 method

-----Result of Drawing Boxes-----
numRows: 10 numCols: 10 minVal: 0 maxVal: 1
1  1  1  1  1  1  1  1  1  1
1  1  .  1  1  .  1  .  1  1
1  1  .  .  1  .  1  .  1  1
1  1  .  .  1  .  1  .  1  1
1  .  1  1  .  .  1  .  1  1
```

CONN 4 Data 1.txt

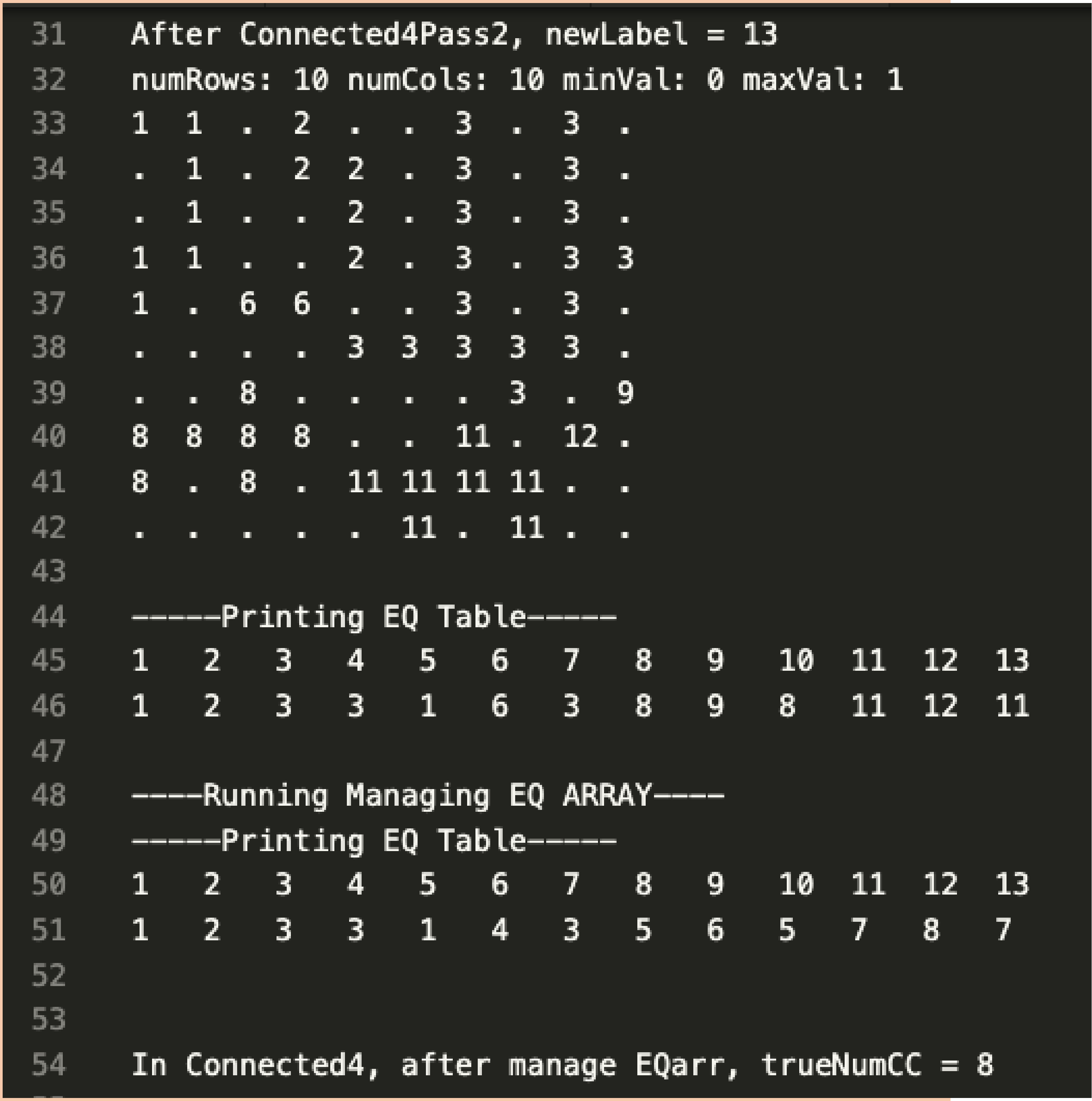
PrettyPrint.txt



```
----Printing Original Table-----
numRows: 10 numCols: 10 minVal: 0 maxVal: 1
1  1  .  1  .  .  1  .  1  .
.  1  .  1  1  .  1  .  1  .
.  1  .  .  1  .  1  .  1  .
1  1  .  .  1  .  1  .  1  1
1  .  1  1  .  .  1  .  1  .
.  .  .  .  1  1  1  1  1  .
.  .  1  .  .  .  .  1  .  1
1  1  1  1  .  .  1  .  1  .
1  .  1  .  1  1  1  1  .  .
.  .  .  .  .  1  .  1  .  .

After Connected4Pass1, newLabel = 13
numRows: 10 numCols: 10 minVal: 0 maxVal: 1
1  1  .  2  .  .  3  .  4  .
.  1  .  2  2  .  3  .  4  .
.  1  .  .  2  .  3  .  4  .
5  1  .  .  2  .  3  .  4  4
5  .  6  6  .  .  3  .  4  .
.  .  .  .  7  7  3  3  3  .
.  .  8  .  .  .  .  3  .  9
10 10 8  8  .  .  11 .  12 .
10 .  8  .  13 13 11 11 .  .
.  .  .  .  .  13 .  11 .  .

-----Printing EQ Table-----
1   2   3   4   5   6   7   8   9   10  11  12  13
1   2   3   3   1   6   3   8   9   8   11  12  11
```

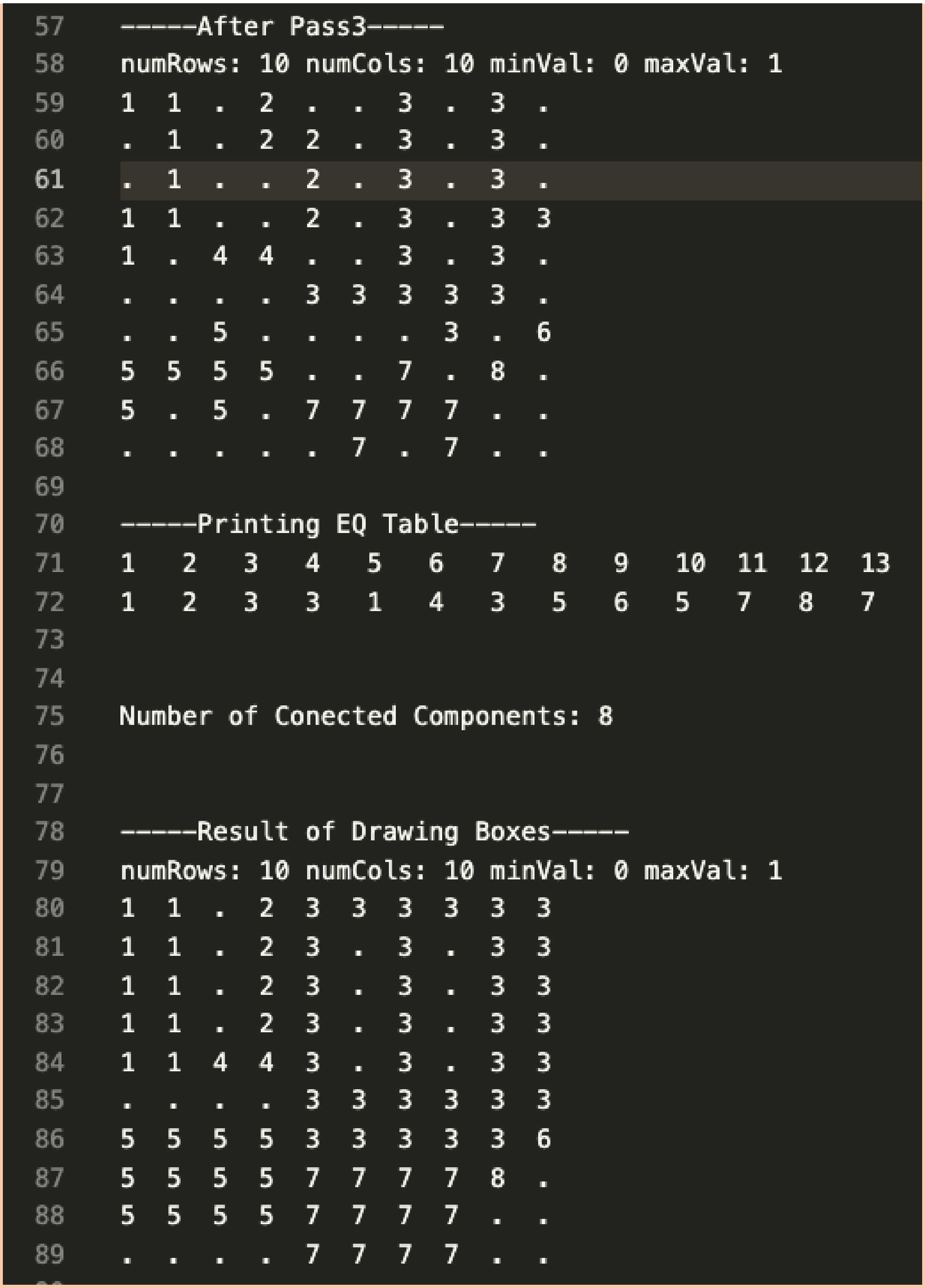


```
After Connected4Pass2, newLabel = 13
numRows: 10 numCols: 10 minVal: 0 maxVal: 1
1  1  .  2  .  .  3  .  3  .
.  1  .  2  2  .  3  .  3  .
.  1  .  .  2  .  3  .  3  .
1  1  .  .  2  .  3  .  3  3
1  .  6  6  .  .  3  .  3  .
.  .  .  .  3  3  3  3  3  .
.  .  8  .  .  .  .  3  .  9
8  8  8  8  .  .  11 .  12 .
8  .  8  .  11 11 11 11 .  .
.  .  .  .  .  11 .  11 .  .

-----Printing EQ Table-----
1   2   3   4   5   6   7   8   9   10  11  12  13
1   2   3   3   1   6   3   8   9   8   11  12  11

----Running Managing EQ ARRAY----
-----Printing EQ Table-----
1   2   3   4   5   6   7   8   9   10  11  12  13
1   2   3   3   1   4   3   5   6   5   7   8   7


In Connected4, after manage EQarr, trueNumCC = 8
```



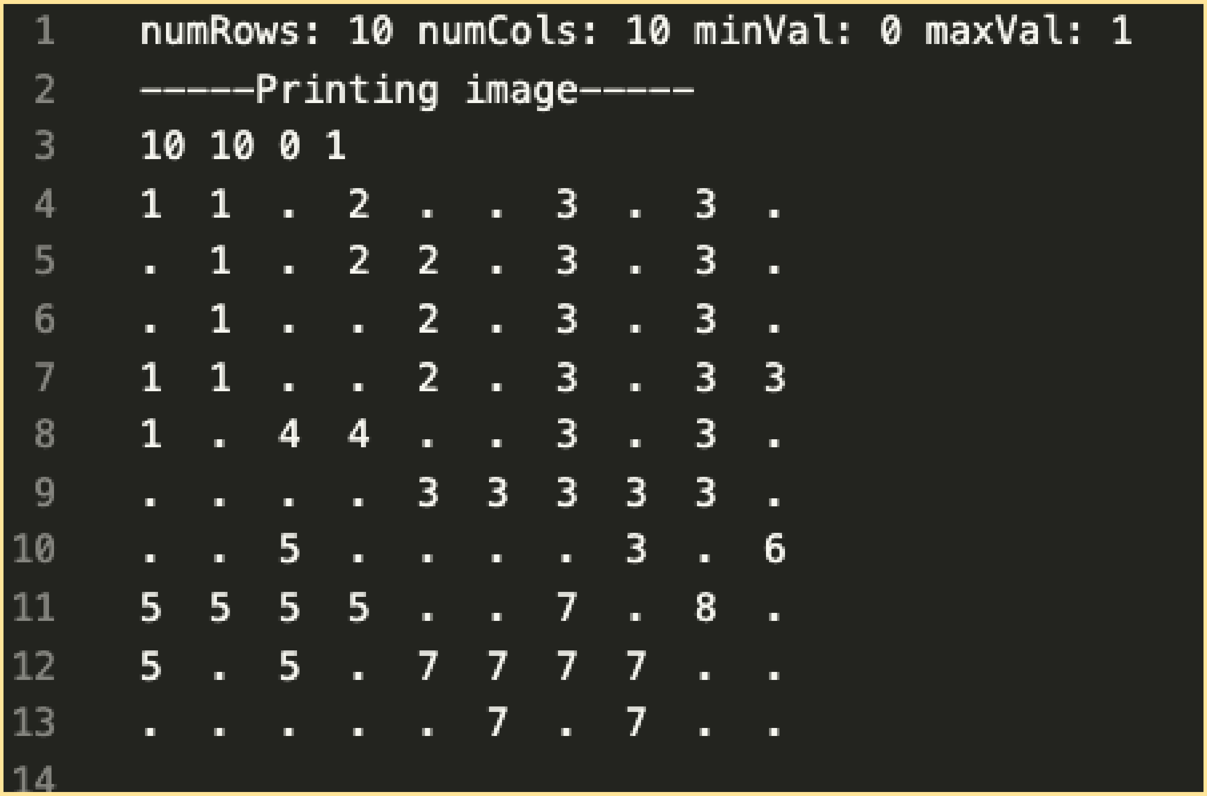
```
-----After Pass3-----
numRows: 10 numCols: 10 minVal: 0 maxVal: 1
1  1  .  2  .  .  3  .  3  .
.  1  .  2  2  .  3  .  3  .
.  1  .  .  2  .  3  .  3  .
1  1  .  .  2  .  3  .  3  3
1  .  4  4  .  .  3  .  3  .
.  .  .  .  3  3  3  3  3  .
.  .  5  .  .  .  .  3  .  6
5  5  5  5  .  .  7  .  8  .
5  .  5  .  7  7  7  7  .  .
.  .  .  .  .  7  .  7  .  .

-----Printing EQ Table-----
1   2   3   4   5   6   7   8   9   10  11  12  13
1   2   3   3   1   4   3   5   6   5   7   8   7


Number of Conected Components: 8

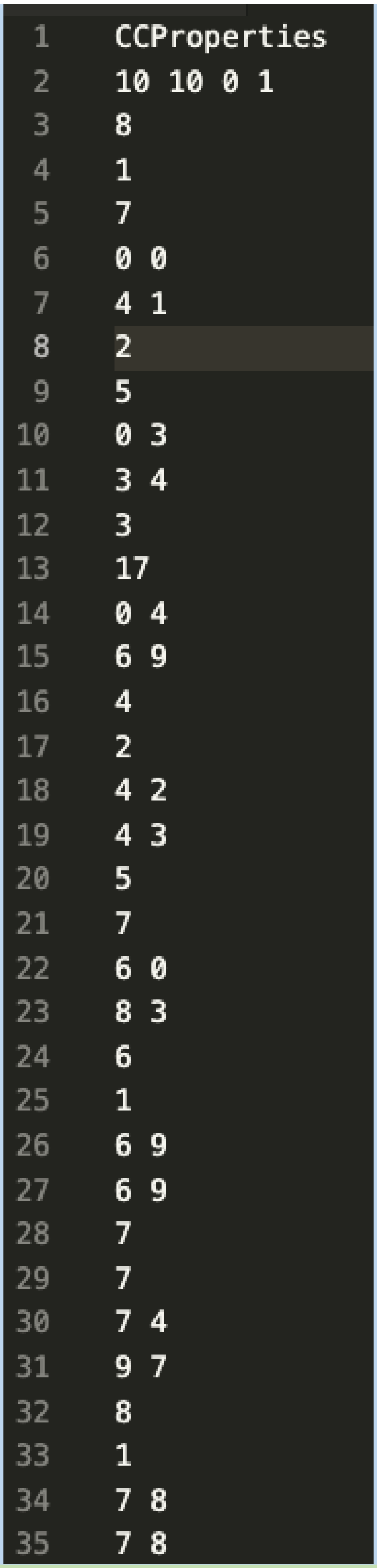

-----Result of Drawing Boxes-----
numRows: 10 numCols: 10 minVal: 0 maxVal: 1
1  1  .  2  3  3  3  3  3  3
1  1  .  2  3  .  3  .  3  3
1  1  .  2  3  .  3  .  3  3
1  1  .  2  3  .  3  .  3  3
1  1  4  4  3  .  3  .  3  3
.  .  .  .  3  3  3  3  3  3
5  5  5  5  3  3  3  3  3  6
5  5  5  5  7  7  7  7  8  .
5  5  5  5  7  7  7  7  .  .
.  .  .  .  7  7  7  7  .  .
```

Label.txt



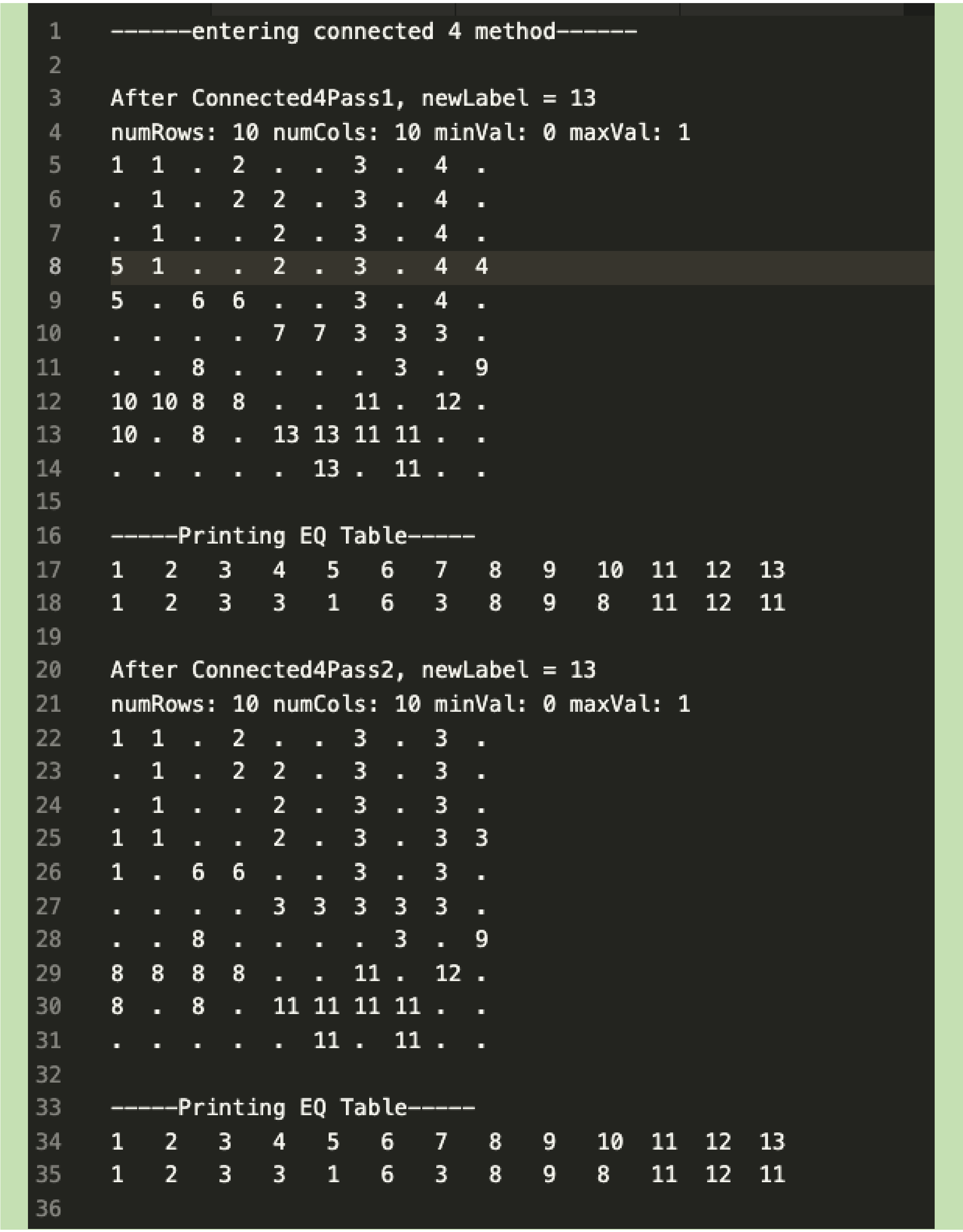
```
numRows: 10 numCols: 10 minVal: 0 maxVal: 1
-----Printing image-----
10 10 0 1
1  1  .  2  .  .  3  .  3  .
.  1  .  2  2  .  3  .  3  .
.  1  .  .  2  .  3  .  3  .
1  1  .  .  2  .  3  .  3  3
1  .  4  4  .  .  3  .  3  .
.  .  .  .  3  3  3  3  3  .
.  .  5  .  .  .  .  3  .  6
5  5  5  5  .  .  7  .  8  .
5  .  5  .  7  7  7  7  .  .
.  .  .  .  .  7  .  7  .  .
```

Properties.txt



```
CCProperties
10 10 0 1
8
1
7
0 0
4 1
2
5
0 3
3 4
3
17
0 4
6 9
4
2
4 2
4 3
5
7
6 0
8 3
6
1
6 9
6 9
7
7
7 4
9 7
8
1
7 8
7 8
```

Debug.txt



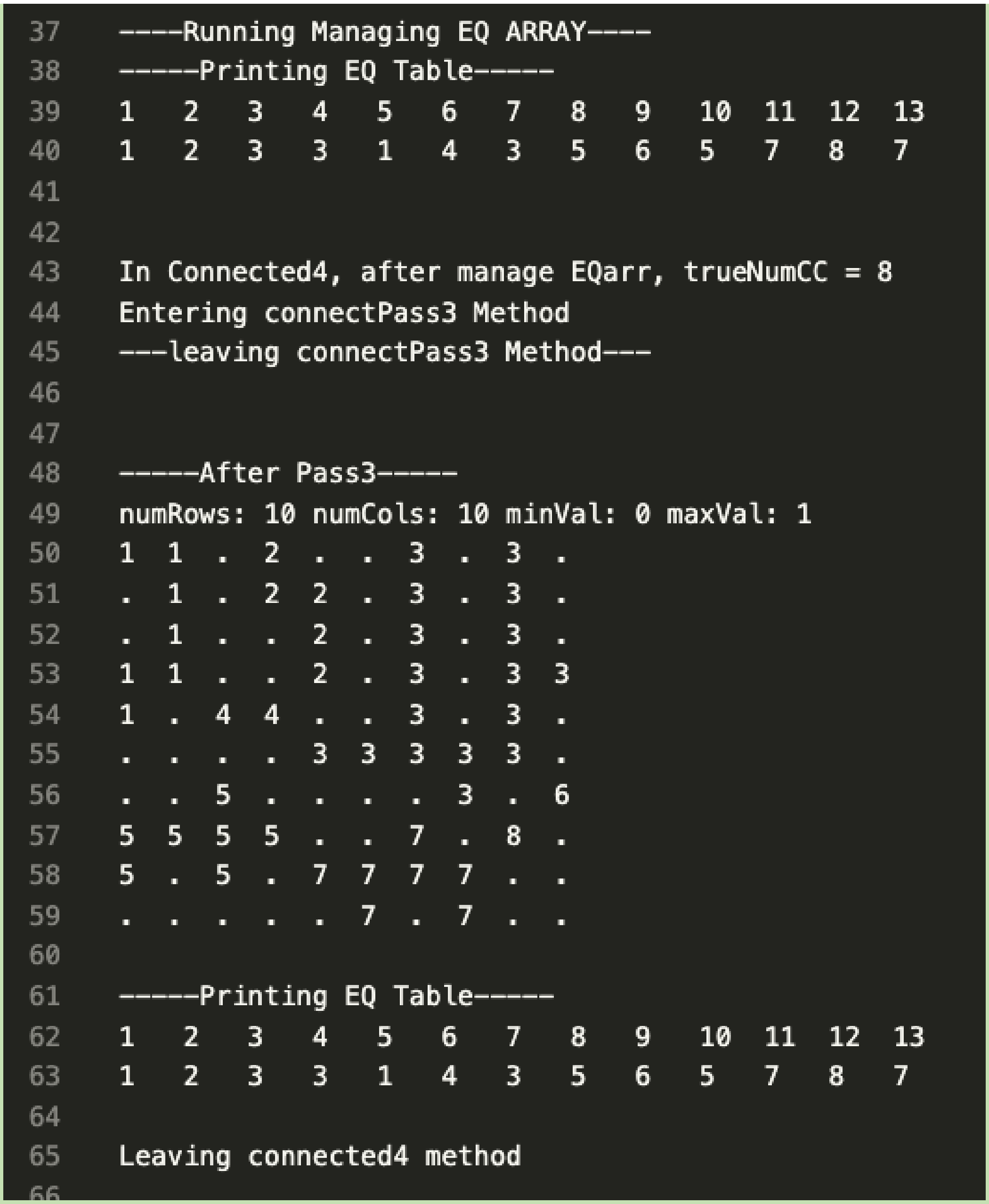
```
------entering connected 4 method------

After Connected4Pass1, newLabel = 13
numRows: 10 numCols: 10 minVal: 0 maxVal: 1
1  1  .  2  .  .  3  .  4  .
.  1  .  2  2  .  3  .  4  .
.  1  .  .  2  .  3  .  4  .
5  1  .  .  2  .  3  .  4  4
5  .  6  6  .  .  3  .  4  .
.  .  .  .  7  7  3  3  3  .
.  .  8  .  .  .  .  3  .  9
10 10 8  8  .  .  11 .  12 .
10 .  8  .  13 13 11 11 .  .
.  .  .  .  .  13 .  11 .  .

-----Printing EQ Table-----
1   2   3   4   5   6   7   8   9   10  11  12  13
1   2   3   3   1   6   3   8   9   8   11  12  11

After Connected4Pass2, newLabel = 13
numRows: 10 numCols: 10 minVal: 0 maxVal: 1
1  1  .  2  .  .  3  .  3  .
.  1  .  2  2  .  3  .  3  .
.  1  .  .  2  .  3  .  3  .
1  1  .  .  2  .  3  .  3  3
1  .  6  6  .  .  3  .  3  .
.  .  .  .  3  3  3  3  3  .
.  .  8  .  .  .  .  3  .  9
8  8  8  8  .  .  11 .  12 .
8  .  8  .  11 11 11 11 .  .
.  .  .  .  .  11 .  11 .  .

-----Printing EQ Table-----
1   2   3   4   5   6   7   8   9   10  11  12  13
1   2   3   3   1   6   3   8   9   8   11  12  11
```



```
----Running Managing EQ ARRAY----
-----Printing EQ Table-----
1   2   3   4   5   6   7   8   9   10  11  12  13
1   2   3   3   1   4   3   5   6   5   7   8   7


In Connected4, after manage EQarr, trueNumCC = 8
Entering connectPass3 Method
---leaving connectPass3 Method---

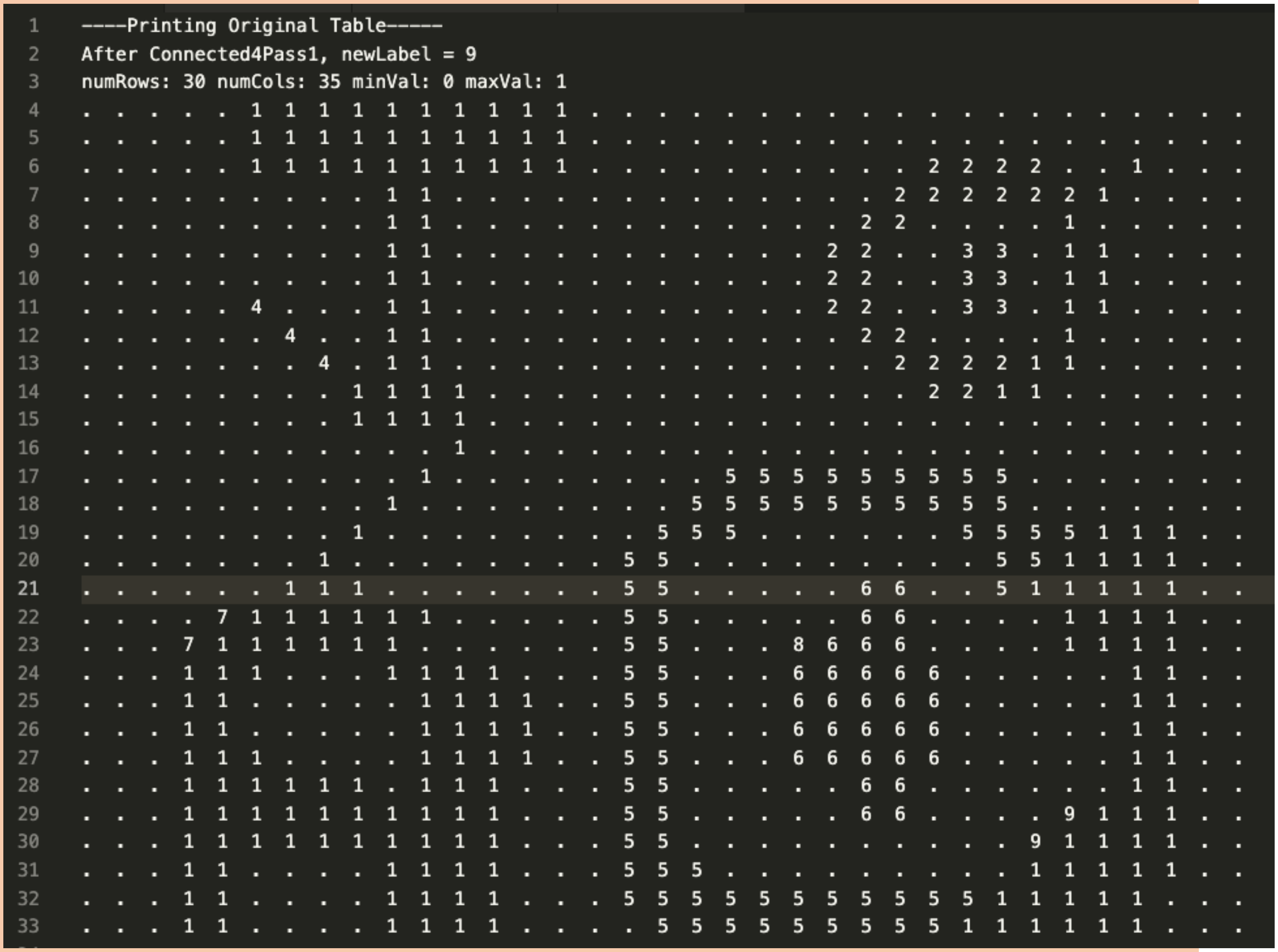

-----After Pass3-----
numRows: 10 numCols: 10 minVal: 0 maxVal: 1
1  1  .  2  .  .  3  .  3  .
.  1  .  2  2  .  3  .  3  .
.  1  .  .  2  .  3  .  3  .
1  1  .  .  2  .  3  .  3  3
1  .  4  4  .  .  3  .  3  .
.  .  .  .  3  3  3  3  3  .
.  .  5  .  .  .  .  3  .  6
5  5  5  5  .  .  7  .  8  .
5  .  5  .  7  7  7  7  .  .
.  .  .  .  .  7  .  7  .  .

-----Printing EQ Table-----
1   2   3   4   5   6   7   8   9   10  11  12  13
1   2   3   3   1   4   3   5   6   5   7   8   7

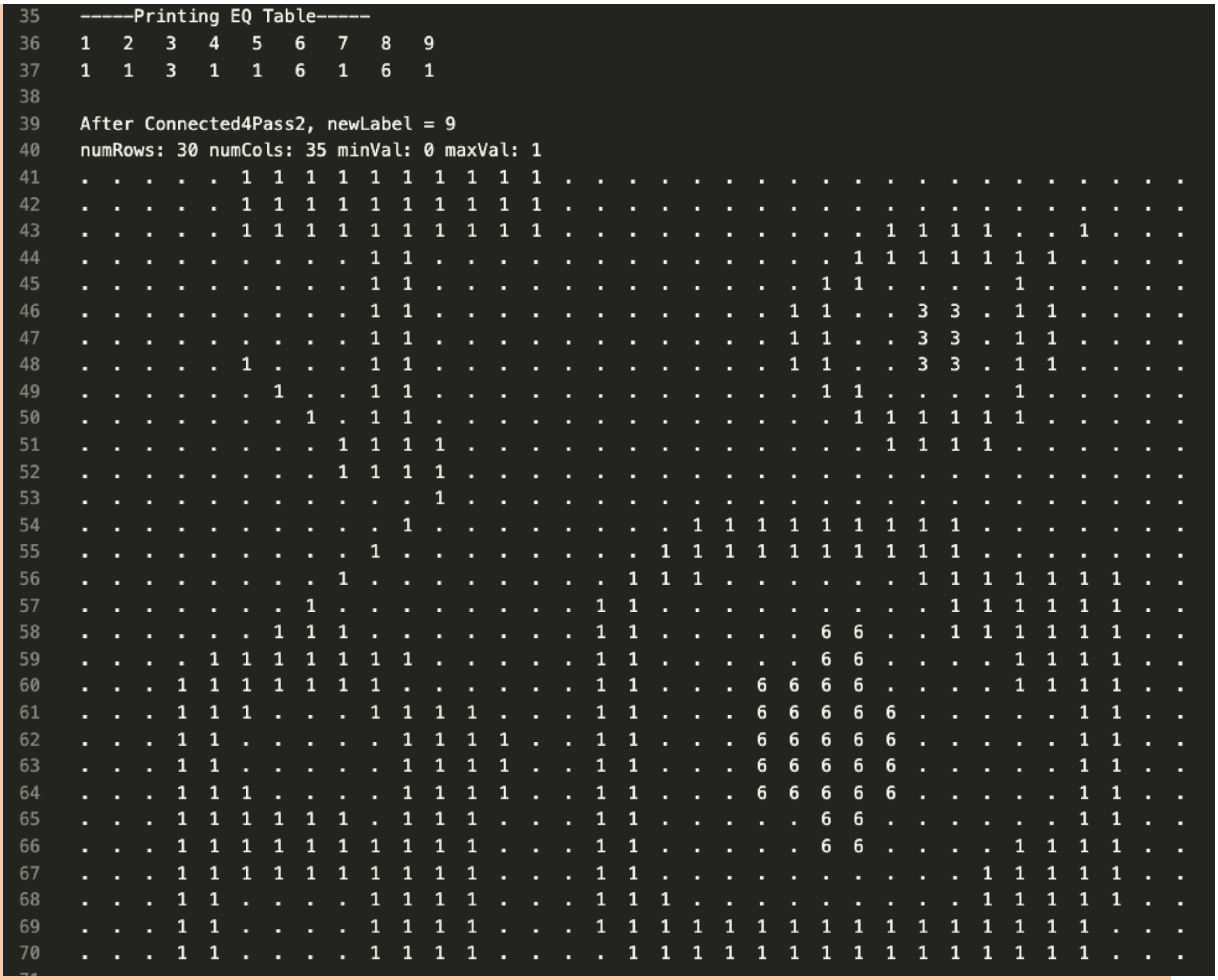
Leaving connected4 method
```

CONN 8 Data 2.txt

PrettyPrint.txt

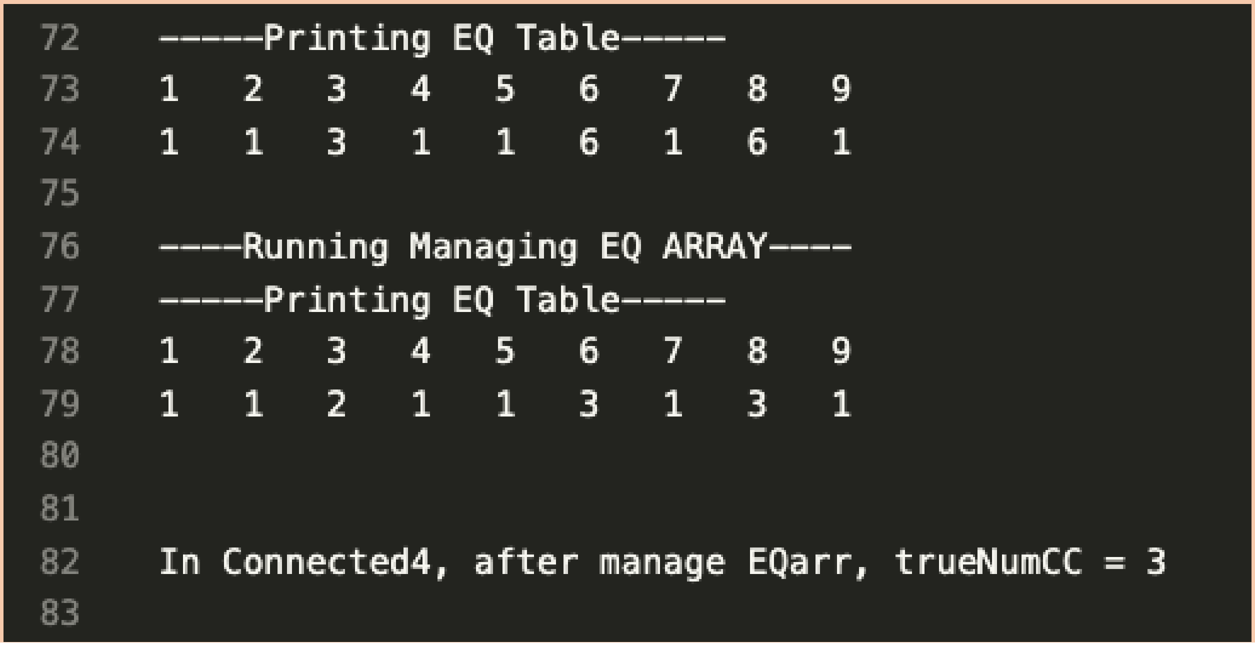


```
----Printing Original Table-----
After Connected4Pass1, newLabel = 9
numRows: 30 numCols: 35 minVal: 0 maxVal: 1
. . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . . . . . . . . . .
. . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . . . . . . . . . .
. . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . 2 2 2 2 . . 1 . . .
. . . . . . . . . 1 1 . . . . . . . . . . . . . 2 2 2 2 2 2 1 . . . .
. . . . . . . . . 1 1 . . . . . . . . . . . . 2 2 . . . . 1 . . . . .
. . . . . . . . . 1 1 . . . . . . . . . . . 2 2 . . 3 3 . 1 1 . . . .
. . . . . . . . . 1 1 . . . . . . . . . . . 2 2 . . 3 3 . 1 1 . . . .
. . . . . 4 . . . 1 1 . . . . . . . . . . . 2 2 . . 3 3 . 1 1 . . . .
. . . . . . 4 . . 1 1 . . . . . . . . . . . . 2 2 . . . . 1 . . . . .
. . . . . . . 4 . 1 1 . . . . . . . . . . . . . 2 2 2 2 1 1 . . . . .
. . . . . . . . 1 1 1 1 . . . . . . . . . . . . . 2 2 1 1 . . . . . .
. . . . . . . . 1 1 1 1 . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . 1 . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . 1 . . . . . . . . 5 5 5 5 5 5 5 5 5 . . . . . . .
. . . . . . . . . 1 . . . . . . . . 5 5 5 5 5 5 5 5 5 5 . . . . . . .
. . . . . . . . 1 . . . . . . . . 5 5 5 . . . . . . 5 5 5 5 1 1 1 . .
. . . . . . . 1 . . . . . . . . 5 5 . . . . . . . . . 5 5 1 1 1 1 . .
. . . . . . 1 1 1 . . . . . . . 5 5 . . . . . 6 6 . . 5 1 1 1 1 1 . .
. . . . 7 1 1 1 1 1 1 . . . . . 5 5 . . . . . 6 6 . . . . 1 1 1 1 . .
. . . 7 1 1 1 1 1 1 . . . . . . 5 5 . . . 8 6 6 6 . . . . 1 1 1 1 . .
. . . 1 1 1 . . . 1 1 1 1 . . . 5 5 . . . 6 6 6 6 6 . . . . . 1 1 . .
. . . 1 1 . . . . . 1 1 1 1 . . 5 5 . . . 6 6 6 6 6 . . . . . 1 1 . .
. . . 1 1 . . . . . 1 1 1 1 . . 5 5 . . . 6 6 6 6 6 . . . . . 1 1 . .
. . . 1 1 1 . . . . 1 1 1 1 . . 5 5 . . . 6 6 6 6 6 . . . . . 1 1 . .
. . . 1 1 1 1 1 1 . 1 1 1 . . . 5 5 . . . . . 6 6 . . . . . . 1 1 . .
. . . 1 1 1 1 1 1 1 1 1 1 . . . 5 5 . . . . . 6 6 . . . . 9 1 1 1 . .
. . . 1 1 1 1 1 1 1 1 1 1 . . . 5 5 . . . . . . . . . . 9 1 1 1 1 . .
. . . 1 1 . . . . 1 1 1 1 . . . 5 5 5 . . . . . . . . . 1 1 1 1 1 . .
. . . 1 1 . . . . 1 1 1 1 . . . 5 5 5 5 5 5 5 5 5 5 5 1 1 1 1 1 . . .
. . . 1 1 . . . . 1 1 1 1 . . . . 5 5 5 5 5 5 5 5 5 1 1 1 1 1 1 . . .
```



```
-----Printing EQ Table-----
1   2   3   4   5   6   7   8   9
1   1   3   1   1   6   1   6   1

After Connected4Pass2, newLabel = 9
numRows: 30 numCols: 35 minVal: 0 maxVal: 1
. . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . . . . . . . . . .
. . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . . . . . . . . . .
. . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . 1 1 1 1 . . 1 . . .
. . . . . . . . . 1 1 . . . . . . . . . . . . . 1 1 1 1 1 1 1 . . . .
. . . . . . . . . 1 1 . . . . . . . . . . . . 1 1 . . . . 1 . . . . .
. . . . . . . . . 1 1 . . . . . . . . . . . 1 1 . . 3 3 . 1 1 . . . .
. . . . . . . . . 1 1 . . . . . . . . . . . 1 1 . . 3 3 . 1 1 . . . .
. . . . . 1 . . . 1 1 . . . . . . . . . . . 1 1 . . 3 3 . 1 1 . . . .
. . . . . . 1 . . 1 1 . . . . . . . . . . . . 1 1 . . . . 1 . . . . .
. . . . . . . 1 . 1 1 . . . . . . . . . . . . . 1 1 1 1 1 1 . . . . .
. . . . . . . . 1 1 1 1 . . . . . . . . . . . . . 1 1 1 1 . . . . . .
. . . . . . . . 1 1 1 1 . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . 1 . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . 1 . . . . . . . . 1 1 1 1 1 1 1 1 1 . . . . . . .
. . . . . . . . . 1 . . . . . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . .
. . . . . . . . 1 . . . . . . . . 1 1 1 . . . . . . 1 1 1 1 1 1 1 . .
. . . . . . . 1 . . . . . . . . 1 1 . . . . . . . . . 1 1 1 1 1 1 . .
. . . . . . 1 1 1 . . . . . . . 1 1 . . . . . 6 6 . . 1 1 1 1 1 1 . .
. . . . 1 1 1 1 1 1 1 . . . . . 1 1 . . . . . 6 6 . . . . 1 1 1 1 . .
. . . 1 1 1 1 1 1 1 . . . . . . 1 1 . . . 6 6 6 6 . . . . 1 1 1 1 . .
. . . 1 1 1 . . . 1 1 1 1 . . . 1 1 . . . 6 6 6 6 6 . . . . . 1 1 . .
. . . 1 1 . . . . . 1 1 1 1 . . 1 1 . . . 6 6 6 6 6 . . . . . 1 1 . .
. . . 1 1 . . . . . 1 1 1 1 . . 1 1 . . . 6 6 6 6 6 . . . . . 1 1 . .
. . . 1 1 1 . . . . 1 1 1 1 . . 1 1 . . . 6 6 6 6 6 . . . . . 1 1 . .
. . . 1 1 1 1 1 1 . 1 1 1 . . . 1 1 . . . . . 6 6 . . . . . . 1 1 . .
. . . 1 1 1 1 1 1 1 1 1 1 . . . 1 1 . . . . . 6 6 . . . . 1 1 1 1 . .
. . . 1 1 1 1 1 1 1 1 1 1 . . . 1 1 . . . . . . . . . . 1 1 1 1 1 . .
. . . 1 1 . . . . 1 1 1 1 . . . 1 1 1 . . . . . . . . . 1 1 1 1 1 . .
. . . 1 1 . . . . 1 1 1 1 . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . .
. . . 1 1 . . . . 1 1 1 1 . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . .
```

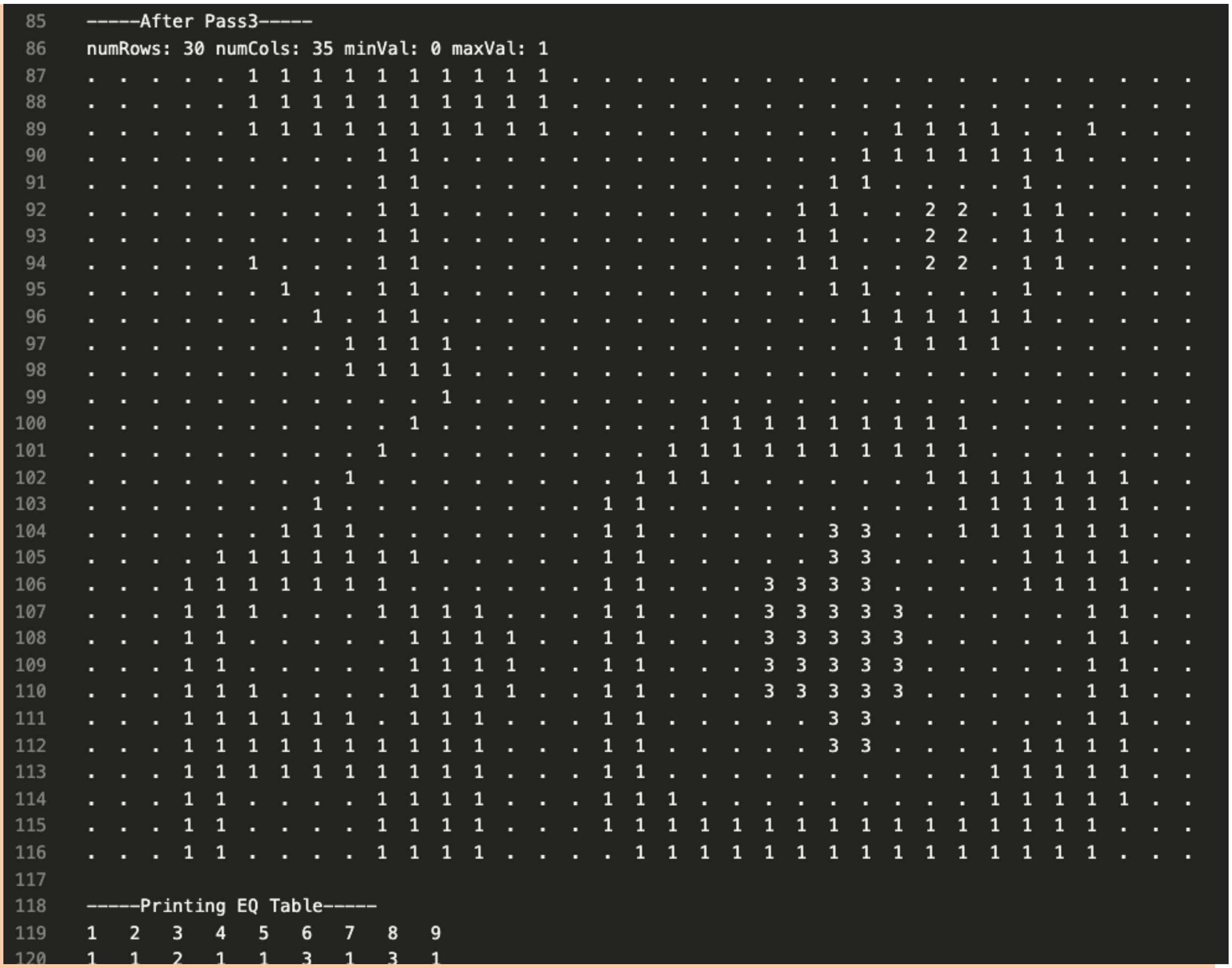


```
-----Printing EQ Table-----
1   2   3   4   5   6   7   8   9
1   1   3   1   1   6   1   6   1

----Running Managing EQ ARRAY----
-----Printing EQ Table-----
1   2   3   4   5   6   7   8   9
1   1   2   1   1   3   1   3   1

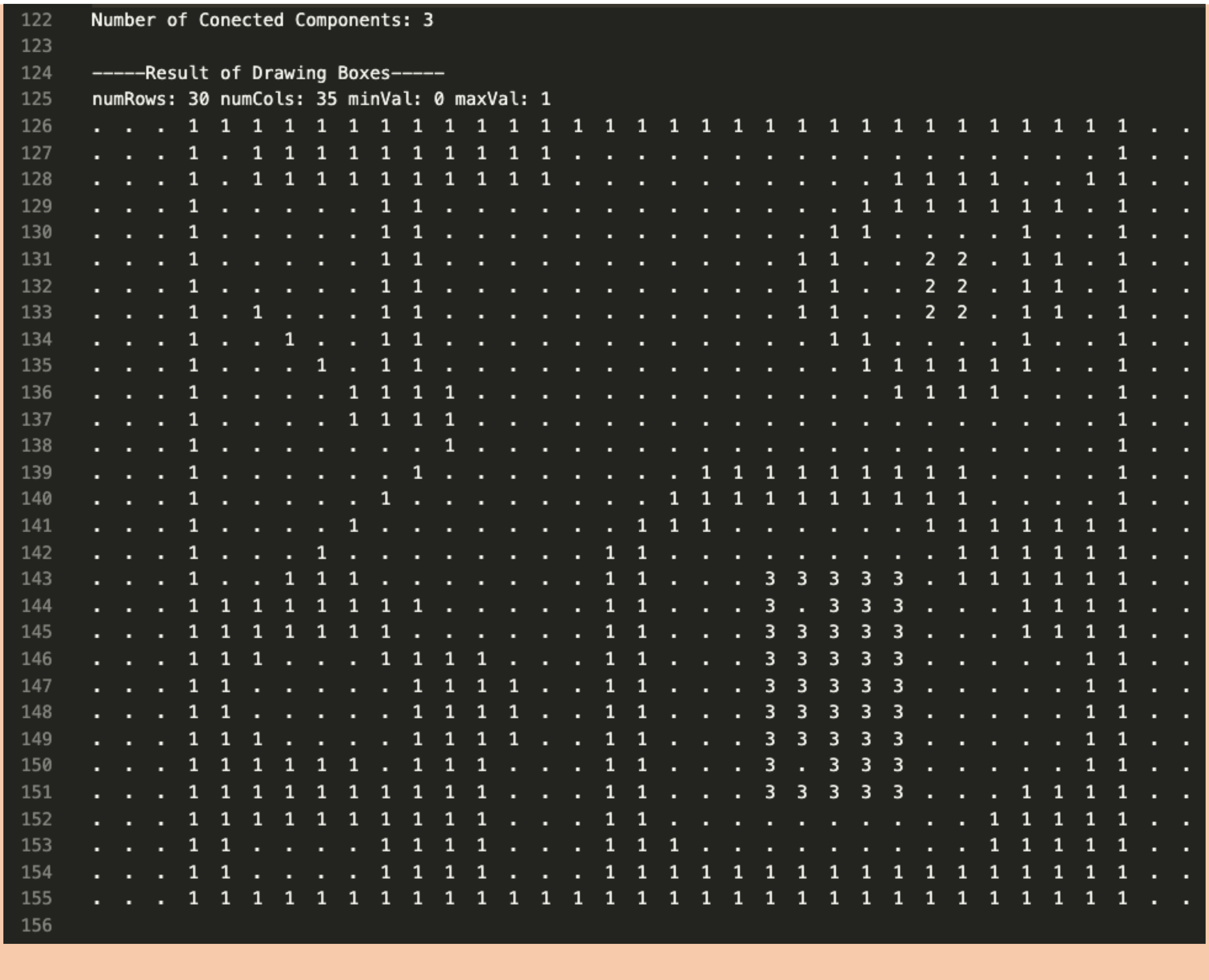

In Connected4, after manage EQarr, trueNumCC = 3

```



```
-----After Pass3-----
numRows: 30 numCols: 35 minVal: 0 maxVal: 1
. . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . . . . . . . . . .
. . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . . . . . . . . . .
. . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . 1 1 1 1 . . 1 . . .
. . . . . . . . . 1 1 . . . . . . . . . . . . . 1 1 1 1 1 1 1 . . . .
. . . . . . . . . 1 1 . . . . . . . . . . . . 1 1 . . . . 1 . . . . .
. . . . . . . . . 1 1 . . . . . . . . . . . 1 1 . . 2 2 . 1 1 . . . .
. . . . . . . . . 1 1 . . . . . . . . . . . 1 1 . . 2 2 . 1 1 . . . .
. . . . . 1 . . . 1 1 . . . . . . . . . . . 1 1 . . 2 2 . 1 1 . . . .
. . . . . . 1 . . 1 1 . . . . . . . . . . . . 1 1 . . . . 1 . . . . .
. . . . . . . 1 . 1 1 . . . . . . . . . . . . . 1 1 1 1 1 1 . . . . .
. . . . . . . . 1 1 1 1 . . . . . . . . . . . . . 1 1 1 1 . . . . . .
. . . . . . . . 1 1 1 1 . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . 1 . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . 1 . . . . . . . . 1 1 1 1 1 1 1 1 1 . . . . . . .
. . . . . . . . . 1 . . . . . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . .
. . . . . . . . 1 . . . . . . . . 1 1 1 . . . . . . 1 1 1 1 1 1 1 . .
. . . . . . . 1 . . . . . . . . 1 1 . . . . . . . . . 1 1 1 1 1 1 . .
. . . . . . 1 1 1 . . . . . . . 1 1 . . . . . 3 3 . . 1 1 1 1 1 1 . .
. . . . 1 1 1 1 1 1 1 . . . . . 1 1 . . . . . 3 3 . . . . 1 1 1 1 . .
. . . 1 1 1 1 1 1 1 . . . . . . 1 1 . . . 3 3 3 3 . . . . 1 1 1 1 . .
. . . 1 1 1 . . . 1 1 1 1 . . . 1 1 . . . 3 3 3 3 3 . . . . . 1 1 . .
. . . 1 1 . . . . . 1 1 1 1 . . 1 1 . . . 3 3 3 3 3 . . . . . 1 1 . .
. . . 1 1 . . . . . 1 1 1 1 . . 1 1 . . . 3 3 3 3 3 . . . . . 1 1 . .
. . . 1 1 1 . . . . 1 1 1 1 . . 1 1 . . . 3 3 3 3 3 . . . . . 1 1 . .
. . . 1 1 1 1 1 1 . 1 1 1 . . . 1 1 . . . . . 3 3 . . . . . . 1 1 . .
. . . 1 1 1 1 1 1 1 1 1 1 . . . 1 1 . . . . . 3 3 . . . . 1 1 1 1 . .
. . . 1 1 1 1 1 1 1 1 1 1 . . . 1 1 . . . . . . . . . . 1 1 1 1 1 . .
. . . 1 1 . . . . 1 1 1 1 . . . 1 1 1 . . . . . . . . . 1 1 1 1 1 . .
. . . 1 1 . . . . 1 1 1 1 . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . .
. . . 1 1 . . . . 1 1 1 1 . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . .

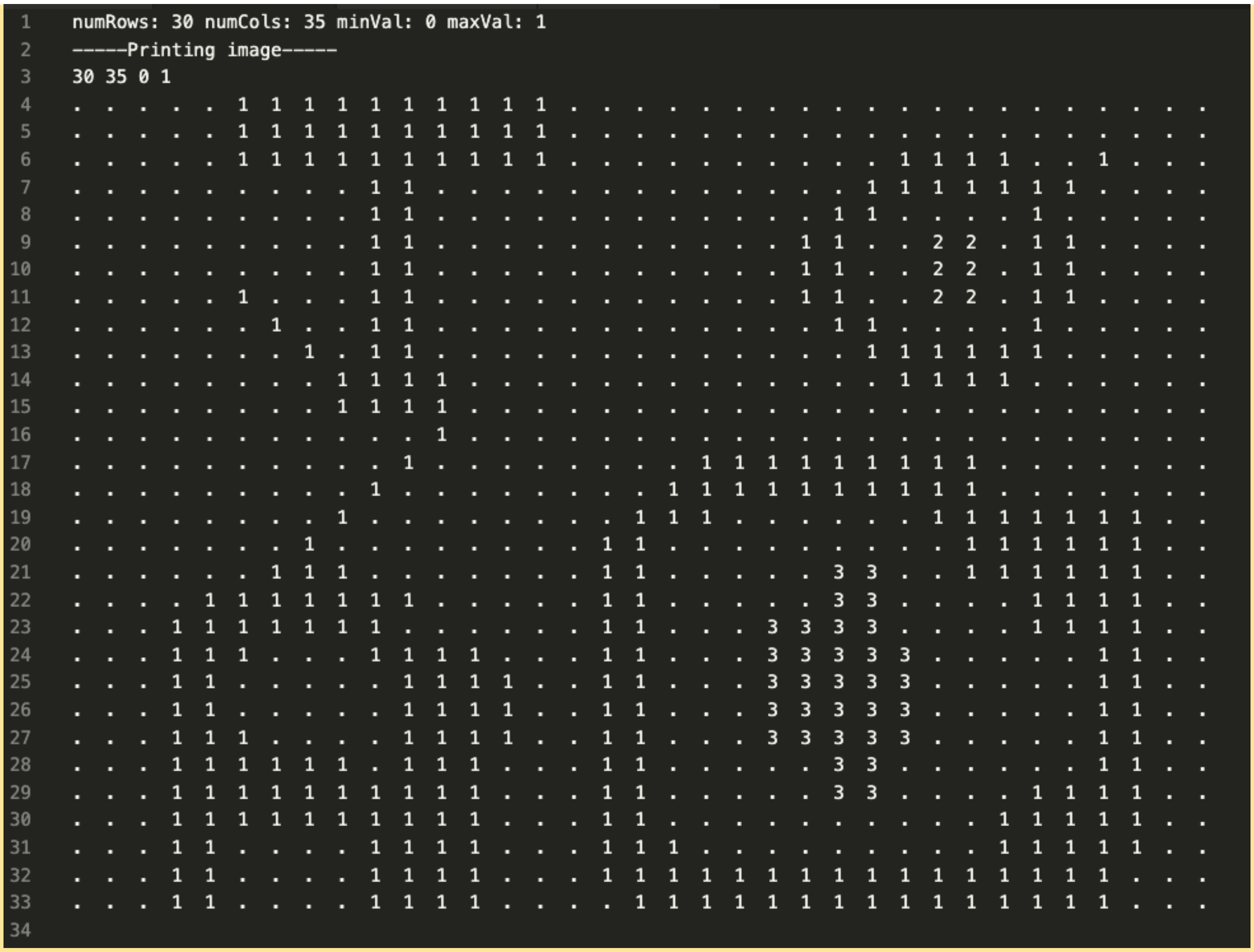
-----Printing EQ Table-----
1   2   3   4   5   6   7   8   9
1   1   2   1   1   3   1   3   1
```



```
Number of Conected Components: 3

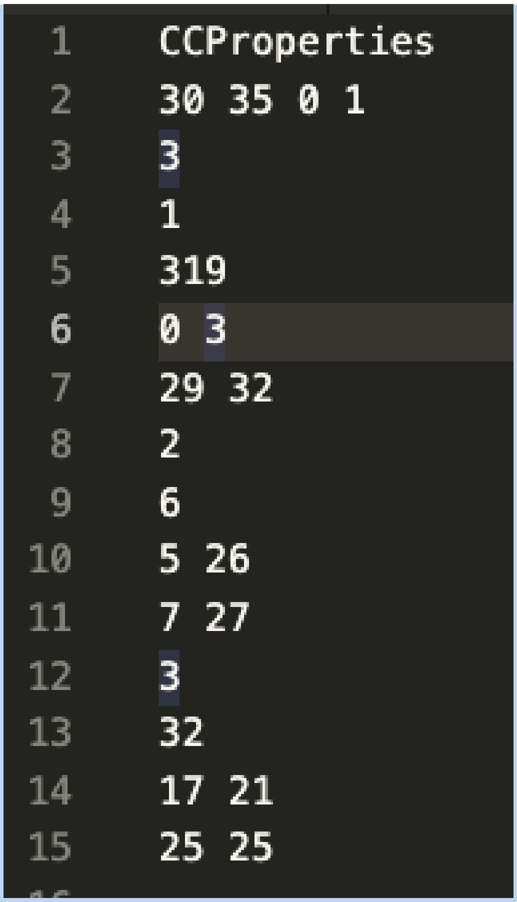
-----Result of Drawing Boxes-----
numRows: 30 numCols: 35 minVal: 0 maxVal: 1
. . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . .
. . . 1 . 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . . . . . . . 1 . .
. . . 1 . 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . 1 1 1 1 . . 1 1 . .
. . . 1 . . . . . 1 1 . . . . . . . . . . . . . 1 1 1 1 1 1 1 . 1 . .
. . . 1 . . . . . 1 1 . . . . . . . . . . . . 1 1 . . . . 1 . . 1 . .
. . . 1 . . . . . 1 1 . . . . . . . . . . . 1 1 . . 2 2 . 1 1 . 1 . .
. . . 1 . . . . . 1 1 . . . . . . . . . . . 1 1 . . 2 2 . 1 1 . 1 . .
. . . 1 . 1 . . . 1 1 . . . . . . . . . . . 1 1 . . 2 2 . 1 1 . 1 . .
. . . 1 . . 1 . . 1 1 . . . . . . . . . . . . 1 1 . . . . 1 . . 1 . .
. . . 1 . . . 1 . 1 1 . . . . . . . . . . . . . 1 1 1 1 1 1 . . 1 . .
. . . 1 . . . . 1 1 1 1 . . . . . . . . . . . . . 1 1 1 1 . . . 1 . .
. . . 1 . . . . 1 1 1 1 . . . . . . . . . . . . . . . . . . . . 1 . .
. . . 1 . . . . . . . 1 . . . . . . . . . . . . . . . . . . . . 1 . .
. . . 1 . . . . . . 1 . . . . . . . . 1 1 1 1 1 1 1 1 1 . . . . 1 . .
. . . 1 . . . . . 1 . . . . . . . . 1 1 1 1 1 1 1 1 1 1 . . . . 1 . .
. . . 1 . . . . 1 . . . . . . . . 1 1 1 . . . . . . 1 1 1 1 1 1 1 . .
. . . 1 . . . 1 . . . . . . . . 1 1 . . . . . . . . . 1 1 1 1 1 1 . .
. . . 1 . . 1 1 1 . . . . . . . 1 1 . . . 3 3 3 3 3 . 1 1 1 1 1 1 . .
. . . 1 1 1 1 1 1 1 1 . . . . . 1 1 . . . 3 . 3 3 3 . . . 1 1 1 1 . .
. . . 1 1 1 1 1 1 1 . . . . . . 1 1 . . . 3 3 3 3 3 . . . 1 1 1 1 . .
. . . 1 1 1 . . . 1 1 1 1 . . . 1 1 . . . 3 3 3 3 3 . . . . . 1 1 . .
. . . 1 1 . . . . . 1 1 1 1 . . 1 1 . . . 3 3 3 3 3 . . . . . 1 1 . .
. . . 1 1 . . . . . 1 1 1 1 . . 1 1 . . . 3 3 3 3 3 . . . . . 1 1 . .
. . . 1 1 1 . . . . 1 1 1 1 . . 1 1 . . . 3 3 3 3 3 . . . . . 1 1 . .
. . . 1 1 1 1 1 1 . 1 1 1 . . . 1 1 . . . 3 . 3 3 3 . . . . . 1 1 . .
. . . 1 1 1 1 1 1 1 1 1 1 . . . 1 1 . . . 3 3 3 3 3 . . . 1 1 1 1 . .
. . . 1 1 1 1 1 1 1 1 1 1 . . . 1 1 . . . . . . . . . . 1 1 1 1 1 . .
. . . 1 1 . . . . 1 1 1 1 . . . 1 1 1 . . . . . . . . . 1 1 1 1 1 . .
. . . 1 1 . . . . 1 1 1 1 . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . .
. . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . .
```

Label.txt



```
numRows: 30 numCols: 35 minVal: 0 maxVal: 1
-----Printing image-----
30 35 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 . . 2 2 . 1 1 . . . .
. . . . . . . . . 1 1 . . . . . . . . . . . 1 1 . . 2 2 . 1 1 . . . .
. . . . . 1 . . . 1 1 . . . . . . . . . . . 1 1 . . 2 2 . 1 1 . . . .
. . . . . . 1 . . 1 1 . . . . . . . . . . . . 1 1 . . . . 1 . . . . .
. . . . . . . 1 . 1 1 . . . . . . . . . . . . . 1 1 1 1 1 1 . . . . .
. . . . . . . . 1 1 1 1 . . . . . . . . . . . . . 1 1 1 1 . . . . . .
. . . . . . . . 1 1 1 1 . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . 1 . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . 1 . . . . . . . . 1 1 1 1 1 1 1 1 1 . . . . . . .
. . . . . . . . . 1 . . . . . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . .
. . . . . . . . 1 . . . . . . . . 1 1 1 . . . . . . 1 1 1 1 1 1 1 . .
. . . . . . . 1 . . . . . . . . 1 1 . . . . . . . . . 1 1 1 1 1 1 . .
. . . . . . 1 1 1 . . . . . . . 1 1 . . . . . 3 3 . . 1 1 1 1 1 1 . .
. . . . 1 1 1 1 1 1 1 . . . . . 1 1 . . . . . 3 3 . . . . 1 1 1 1 . .
. . . 1 1 1 1 1 1 1 . . . . . . 1 1 . . . 3 3 3 3 . . . . 1 1 1 1 . .
. . . 1 1 1 . . . 1 1 1 1 . . . 1 1 . . . 3 3 3 3 3 . . . . . 1 1 . .
. . . 1 1 . . . . . 1 1 1 1 . . 1 1 . . . 3 3 3 3 3 . . . . . 1 1 . .
. . . 1 1 . . . . . 1 1 1 1 . . 1 1 . . . 3 3 3 3 3 . . . . . 1 1 . .
. . . 1 1 1 . . . . 1 1 1 1 . . 1 1 . . . 3 3 3 3 3 . . . . . 1 1 . .
. . . 1 1 1 1 1 1 . 1 1 1 . . . 1 1 . . . . . 3 3 . . . . . . 1 1 . .
. . . 1 1 1 1 1 1 1 1 1 1 . . . 1 1 . . . . . 3 3 . . . . 1 1 1 1 . .
. . . 1 1 1 1 1 1 1 1 1 1 . . . 1 1 . . . . . . . . . . 1 1 1 1 1 . .
. . . 1 1 . . . . 1 1 1 1 . . . 1 1 1 . . . . . . . . . 1 1 1 1 1 . .
. . . 1 1 . . . . 1 1 1 1 . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . .
. . . 1 1 . . . . 1 1 1 1 . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . .
```

Propert.txt



```
CCProperties
30 35 0 1
3
1
319
0 3
29 32
2
6
5 26
7 27
3
32
17 21
25 25
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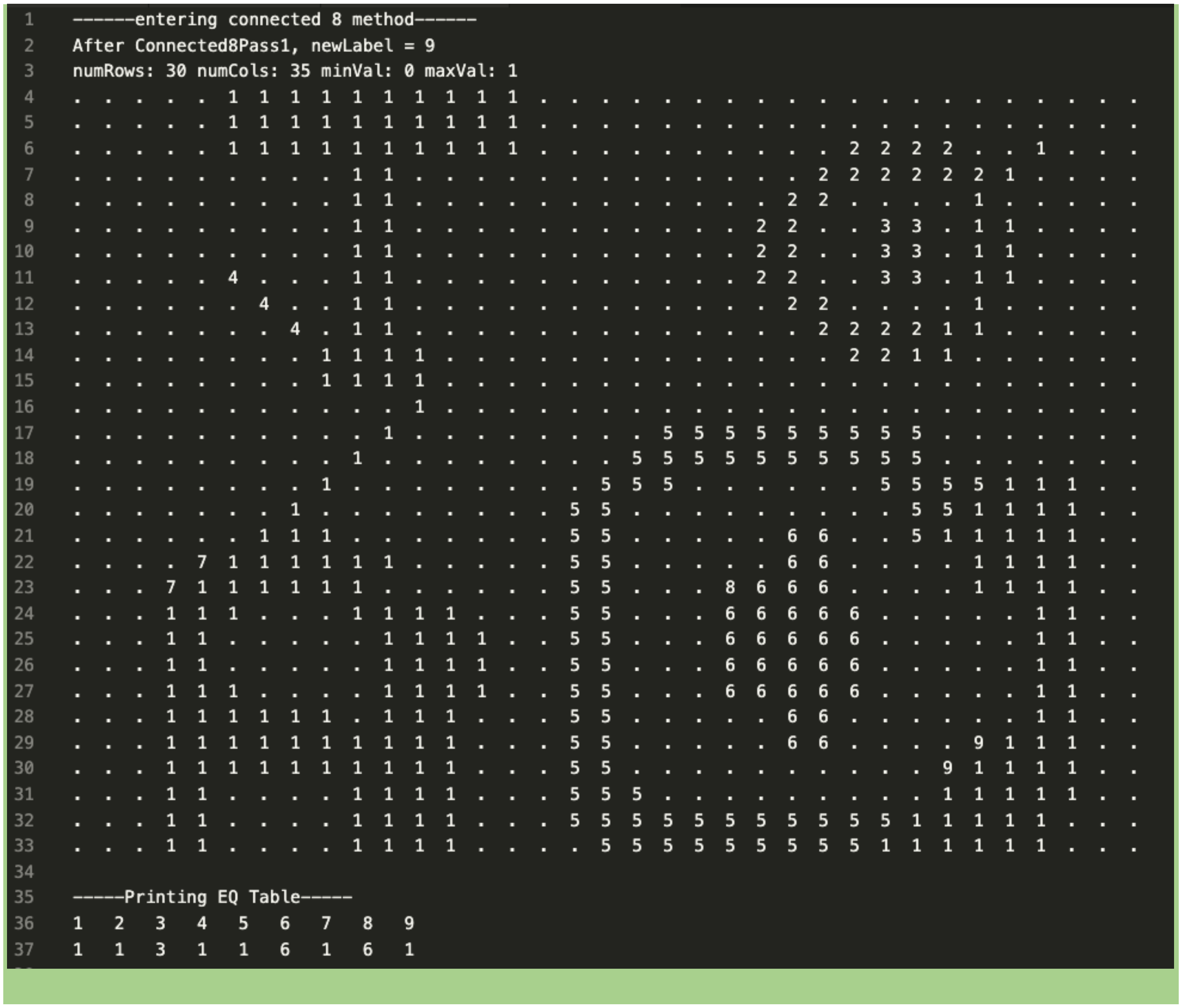
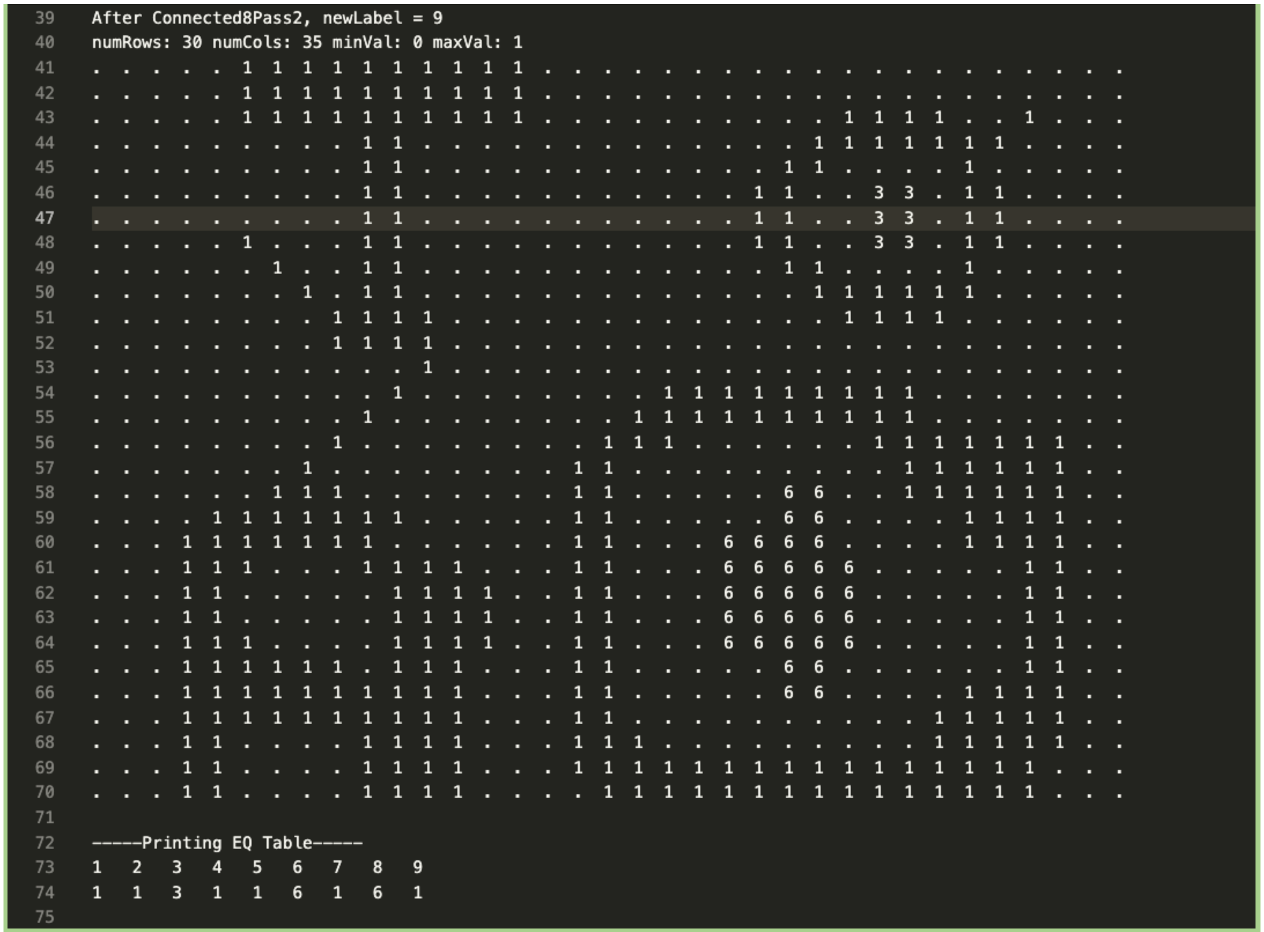
debug.txt



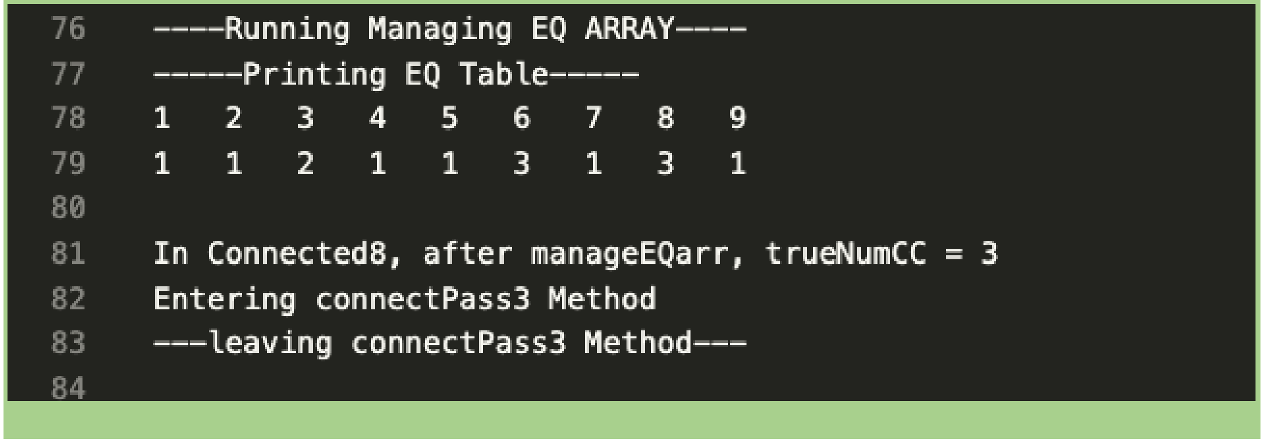
```
------entering connected 8 method------
After Connected8Pass1, newLabel = 9
numRows: 30 numCols: 35 minVal: 0 maxVal: 1
. . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . . . . . . . . . .
. . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . . . . . . . . . .
. . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . 2 2 2 2 . . 1 . . .
. . . . . . . . . 1 1 . . . . . . . . . . . . . 2 2 2 2 2 2 1 . . . .
. . . . . . . . . 1 1 . . . . . . . . . . . . 2 2 . . . . 1 . . . . .
. . . . . . . . . 1 1 . . . . . . . . . . . 2 2 . . 3 3 . 1 1 . . . .
. . . . . . . . . 1 1 . . . . . . . . . . . 2 2 . . 3 3 . 1 1 . . . .
. . . . . 4 . . . 1 1 . . . . . . . . . . . 2 2 . . 3 3 . 1 1 . . . .
. . . . . . 4 . . 1 1 . . . . . . . . . . . . 2 2 . . . . 1 . . . . .
. . . . . . . 4 . 1 1 . . . . . . . . . . . . . 2 2 2 2 1 1 . . . . .
. . . . . . . . 1 1 1 1 . . . . . . . . . . . . . 2 2 1 1 . . . . . .
. . . . . . . . 1 1 1 1 . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . 1 . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . 1 . . . . . . . . 5 5 5 5 5 5 5 5 5 . . . . . . .
. . . . . . . . . 1 . . . . . . . . 5 5 5 5 5 5 5 5 5 5 . . . . . . .
. . . . . . . . 1 . . . . . . . . 5 5 5 . . . . . . 5 5 5 5 1 1 1 . .
. . . . . . . 1 . . . . . . . . 5 5 . . . . . . . . . 5 5 1 1 1 1 . .
. . . . . . 1 1 1 . . . . . . . 5 5 . . . . . 6 6 . . 5 1 1 1 1 1 . .
. . . . 7 1 1 1 1 1 1 . . . . . 5 5 . . . . . 6 6 . . . . 1 1 1 1 . .
. . . 7 1 1 1 1 1 1 . . . . . . 5 5 . . . 8 6 6 6 . . . . 1 1 1 1 . .
. . . 1 1 1 . . . 1 1 1 1 . . . 5 5 . . . 6 6 6 6 6 . . . . . 1 1 . .
. . . 1 1 . . . . . 1 1 1 1 . . 5 5 . . . 6 6 6 6 6 . . . . . 1 1 . .
. . . 1 1 . . . . . 1 1 1 1 . . 5 5 . . . 6 6 6 6 6 . . . . . 1 1 . .
. . . 1 1 1 . . . . 1 1 1 1 . . 5 5 . . . 6 6 6 6 6 . . . . . 1 1 . .
. . . 1 1 1 1 1 1 . 1 1 1 . . . 5 5 . . . . . 6 6 . . . . . . 1 1 . .
. . . 1 1 1 1 1 1 1 1 1 1 . . . 5 5 . . . . . 6 6 . . . . 9 1 1 1 . .
. . . 1 1 1 1 1 1 1 1 1 1 . . . 5 5 . . . . . . . . . . 9 1 1 1 1 . .
. . . 1 1 . . . . 1 1 1 1 . . . 5 5 5 . . . . . . . . . 1 1 1 1 1 . .
. . . 1 1 . . . . 1 1 1 1 . . . 5 5 5 5 5 5 5 5 5 5 5 1 1 1 1 1 . . .
. . . 1 1 . . . . 1 1 1 1 . . . . 5 5 5 5 5 5 5 5 5 1 1 1 1 1 1 . . .

-----Printing EQ Table-----
1   2   3   4   5   6   7   8   9
1   1   3   1   1   6   1   6   1
```



```
After Connected8Pass2, newLabel = 9
numRows: 30 numCols: 35 minVal: 0 maxVal: 1
. . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . . . . . . . . . .
. . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . . . . . . . . . . .
. . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . . . . . 1 1 1 1 . . 1 . . .
. . . . . . . . . 1 1 . . . . . . . . . . . . . 1 1 1 1 1 1 1 . . . .
. . . . . . . . . 1 1 . . . . . . . . . . . . 1 1 . . . . 1 . . . . .
. . . . . . . . . 1 1 . . . . . . . . . . . 1 1 . . 3 3 . 1 1 . . . .
. . . . . . . . . 1 1 . . . . . . . . . . . 1 1 . . 3 3 . 1 1 . . . .
. . . . . 1 . . . 1 1 . . . . . . . . . . . 1 1 . . 3 3 . 1 1 . . . .
. . . . . . 1 . . 1 1 . . . . . . . . . . . . 1 1 . . . . 1 . . . . .
. . . . . . . 1 . 1 1 . . . . . . . . . . . . . 1 1 1 1 1 1 . . . . .
. . . . . . . . 1 1 1 1 . . . . . . . . . . . . . 1 1 1 1 . . . . . .
. . . . . . . . 1 1 1 1 . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . 1 . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . 1 . . . . . . . . 1 1 1 1 1 1 1 1 1 . . . . . . .
. . . . . . . . . 1 . . . . . . . . 1 1 1 1 1 1 1 1 1 1 . . . . . . .
. . . . . . . . 1 . . . . . . . . 1 1 1 . . . . . . 1 1 1 1 1 1 1 . .
. . . . . . . 1 . . . . . . . . 1 1 . . . . . . . . . 1 1 1 1 1 1 . .
. . . . . . 1 1 1 . . . . . . . 1 1 . . . . . 6 6 . . 1 1 1 1 1 1 . .
. . . . 1 1 1 1 1 1 1 . . . . . 1 1 . . . . . 6 6 . . . . 1 1 1 1 . .
. . . 1 1 1 1 1 1 1 . . . . . . 1 1 . . . 6 6 6 6 . . . . 1 1 1 1 . .
. . . 1 1 1 . . . 1 1 1 1 . . . 1 1 . . . 6 6 6 6 6 . . . . . 1 1 . .
. . . 1 1 . . . . . 1 1 1 1 . . 1 1 . . . 6 6 6 6 6 . . . . . 1 1 . .
. . . 1 1 . . . . . 1 1 1 1 . . 1 1 . . . 6 6 6 6 6 . . . . . 1 1 . .
. . . 1 1 1 . . . . 1 1 1 1 . . 1 1 . . . 6 6 6 6 6 . . . . . 1 1 . .
. . . 1 1 1 1 1 1 . 1 1 1 . . . 1 1 . . . . . 6 6 . . . . . . 1 1 . .
. . . 1 1 1 1 1 1 1 1 1 1 . . . 1 1 . . . . . 6 6 . . . . 1 1 1 1 . .
. . . 1 1 1 1 1 1 1 1 1 1 . . . 1 1 . . . . . . . . . . 1 1 1 1 1 . .
. . . 1 1 . . . . 1 1 1 1 . . . 1 1 1 . . . . . . . . . 1 1 1 1 1 . .
. . . 1 1 . . . . 1 1 1 1 . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . .
. . . 1 1 . . . . 1 1 1 1 . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 . . .

-----Printing EQ Table-----
1   2   3   4   5   6   7   8   9
1   1   3   1   1   6   1   6   1
```

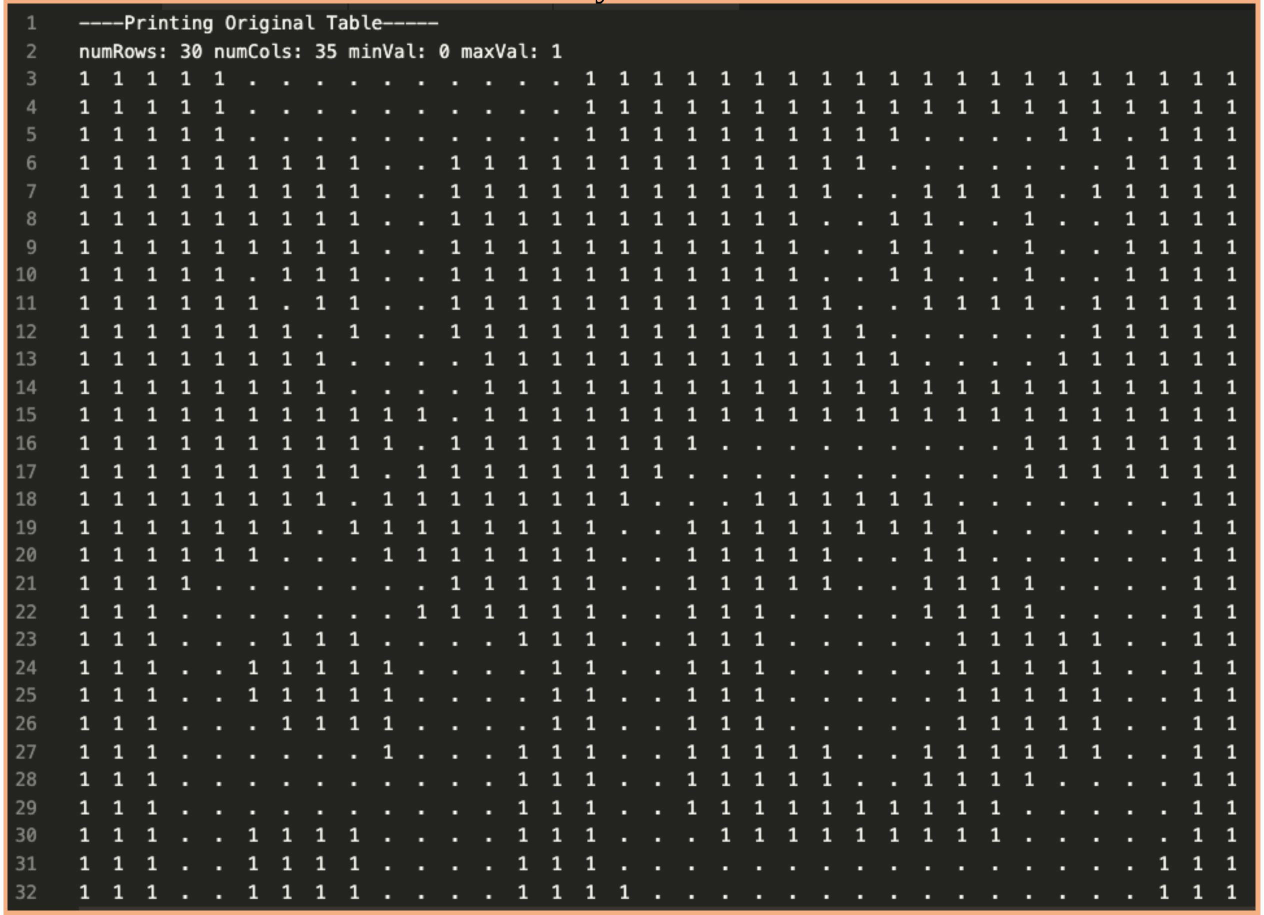


```
----Running Managing EQ ARRAY----
-----Printing EQ Table-----
1   2   3   4   5   6   7   8   9
1   1   2   1   1   3   1   3   1

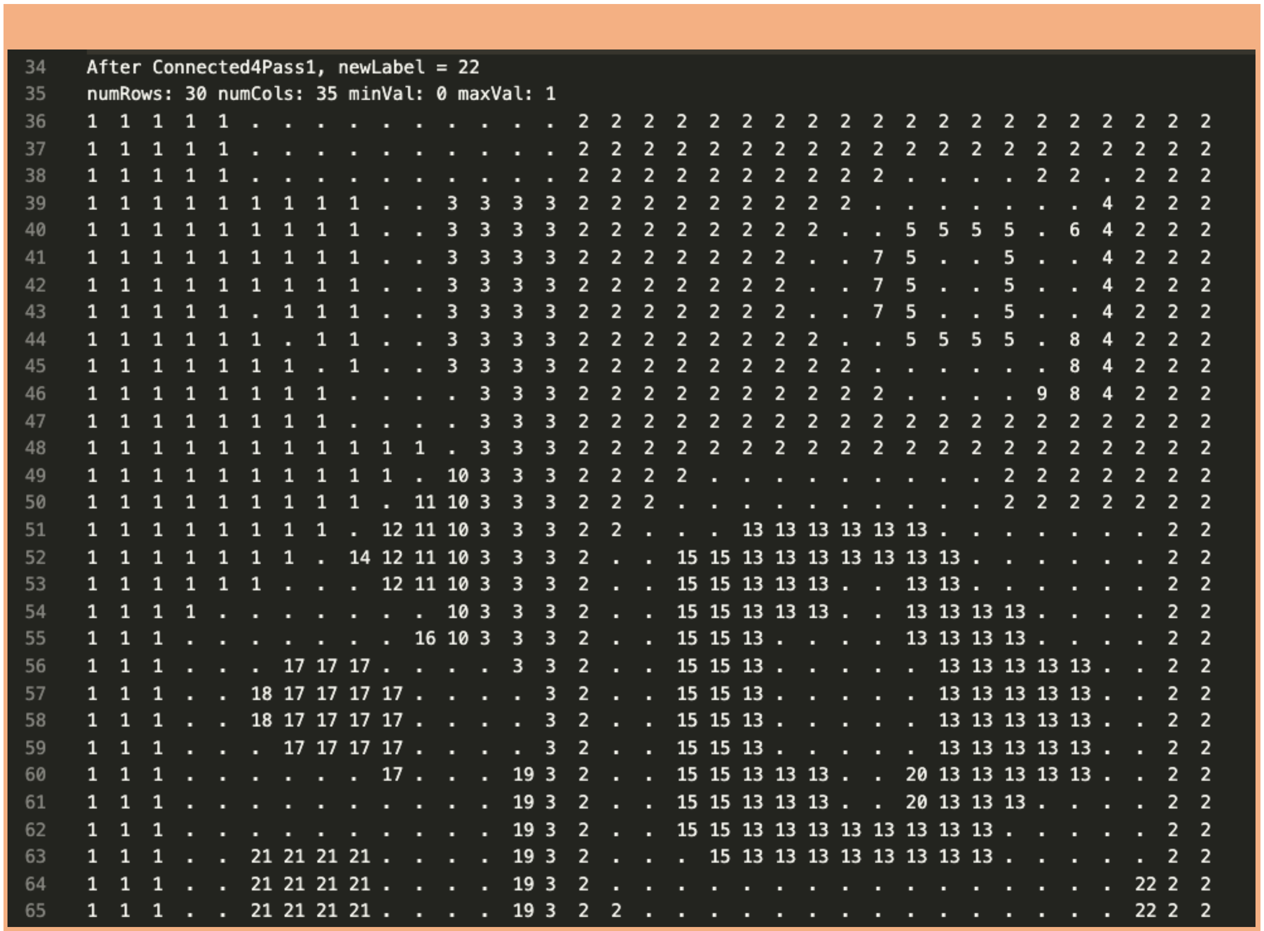
In Connected8, after manageEQarr, trueNumCC = 3
Entering connectPass3 Method
---leaving connectPass3 Method---
```

CONN 4 Data2.txt CONVERSION

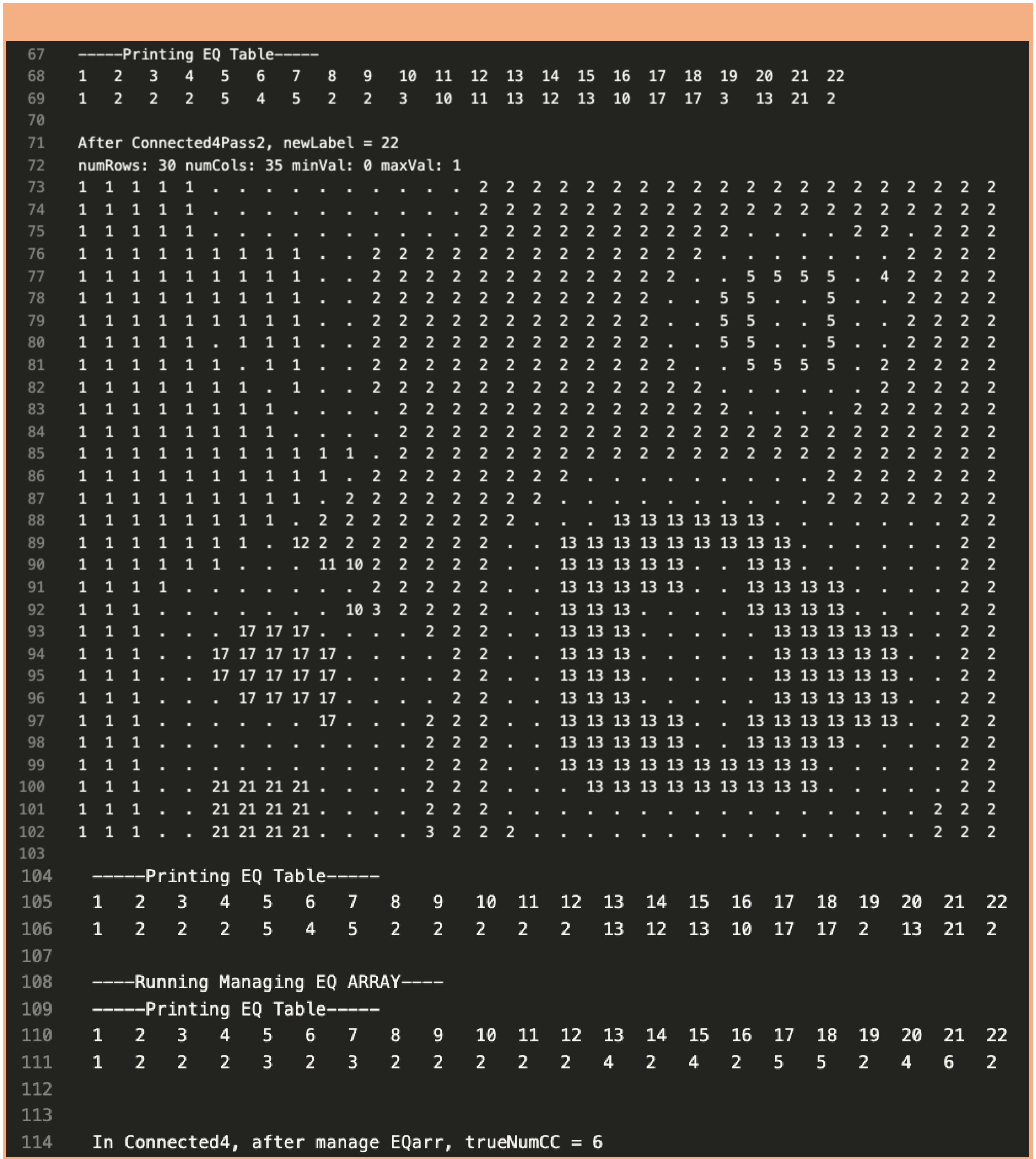
PrettyPrint.txt



```
----Printing Original Table-----
numRows: 30 numCols: 35 minVal: 0 maxVal: 1
1 1 1 1 1 . . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 . . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 . . . . . . . . . . 1 1 1 1 1 1 1 1 1 1 . . . . 1 1 . 1 1 1
1 1 1 1 1 1 1 1 1 . . 1 1 1 1 1 1 1 1 1 1 1 1 1 . . . . . . . 1 1 1 1
1 1 1 1 1 1 1 1 1 . . 1 1 1 1 1 1 1 1 1 1 1 1 . . 1 1 1 1 . 1 1 1 1 1
1 1 1 1 1 1 1 1 1 . . 1 1 1 1 1 1 1 1 1 1 1 . . 1 1 . . 1 . . 1 1 1 1
1 1 1 1 1 1 1 1 1 . . 1 1 1 1 1 1 1 1 1 1 1 . . 1 1 . . 1 . . 1 1 1 1
1 1 1 1 1 . 1 1 1 . . 1 1 1 1 1 1 1 1 1 1 1 . . 1 1 . . 1 . . 1 1 1 1
1 1 1 1 1 1 . 1 1 . . 1 1 1 1 1 1 1 1 1 1 1 1 . . 1 1 1 1 . 1 1 1 1 1
1 1 1 1 1 1 1 . 1 . . 1 1 1 1 1 1 1 1 1 1 1 1 1 . . . . . . 1 1 1 1 1
1 1 1 1 1 1 1 1 . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 . . . . 1 1 1 1 1 1
1 1 1 1 1 1 1 1 . . . . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 . 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 . 1 1 1 1 1 1 1 1 . . . . . . . . . 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 . 1 1 1 1 1 1 1 1 . . . . . . . . . . 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 . 1 1 1 1 1 1 1 1 . . . 1 1 1 1 1 1 . . . . . . . 1 1
1 1 1 1 1 1 1 . 1 1 1 1 1 1 1 1 . . 1 1 1 1 1 1 1 1 1 . . . . . . 1 1
1 1 1 1 1 1 . . . 1 1 1 1 1 1 1 . . 1 1 1 1 1 . . 1 1 . . . . . . 1 1
1 1 1 1 . . . . . . . 1 1 1 1 1 . . 1 1 1 1 1 . . 1 1 1 1 . . . . 1 1
1 1 1 . . . . . . . 1 1 1 1 1 1 . . 1 1 1 . . . . 1 1 1 1 . . . . 1 1
1 1 1 . . . 1 1 1 . . . . 1 1 1 . . 1 1 1 . . . . . 1 1 1 1 1 . . 1 1
1 1 1 . . 1 1 1 1 1 . . . . 1 1 . . 1 1 1 . . . . . 1 1 1 1 1 . . 1 1
1 1 1 . . 1 1 1 1 1 . . . . 1 1 . . 1 1 1 . . . . . 1 1 1 1 1 . . 1 1
1 1 1 . . . 1 1 1 1 . . . . 1 1 . . 1 1 1 . . . . . 1 1 1 1 1 . . 1 1
1 1 1 . . . . . . 1 . . . 1 1 1 . . 1 1 1 1 1 . . 1 1 1 1 1 1 . . 1 1
1 1 1 . . . . . . . . . . 1 1 1 . . 1 1 1 1 1 . . 1 1 1 1 . . . . 1 1
1 1 1 . . . . . . . . . . 1 1 1 . . 1 1 1 1 1 1 1 1 1 1 . . . . . 1 1
1 1 1 . . 1 1 1 1 . . . . 1 1 1 . . . 1 1 1 1 1 1 1 1 1 . . . . . 1 1
1 1 1 . . 1 1 1 1 . . . . 1 1 1 . . . . . . . . . . . . . . . . 1 1 1
1 1 1 . . 1 1 1 1 . . . . 1 1 1 1 . . . . . . . . . . . . . . . 1 1 1
```



```
After Connected4Pass1, newLabel = 22
numRows: 30 numCols: 35 minVal: 0 maxVal: 1
1  1  1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  .  .  .  .  2  2  .  2  2  2
1  1  1  1  1  1  1  1  1  .  .  3  3  3  3  2  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  4  2  2  2
1  1  1  1  1  1  1  1  1  .  .  3  3  3  3  2  2  2  2  2  2  2  2  .  .  5  5  5  5  .  6  4  2  2  2
1  1  1  1  1  1  1  1  1  .  .  3  3  3  3  2  2  2  2  2  2  2  .  .  7  5  .  .  5  .  .  4  2  2  2
1  1  1  1  1  1  1  1  1  .  .  3  3  3  3  2  2  2  2  2  2  2  .  .  7  5  .  .  5  .  .  4  2  2  2
1  1  1  1  1  .  1  1  1  .  .  3  3  3  3  2  2  2  2  2  2  2  .  .  7  5  .  .  5  .  .  4  2  2  2
1  1  1  1  1  1  .  1  1  .  .  3  3  3  3  2  2  2  2  2  2  2  2  .  .  5  5  5  5  .  8  4  2  2  2
1  1  1  1  1  1  1  .  1  .  .  3  3  3  3  2  2  2  2  2  2  2  2  2  .  .  .  .  .  .  8  4  2  2  2
1  1  1  1  1  1  1  1  .  .  .  .  3  3  3  2  2  2  2  2  2  2  2  2  2  .  .  .  .  9  8  4  2  2  2
1  1  1  1  1  1  1  1  .  .  .  .  3  3  3  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  1  1  1  .  3  3  3  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  1  1  .  10 3  3  3  2  2  2  2  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  1  .  11 10 3  3  3  2  2  2  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  .  12 11 10 3  3  3  2  2  .  .  .  13 13 13 13 13 13 .  .  .  .  .  .  .  2  2
1  1  1  1  1  1  1  .  14 12 11 10 3  3  3  2  .  .  15 15 13 13 13 13 13 13 13 .  .  .  .  .  .  2  2
1  1  1  1  1  1  .  .  .  12 11 10 3  3  3  2  .  .  15 15 13 13 13 .  .  13 13 .  .  .  .  .  .  2  2
1  1  1  1  .  .  .  .  .  .  .  10 3  3  3  2  .  .  15 15 13 13 13 .  .  13 13 13 13 .  .  .  .  2  2
1  1  1  .  .  .  .  .  .  .  16 10 3  3  3  2  .  .  15 15 13 .  .  .  .  13 13 13 13 .  .  .  .  2  2
1  1  1  .  .  .  17 17 17 .  .  .  .  3  3  2  .  .  15 15 13 .  .  .  .  .  13 13 13 13 13 .  .  2  2
1  1  1  .  .  18 17 17 17 17 .  .  .  .  3  2  .  .  15 15 13 .  .  .  .  .  13 13 13 13 13 .  .  2  2
1  1  1  .  .  18 17 17 17 17 .  .  .  .  3  2  .  .  15 15 13 .  .  .  .  .  13 13 13 13 13 .  .  2  2
1  1  1  .  .  .  17 17 17 17 .  .  .  .  3  2  .  .  15 15 13 .  .  .  .  .  13 13 13 13 13 .  .  2  2
1  1  1  .  .  .  .  .  .  17 .  .  .  19 3  2  .  .  15 15 13 13 13 .  .  20 13 13 13 13 13 .  .  2  2
1  1  1  .  .  .  .  .  .  .  .  .  .  19 3  2  .  .  15 15 13 13 13 .  .  20 13 13 13 .  .  .  .  2  2
1  1  1  .  .  .  .  .  .  .  .  .  .  19 3  2  .  .  15 15 13 13 13 13 13 13 13 13 .  .  .  .  .  2  2
1  1  1  .  .  21 21 21 21 .  .  .  .  19 3  2  .  .  .  15 13 13 13 13 13 13 13 13 .  .  .  .  .  2  2
1  1  1  .  .  21 21 21 21 .  .  .  .  19 3  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  22 2  2
1  1  1  .  .  21 21 21 21 .  .  .  .  19 3  2  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  22 2  2
```



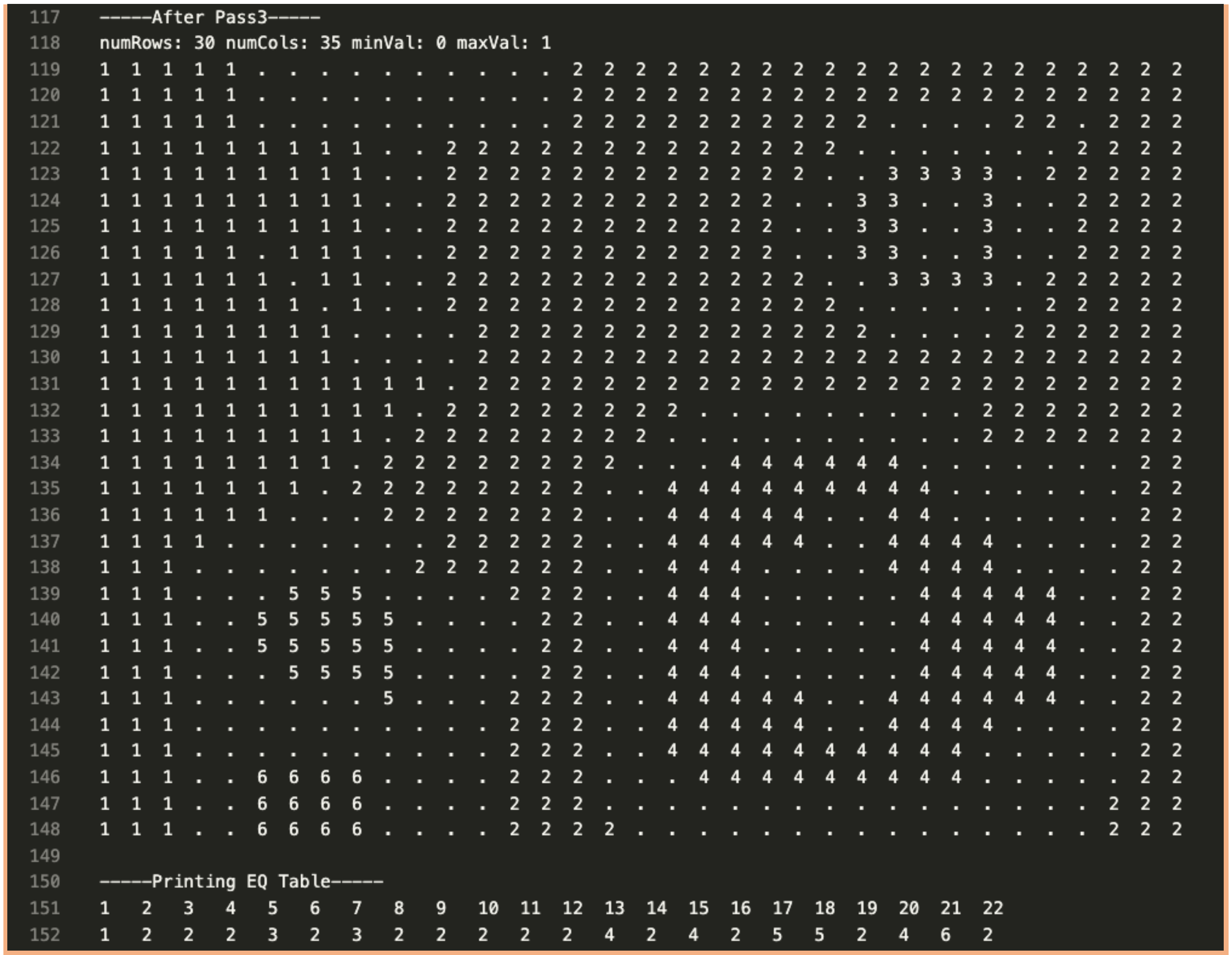
```
-----Printing EQ Table-----
1   2   3   4   5   6   7   8   9   10  11  12  13  14  15  16  17  18  19  20  21  22
1   2   2   2   5   4   5   2   2   3   10  11  13  12  13  10  17  17  3   13  21  2

After Connected4Pass2, newLabel = 22
numRows: 30 numCols: 35 minVal: 0 maxVal: 1
1  1  1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  .  .  .  .  2  2  .  2  2  2
1  1  1  1  1  1  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  2  2  2  2
1  1  1  1  1  1  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  2  .  .  5  5  5  5  .  4  2  2  2  2
1  1  1  1  1  1  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  .  .  5  5  .  .  5  .  .  2  2  2  2
1  1  1  1  1  1  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  .  .  5  5  .  .  5  .  .  2  2  2  2
1  1  1  1  1  .  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  .  .  5  5  .  .  5  .  .  2  2  2  2
1  1  1  1  1  1  .  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  2  .  .  5  5  5  5  .  2  2  2  2  2
1  1  1  1  1  1  1  .  1  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  .  .  2  2  2  2  2
1  1  1  1  1  1  1  1  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  2  2  2  2  2  2
1  1  1  1  1  1  1  1  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  1  1  1  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  1  1  .  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  1  .  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  .  2  2  2  2  2  2  2  2  2  .  .  .  13 13 13 13 13 13 .  .  .  .  .  .  2  2
1  1  1  1  1  1  1  .  12 2  2  2  2  2  2  2  .  .  13 13 13 13 13 13 13 13 13 .  .  .  .  .  .  2  2
1  1  1  1  1  1  .  .  .  11 10 2  2  2  2  2  .  .  13 13 13 13 13 .  .  13 13 .  .  .  .  .  .  2  2
1  1  1  1  .  .  .  .  .  .  .  2  2  2  2  2  .  .  13 13 13 13 13 .  .  13 13 13 13 .  .  .  .  2  2
1  1  1  .  .  .  .  .  .  .  10 3  2  2  2  2  .  .  13 13 13 .  .  .  .  13 13 13 13 .  .  .  .  2  2
1  1  1  .  .  .  17 17 17 .  .  .  .  2  2  2  .  .  13 13 13 .  .  .  .  .  13 13 13 13 13 .  .  2  2
1  1  1  .  .  17 17 17 17 17 .  .  .  .  2  2  .  .  13 13 13 .  .  .  .  .  13 13 13 13 13 .  .  2  2
1  1  1  .  .  17 17 17 17 17 .  .  .  .  2  2  .  .  13 13 13 .  .  .  .  .  13 13 13 13 13 .  .  2  2
1  1  1  .  .  .  17 17 17 17 .  .  .  .  2  2  .  .  13 13 13 .  .  .  .  .  13 13 13 13 13 .  .  2  2
1  1  1  .  .  .  .  .  .  17 .  .  .  2  2  2  .  .  13 13 13 13 13 .  .  13 13 13 13 13 13 .  .  2  2
1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  .  .  13 13 13 13 13 .  .  13 13 13 13 .  .  .  .  2  2
1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  .  .  13 13 13 13 13 13 13 13 13 13 .  .  .  .  .  2  2
1  1  1  .  .  21 21 21 21 .  .  .  .  2  2  2  .  .  .  13 13 13 13 13 13 13 13 13 .  .  .  .  .  2  2
1  1  1  .  .  21 21 21 21 .  .  .  .  2  2  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  2  2
1  1  1  .  .  21 21 21 21 .  .  .  .  3  2  2  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  2  2

 -----Printing EQ Table-----
 1   2   3   4   5   6   7   8   9   10  11  12  13  14  15  16  17  18  19  20  21  22
 1   2   2   2   5   4   5   2   2   2   2   2   13  12  13  10  17  17  2   13  21  2

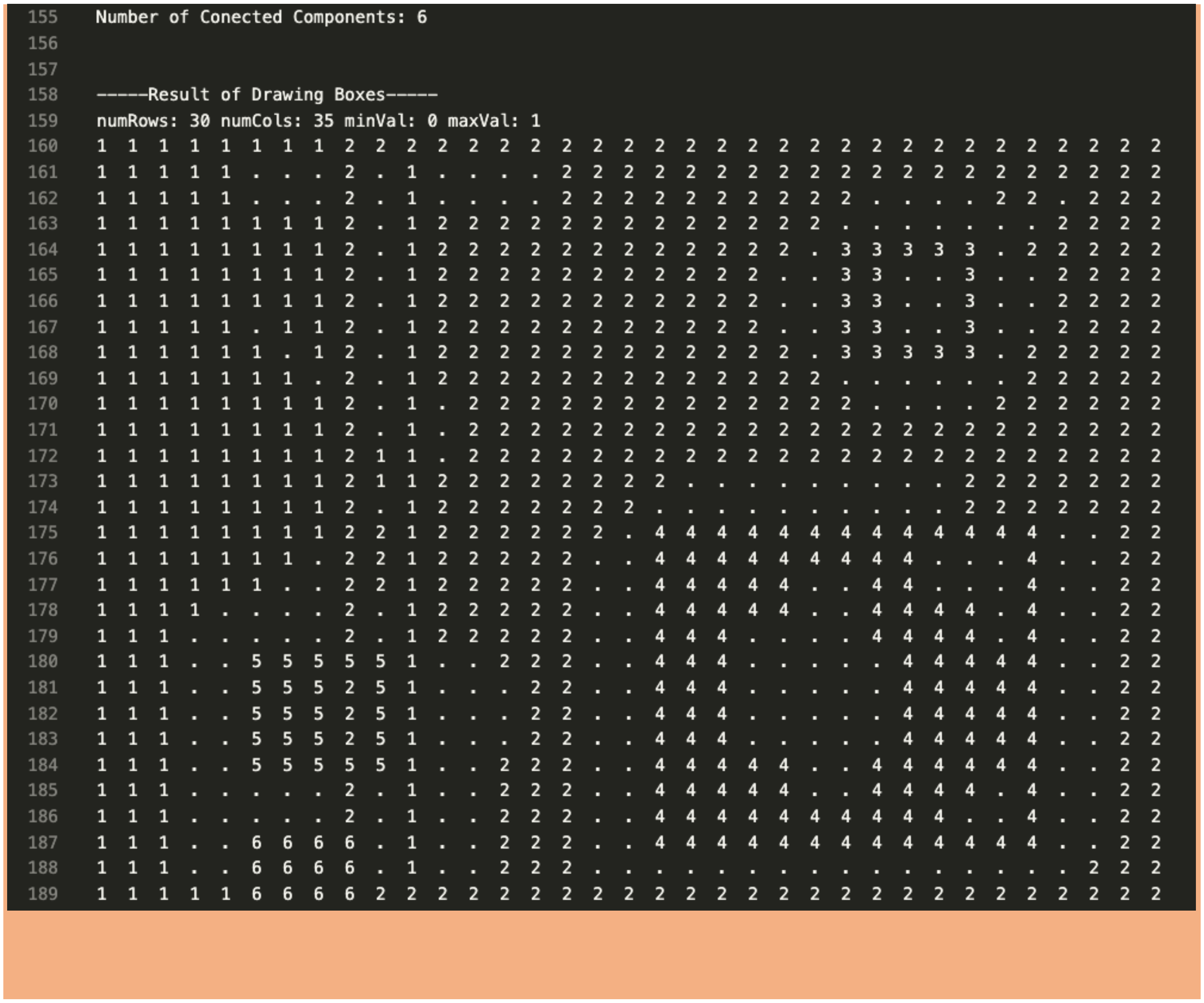
 ----Running Managing EQ ARRAY----
 -----Printing EQ Table-----
 1   2   3   4   5   6   7   8   9   10  11  12  13  14  15  16  17  18  19  20  21  22
 1   2   2   2   3   2   3   2   2   2   2   2   4   2   4   2   5   5   2   4   6   2


 In Connected4, after manage EQarr, trueNumCC = 6
```



```
-----After Pass3-----
numRows: 30 numCols: 35 minVal: 0 maxVal: 1
1  1  1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  .  .  .  .  2  2  .  2  2  2
1  1  1  1  1  1  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  2  2  2  2
1  1  1  1  1  1  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  2  .  .  3  3  3  3  .  2  2  2  2  2
1  1  1  1  1  1  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  .  .  3  3  .  .  3  .  .  2  2  2  2
1  1  1  1  1  1  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  .  .  3  3  .  .  3  .  .  2  2  2  2
1  1  1  1  1  .  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  .  .  3  3  .  .  3  .  .  2  2  2  2
1  1  1  1  1  1  .  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  2  .  .  3  3  3  3  .  2  2  2  2  2
1  1  1  1  1  1  1  .  1  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  .  .  2  2  2  2  2
1  1  1  1  1  1  1  1  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  2  2  2  2  2  2
1  1  1  1  1  1  1  1  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  1  1  1  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  1  1  .  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  1  .  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  .  2  2  2  2  2  2  2  2  .  .  .  4  4  4  4  4  4  .  .  .  .  .  .  .  2  2
1  1  1  1  1  1  1  .  2  2  2  2  2  2  2  2  .  .  4  4  4  4  4  4  4  4  4  .  .  .  .  .  .  2  2
1  1  1  1  1  1  .  .  .  2  2  2  2  2  2  2  .  .  4  4  4  4  4  .  .  4  4  .  .  .  .  .  .  2  2
1  1  1  1  .  .  .  .  .  .  .  2  2  2  2  2  .  .  4  4  4  4  4  .  .  4  4  4  4  .  .  .  .  2  2
1  1  1  .  .  .  .  .  .  .  2  2  2  2  2  2  .  .  4  4  4  .  .  .  .  4  4  4  4  .  .  .  .  2  2
1  1  1  .  .  .  5  5  5  .  .  .  .  2  2  2  .  .  4  4  4  .  .  .  .  .  4  4  4  4  4  .  .  2  2
1  1  1  .  .  5  5  5  5  5  .  .  .  .  2  2  .  .  4  4  4  .  .  .  .  .  4  4  4  4  4  .  .  2  2
1  1  1  .  .  5  5  5  5  5  .  .  .  .  2  2  .  .  4  4  4  .  .  .  .  .  4  4  4  4  4  .  .  2  2
1  1  1  .  .  .  5  5  5  5  .  .  .  .  2  2  .  .  4  4  4  .  .  .  .  .  4  4  4  4  4  .  .  2  2
1  1  1  .  .  .  .  .  .  5  .  .  .  2  2  2  .  .  4  4  4  4  4  .  .  4  4  4  4  4  4  .  .  2  2
1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  .  .  4  4  4  4  4  .  .  4  4  4  4  .  .  .  .  2  2
1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  .  .  4  4  4  4  4  4  4  4  4  4  .  .  .  .  .  2  2
1  1  1  .  .  6  6  6  6  .  .  .  .  2  2  2  .  .  .  4  4  4  4  4  4  4  4  4  .  .  .  .  .  2  2
1  1  1  .  .  6  6  6  6  .  .  .  .  2  2  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  2  2
1  1  1  .  .  6  6  6  6  .  .  .  .  2  2  2  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  2  2

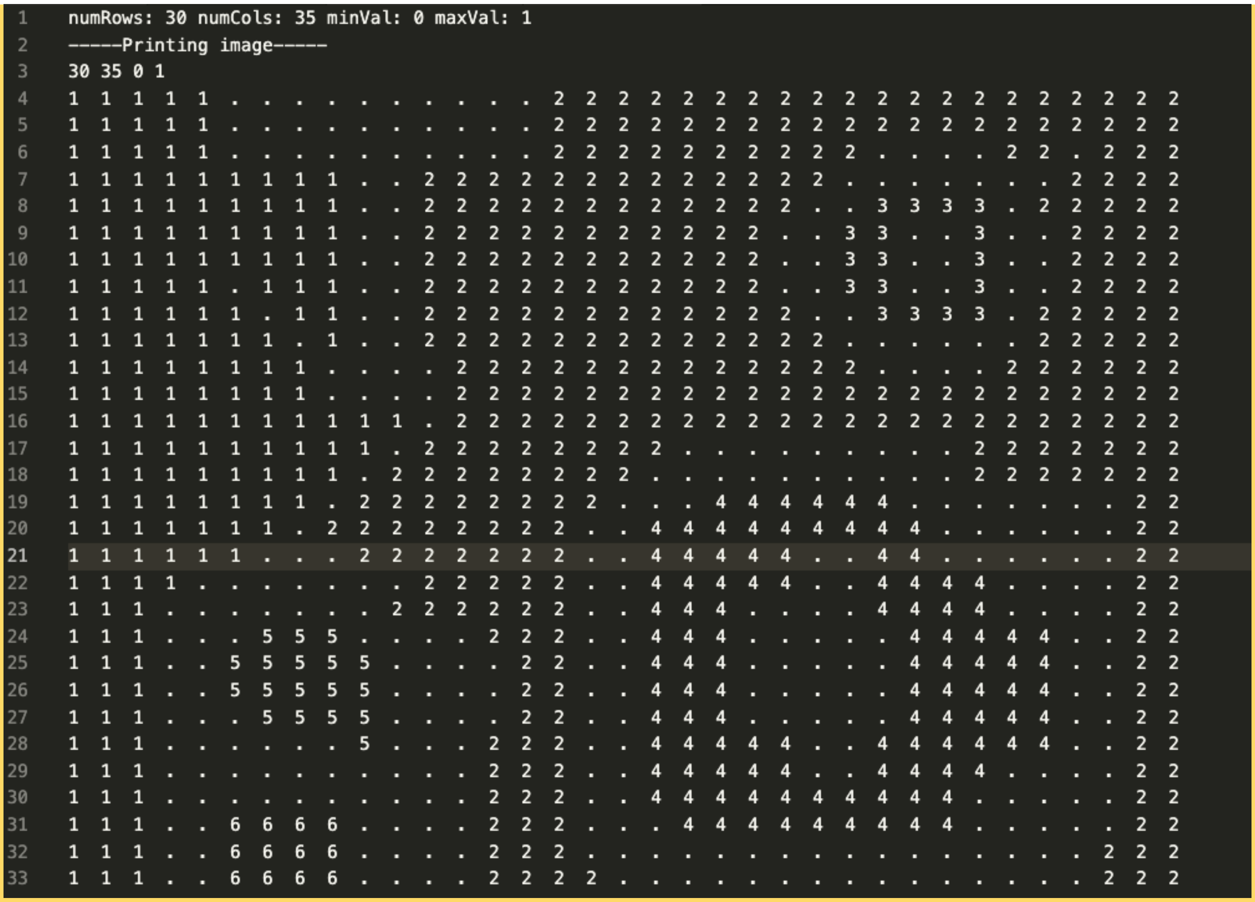
-----Printing EQ Table-----
1   2   3   4   5   6   7   8   9   10  11  12  13  14  15  16  17  18  19  20  21  22
1   2   2   2   3   2   3   2   2   2   2   2   4   2   4   2   5   5   2   4   6   2
```



```
Number of Conected Components: 6

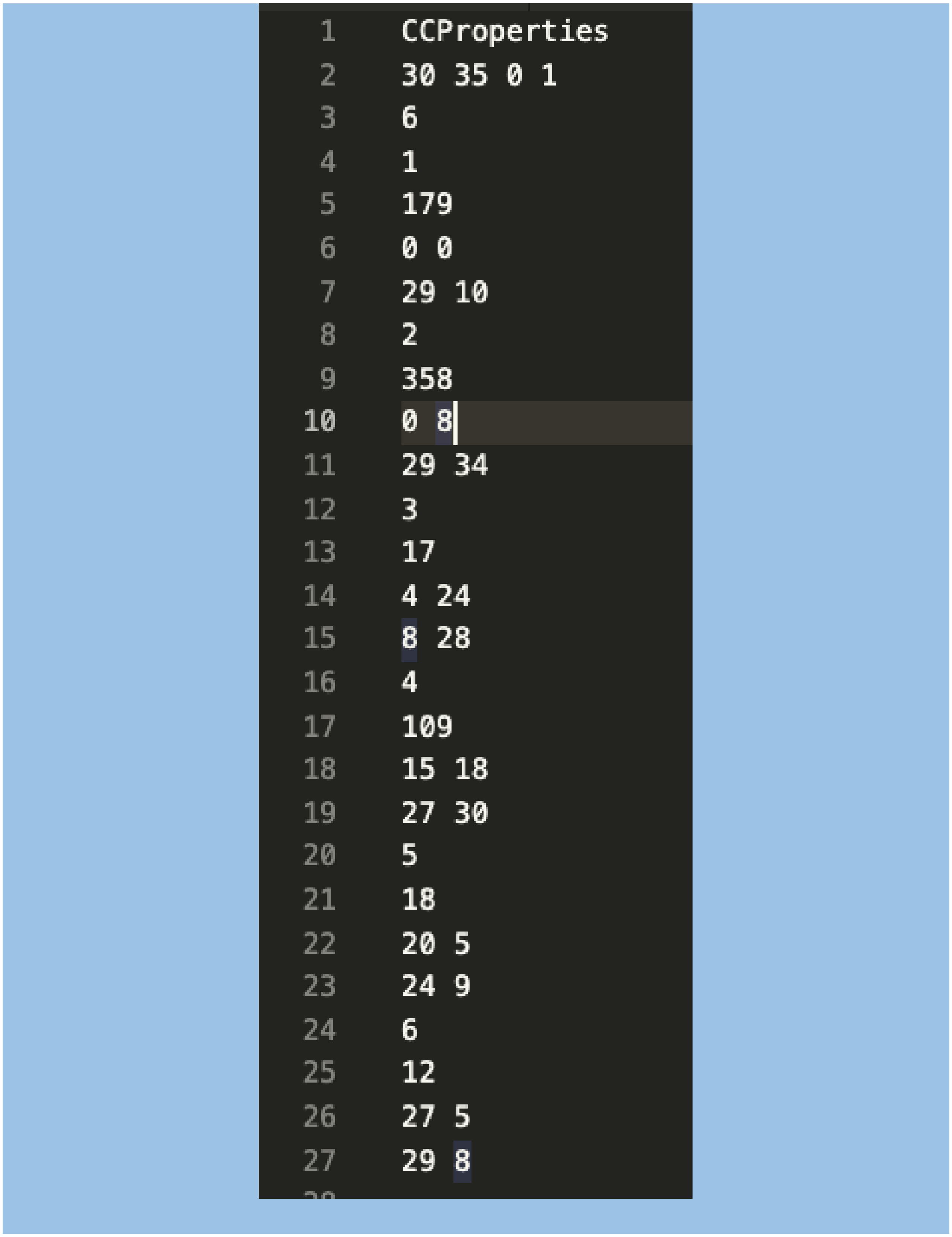

-----Result of Drawing Boxes-----
numRows: 30 numCols: 35 minVal: 0 maxVal: 1
1  1  1  1  1  1  1  1  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  .  .  .  2  .  1  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  .  .  .  2  .  1  .  .  .  .  2  2  2  2  2  2  2  2  2  2  .  .  .  .  2  2  .  2  2  2
1  1  1  1  1  1  1  1  2  .  1  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  2  2  2  2
1  1  1  1  1  1  1  1  2  .  1  2  2  2  2  2  2  2  2  2  2  2  2  .  3  3  3  3  3  .  2  2  2  2  2
1  1  1  1  1  1  1  1  2  .  1  2  2  2  2  2  2  2  2  2  2  2  .  .  3  3  .  .  3  .  .  2  2  2  2
1  1  1  1  1  1  1  1  2  .  1  2  2  2  2  2  2  2  2  2  2  2  .  .  3  3  .  .  3  .  .  2  2  2  2
1  1  1  1  1  .  1  1  2  .  1  2  2  2  2  2  2  2  2  2  2  2  .  .  3  3  .  .  3  .  .  2  2  2  2
1  1  1  1  1  1  .  1  2  .  1  2  2  2  2  2  2  2  2  2  2  2  2  .  3  3  3  3  3  .  2  2  2  2  2
1  1  1  1  1  1  1  .  2  .  1  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  .  .  2  2  2  2  2
1  1  1  1  1  1  1  1  2  .  1  .  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  2  2  2  2  2  2
1  1  1  1  1  1  1  1  2  .  1  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  2  1  1  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  2  1  1  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  2  .  1  2  2  2  2  2  2  2  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  2  2  1  2  2  2  2  2  2  .  4  4  4  4  4  4  4  4  4  4  4  4  4  .  .  2  2
1  1  1  1  1  1  1  .  2  2  1  2  2  2  2  2  .  .  4  4  4  4  4  4  4  4  4  .  .  .  4  .  .  2  2
1  1  1  1  1  1  .  .  2  2  1  2  2  2  2  2  .  .  4  4  4  4  4  .  .  4  4  .  .  .  4  .  .  2  2
1  1  1  1  .  .  .  .  2  .  1  2  2  2  2  2  .  .  4  4  4  4  4  .  .  4  4  4  4  .  4  .  .  2  2
1  1  1  .  .  .  .  .  2  .  1  2  2  2  2  2  .  .  4  4  4  .  .  .  .  4  4  4  4  .  4  .  .  2  2
1  1  1  .  .  5  5  5  5  5  1  .  .  2  2  2  .  .  4  4  4  .  .  .  .  .  4  4  4  4  4  .  .  2  2
1  1  1  .  .  5  5  5  2  5  1  .  .  .  2  2  .  .  4  4  4  .  .  .  .  .  4  4  4  4  4  .  .  2  2
1  1  1  .  .  5  5  5  2  5  1  .  .  .  2  2  .  .  4  4  4  .  .  .  .  .  4  4  4  4  4  .  .  2  2
1  1  1  .  .  5  5  5  2  5  1  .  .  .  2  2  .  .  4  4  4  .  .  .  .  .  4  4  4  4  4  .  .  2  2
1  1  1  .  .  5  5  5  5  5  1  .  .  2  2  2  .  .  4  4  4  4  4  .  .  4  4  4  4  4  4  .  .  2  2
1  1  1  .  .  .  .  .  2  .  1  .  .  2  2  2  .  .  4  4  4  4  4  .  .  4  4  4  4  .  4  .  .  2  2
1  1  1  .  .  .  .  .  2  .  1  .  .  2  2  2  .  .  4  4  4  4  4  4  4  4  4  4  .  .  4  .  .  2  2
1  1  1  .  .  6  6  6  6  .  1  .  .  2  2  2  .  .  4  4  4  4  4  4  4  4  4  4  4  4  4  .  .  2  2
1  1  1  .  .  6  6  6  6  .  1  .  .  2  2  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  2  2
1  1  1  1  1  6  6  6  6  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
```

Label.txt



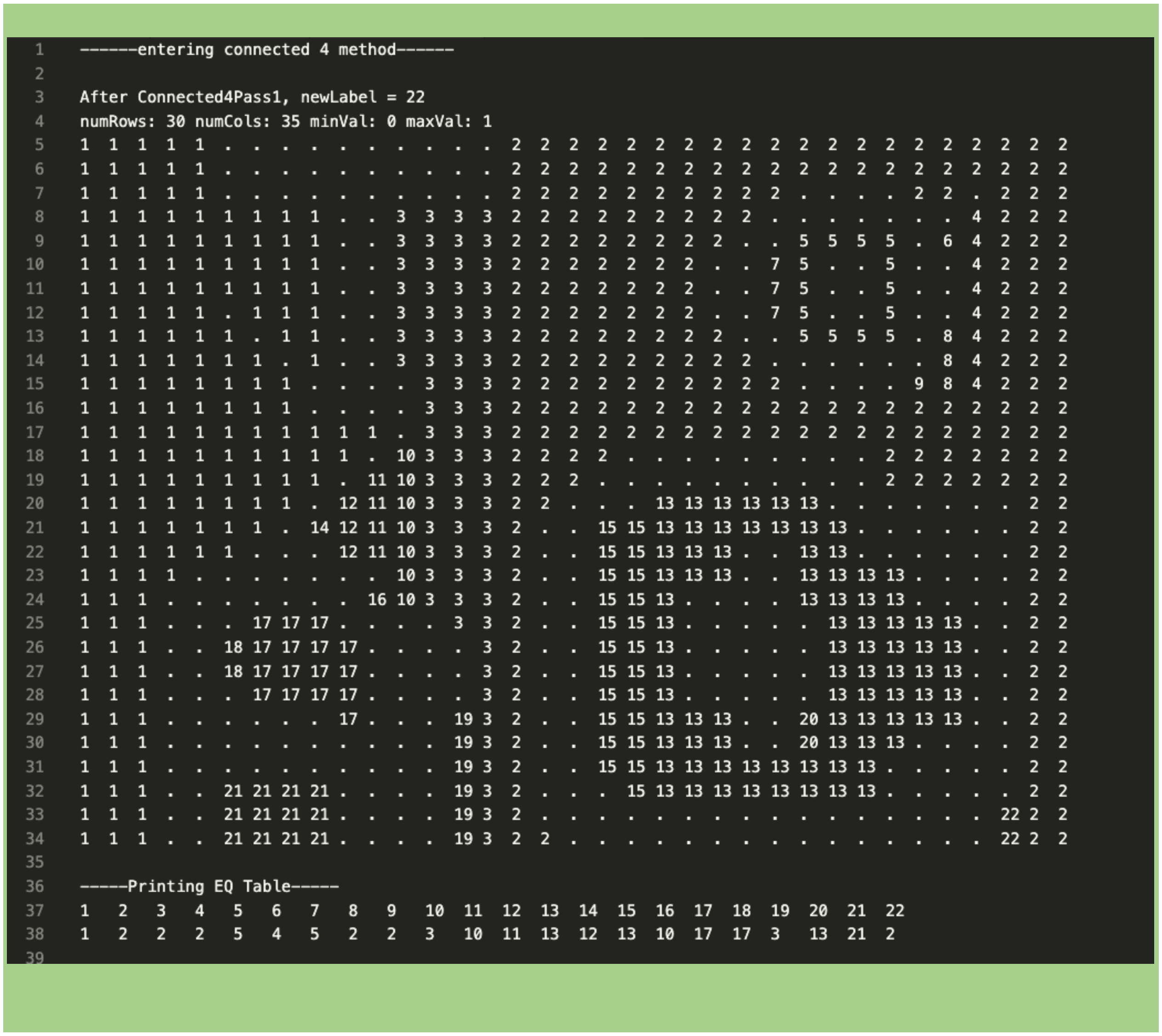
```
numRows: 30 numCols: 35 minVal: 0 maxVal: 1
-----Printing image-----
30 35 0 1
1  1  1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  .  .  .  .  2  2  .  2  2  2
1  1  1  1  1  1  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  2  2  2  2
1  1  1  1  1  1  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  2  .  .  3  3  3  3  .  2  2  2  2  2
1  1  1  1  1  1  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  .  .  3  3  .  .  3  .  .  2  2  2  2
1  1  1  1  1  1  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  .  .  3  3  .  .  3  .  .  2  2  2  2
1  1  1  1  1  .  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  .  .  3  3  .  .  3  .  .  2  2  2  2
1  1  1  1  1  1  .  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  2  .  .  3  3  3  3  .  2  2  2  2  2
1  1  1  1  1  1  1  .  1  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  .  .  2  2  2  2  2
1  1  1  1  1  1  1  1  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  2  2  2  2  2  2
1  1  1  1  1  1  1  1  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  1  1  1  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  1  1  .  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  1  .  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  .  2  2  2  2  2  2  2  2  .  .  .  4  4  4  4  4  4  .  .  .  .  .  .  .  2  2
1  1  1  1  1  1  1  .  2  2  2  2  2  2  2  2  .  .  4  4  4  4  4  4  4  4  4  .  .  .  .  .  .  2  2
1  1  1  1  1  1  .  .  .  2  2  2  2  2  2  2  .  .  4  4  4  4  4  .  .  4  4  .  .  .  .  .  .  2  2
1  1  1  1  .  .  .  .  .  .  .  2  2  2  2  2  .  .  4  4  4  4  4  .  .  4  4  4  4  .  .  .  .  2  2
1  1  1  .  .  .  .  .  .  .  2  2  2  2  2  2  .  .  4  4  4  .  .  .  .  4  4  4  4  .  .  .  .  2  2
1  1  1  .  .  .  5  5  5  .  .  .  .  2  2  2  .  .  4  4  4  .  .  .  .  .  4  4  4  4  4  .  .  2  2
1  1  1  .  .  5  5  5  5  5  .  .  .  .  2  2  .  .  4  4  4  .  .  .  .  .  4  4  4  4  4  .  .  2  2
1  1  1  .  .  5  5  5  5  5  .  .  .  .  2  2  .  .  4  4  4  .  .  .  .  .  4  4  4  4  4  .  .  2  2
1  1  1  .  .  .  5  5  5  5  .  .  .  .  2  2  .  .  4  4  4  .  .  .  .  .  4  4  4  4  4  .  .  2  2
1  1  1  .  .  .  .  .  .  5  .  .  .  2  2  2  .  .  4  4  4  4  4  .  .  4  4  4  4  4  4  .  .  2  2
1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  .  .  4  4  4  4  4  .  .  4  4  4  4  .  .  .  .  2  2
1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  .  .  4  4  4  4  4  4  4  4  4  4  .  .  .  .  .  2  2
1  1  1  .  .  6  6  6  6  .  .  .  .  2  2  2  .  .  .  4  4  4  4  4  4  4  4  4  .  .  .  .  .  2  2
1  1  1  .  .  6  6  6  6  .  .  .  .  2  2  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  2  2
1  1  1  .  .  6  6  6  6  .  .  .  .  2  2  2  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  2  2
```

Property.txt



```
CCProperties
30 35 0 1
6
1
179
0 0
29 10
2
358
0 8
29 34
3
17
4 24
8 28
4
109
15 18
27 30
5
18
20 5
24 9
6
12
27 5
29 8
```

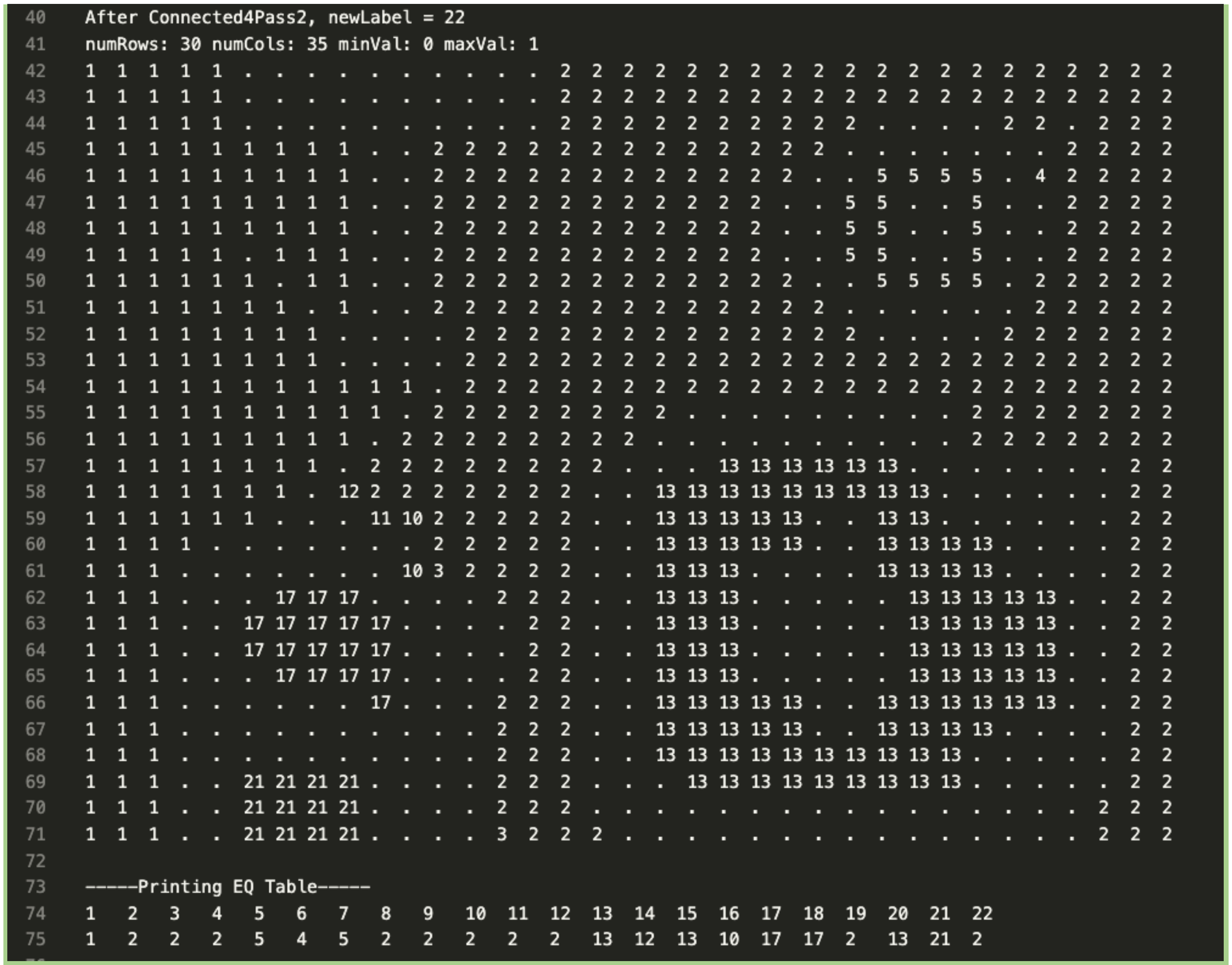
Debug.txt



```
------entering connected 4 method------

After Connected4Pass1, newLabel = 22
numRows: 30 numCols: 35 minVal: 0 maxVal: 1
1  1  1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  
1  1  1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  
1  1  1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  .  .  .  .  2  2  .  2  2  2  
1  1  1  1  1  1  1  1  1  .  .  3  3  3  3  2  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  4  2  2  2  
1  1  1  1  1  1  1  1  1  .  .  3  3  3  3  2  2  2  2  2  2  2  2  .  .  5  5  5  5  .  6  4  2  2  2  
1  1  1  1  1  1  1  1  1  .  .  3  3  3  3  2  2  2  2  2  2  2  .  .  7  5  .  .  5  .  .  4  2  2  2  
1  1  1  1  1  1  1  1  1  .  .  3  3  3  3  2  2  2  2  2  2  2  .  .  7  5  .  .  5  .  .  4  2  2  2  
1  1  1  1  1  .  1  1  1  .  .  3  3  3  3  2  2  2  2  2  2  2  .  .  7  5  .  .  5  .  .  4  2  2  2  
1  1  1  1  1  1  .  1  1  .  .  3  3  3  3  2  2  2  2  2  2  2  2  .  .  5  5  5  5  .  8  4  2  2  2  
1  1  1  1  1  1  1  .  1  .  .  3  3  3  3  2  2  2  2  2  2  2  2  2  .  .  .  .  .  .  8  4  2  2  2  
1  1  1  1  1  1  1  1  .  .  .  .  3  3  3  2  2  2  2  2  2  2  2  2  2  .  .  .  .  9  8  4  2  2  2  
1  1  1  1  1  1  1  1  .  .  .  .  3  3  3  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  
1  1  1  1  1  1  1  1  1  1  1  .  3  3  3  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  
1  1  1  1  1  1  1  1  1  1  .  10 3  3  3  2  2  2  2  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  
1  1  1  1  1  1  1  1  1  .  11 10 3  3  3  2  2  2  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  
1  1  1  1  1  1  1  1  .  12 11 10 3  3  3  2  2  .  .  .  13 13 13 13 13 13 .  .  .  .  .  .  .  2  2  
1  1  1  1  1  1  1  .  14 12 11 10 3  3  3  2  .  .  15 15 13 13 13 13 13 13 13 .  .  .  .  .  .  2  2  
1  1  1  1  1  1  .  .  .  12 11 10 3  3  3  2  .  .  15 15 13 13 13 .  .  13 13 .  .  .  .  .  .  2  2  
1  1  1  1  .  .  .  .  .  .  .  10 3  3  3  2  .  .  15 15 13 13 13 .  .  13 13 13 13 .  .  .  .  2  2  
1  1  1  .  .  .  .  .  .  .  16 10 3  3  3  2  .  .  15 15 13 .  .  .  .  13 13 13 13 .  .  .  .  2  2  
1  1  1  .  .  .  17 17 17 .  .  .  .  3  3  2  .  .  15 15 13 .  .  .  .  .  13 13 13 13 13 .  .  2  2  
1  1  1  .  .  18 17 17 17 17 .  .  .  .  3  2  .  .  15 15 13 .  .  .  .  .  13 13 13 13 13 .  .  2  2  
1  1  1  .  .  18 17 17 17 17 .  .  .  .  3  2  .  .  15 15 13 .  .  .  .  .  13 13 13 13 13 .  .  2  2  
1  1  1  .  .  .  17 17 17 17 .  .  .  .  3  2  .  .  15 15 13 .  .  .  .  .  13 13 13 13 13 .  .  2  2  
1  1  1  .  .  .  .  .  .  17 .  .  .  19 3  2  .  .  15 15 13 13 13 .  .  20 13 13 13 13 13 .  .  2  2  
1  1  1  .  .  .  .  .  .  .  .  .  .  19 3  2  .  .  15 15 13 13 13 .  .  20 13 13 13 .  .  .  .  2  2  
1  1  1  .  .  .  .  .  .  .  .  .  .  19 3  2  .  .  15 15 13 13 13 13 13 13 13 13 .  .  .  .  .  2  2  
1  1  1  .  .  21 21 21 21 .  .  .  .  19 3  2  .  .  .  15 13 13 13 13 13 13 13 13 .  .  .  .  .  2  2  
1  1  1  .  .  21 21 21 21 .  .  .  .  19 3  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  22 2  2  
1  1  1  .  .  21 21 21 21 .  .  .  .  19 3  2  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  22 2  2  

-----Printing EQ Table-----
1   2   3   4   5   6   7   8   9   10  11  12  13  14  15  16  17  18  19  20  21  22  
1   2   2   2   5   4   5   2   2   3   10  11  13  12  13  10  17  17  3   13  21  2   
```



```
After Connected4Pass2, newLabel = 22
numRows: 30 numCols: 35 minVal: 0 maxVal: 1
1  1  1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  .  .  .  .  2  2  .  2  2  2
1  1  1  1  1  1  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  2  2  2  2
1  1  1  1  1  1  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  2  .  .  5  5  5  5  .  4  2  2  2  2
1  1  1  1  1  1  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  .  .  5  5  .  .  5  .  .  2  2  2  2
1  1  1  1  1  1  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  .  .  5  5  .  .  5  .  .  2  2  2  2
1  1  1  1  1  .  1  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  .  .  5  5  .  .  5  .  .  2  2  2  2
1  1  1  1  1  1  .  1  1  .  .  2  2  2  2  2  2  2  2  2  2  2  2  .  .  5  5  5  5  .  2  2  2  2  2
1  1  1  1  1  1  1  .  1  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  .  .  2  2  2  2  2
1  1  1  1  1  1  1  1  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  2  2  2  2  2  2
1  1  1  1  1  1  1  1  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  1  1  1  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  1  1  .  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  1  .  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2
1  1  1  1  1  1  1  1  .  2  2  2  2  2  2  2  2  .  .  .  13 13 13 13 13 13 .  .  .  .  .  .  .  2  2
1  1  1  1  1  1  1  .  12 2  2  2  2  2  2  2  .  .  13 13 13 13 13 13 13 13 13 .  .  .  .  .  .  2  2
1  1  1  1  1  1  .  .  .  11 10 2  2  2  2  2  .  .  13 13 13 13 13 .  .  13 13 .  .  .  .  .  .  2  2
1  1  1  1  .  .  .  .  .  .  .  2  2  2  2  2  .  .  13 13 13 13 13 .  .  13 13 13 13 .  .  .  .  2  2
1  1  1  .  .  .  .  .  .  .  10 3  2  2  2  2  .  .  13 13 13 .  .  .  .  13 13 13 13 .  .  .  .  2  2
1  1  1  .  .  .  17 17 17 .  .  .  .  2  2  2  .  .  13 13 13 .  .  .  .  .  13 13 13 13 13 .  .  2  2
1  1  1  .  .  17 17 17 17 17 .  .  .  .  2  2  .  .  13 13 13 .  .  .  .  .  13 13 13 13 13 .  .  2  2
1  1  1  .  .  17 17 17 17 17 .  .  .  .  2  2  .  .  13 13 13 .  .  .  .  .  13 13 13 13 13 .  .  2  2
1  1  1  .  .  .  17 17 17 17 .  .  .  .  2  2  .  .  13 13 13 .  .  .  .  .  13 13 13 13 13 .  .  2  2
1  1  1  .  .  .  .  .  .  17 .  .  .  2  2  2  .  .  13 13 13 13 13 .  .  13 13 13 13 13 13 .  .  2  2
1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  .  .  13 13 13 13 13 .  .  13 13 13 13 .  .  .  .  2  2
1  1  1  .  .  .  .  .  .  .  .  .  .  2  2  2  .  .  13 13 13 13 13 13 13 13 13 13 .  .  .  .  .  2  2
1  1  1  .  .  21 21 21 21 .  .  .  .  2  2  2  .  .  .  13 13 13 13 13 13 13 13 13 .  .  .  .  .  2  2
1  1  1  .  .  21 21 21 21 .  .  .  .  2  2  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  2  2
1  1  1  .  .  21 21 21 21 .  .  .  .  3  2  2  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  2  2

-----Printing EQ Table-----
1    2    3    4    5    6    7    8    9    10   11   12   13   14   15   16   17   18   19   20   21   22
1    2    2    2    5    4    5    2    2    2    2    2    13   12   13   10   17   17   2    13   21   2
```

Main.cpp

```
#include <iostream>

#include <fstream>

#include <sstream>

#include <vector>

#include <cstring>

#include <algorithm>

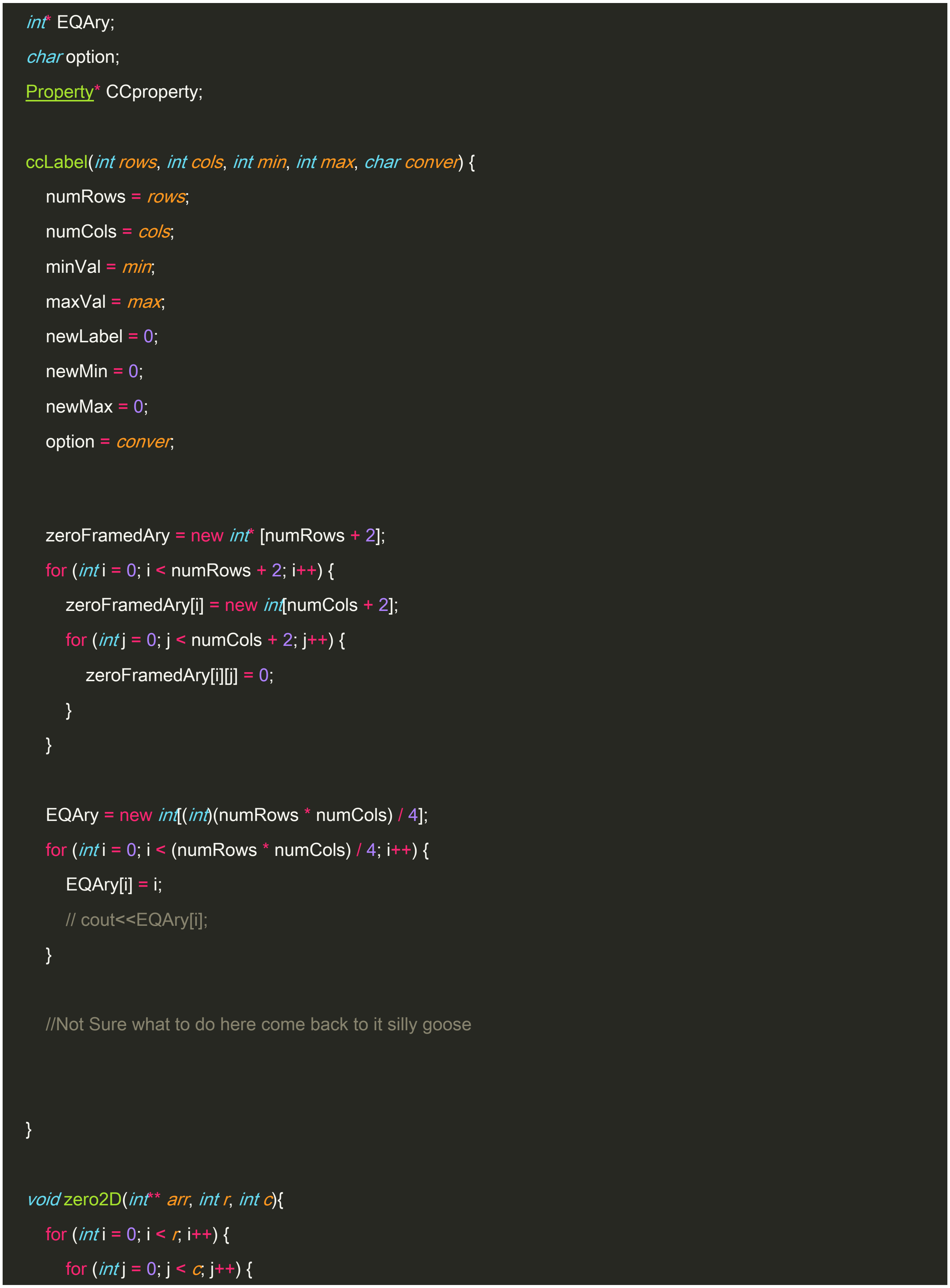
using namespace std;



struct Property {
    int label;
    int numPixels;
    int minR;
    int minC;
    int maxR;
    int maxC;

    Property() {
        label = 0;
        numPixels = 0;
        minR = 0;
        minC = 0;
        maxR = 0;
        maxC = 0;
    }
    Property(int label, int numPixels, int minR, int minC, int maxR, int maxC) {
        this->label = label;
        this->numPixels = numPixels;
        this->minR = minR;
        this->minC = minC;
        this->maxR = maxR;
        this->maxC = maxC;
    }
};

class ccLabel {
public:
    int numRows;
    int numCols;
    int minVal;
    int maxVal;
    int newLabel;
    int trueNumCC;
    int newMin;
    int newMax;
    int** zeroFramedAry;
    int NonZeroNeighborAry[5];
```



```
int* EQAry;
char option;
Property* CCproperty;

ccLabel(int rows, int cols, int min, int max, char conver) {
    numRows = rows;
    numCols = cols;
    minVal = min;
    maxVal = max;
    newLabel = 0;
    newMin = 0;
    newMax = 0;
    option = conver;


    zeroFramedAry = new int* [numRows + 2];
    for (int i = 0; i < numRows + 2; i++) {
        zeroFramedAry[i] = new int[numCols + 2];
        for (int j = 0; j < numCols + 2; j++) {
            zeroFramedAry[i][j] = 0;
        }
    }

    EQAry = new int[(int)(numRows * numCols) / 4];
    for (int i = 0; i < (numRows * numCols) / 4; i++) {
        EQAry[i] = i;
        // cout<<EQAry[i];
    }

    //Not Sure what to do here come back to it silly goose


}

void zero2D(int** arr, int r, int c){
    for (int i = 0; i < r; i++) {
        for (int j = 0; j < c; j++) {
            arr[i][j] = 0;
        }
    }

}

void negative1D(int *arr, int size){
    for(int i = 0; i < size; i++){
        arr[i] = -1;
    }
}

void loadImage(ifstream *infile, ofstream *outfile){

    string line;
    int val;
    int r=0;

    while (getline(*infile, line)){
        int c=1;
        istringstream set(line);
        while (set >> val){
            // cout << val << " ";
            zeroFramedAry[r][c] = val;
            c++;
        }
        // cout << endl;
        r++;
    //     // cout <<endl;
    }
}

void connectPass3(ofstream *out){
    *out << "Entering connectPass3 Method"<<endl;
    //step1

    for (int i = 1; i <= trueNumCC; i++)
```

```
{
    CCproperty[i].label = i;
    CCproperty[i].numPixels = 0;
    CCproperty[i].minR = numRows;
    CCproperty[i].maxR = 0;
    CCproperty[i].minC = numCols;
    CCproperty[i].maxC = 0;

}
int r=1;

//step 4
while(r<numRows+1){
    int c=1;
    while (c<numCols+1){
        int pix = zeroFramedAry[r][c];

        //step 3
        if(pix > 0){
            zeroFramedAry[r][c] = EQAry[pix];
            int k = zeroFramedAry[r][c];
            CCproperty[k].numPixels++;


            if(r<CCproperty[k].minR)
                CCproperty[k].minR = r;

            if(r>CCproperty[k].maxR)
                CCproperty[k].maxR = r;

            if(c<CCproperty[k].minC)
                CCproperty[k].minC = c;

            if(c>CCproperty[k].maxC)
                CCproperty[k].maxC = c;

            }
            c++;
        }
        r++;
    }

    *out << "---leaving connectPass3 Method---"<<endl<<endl;


}

void conversion(){

    for (int i = 1; i < numRows+1; i++){
        for (int j = 1; j < numCols+1; j++){
            zeroFramedAry[i][j] = (zeroFramedAry[i][j]+1)%2;
      }
    }

}

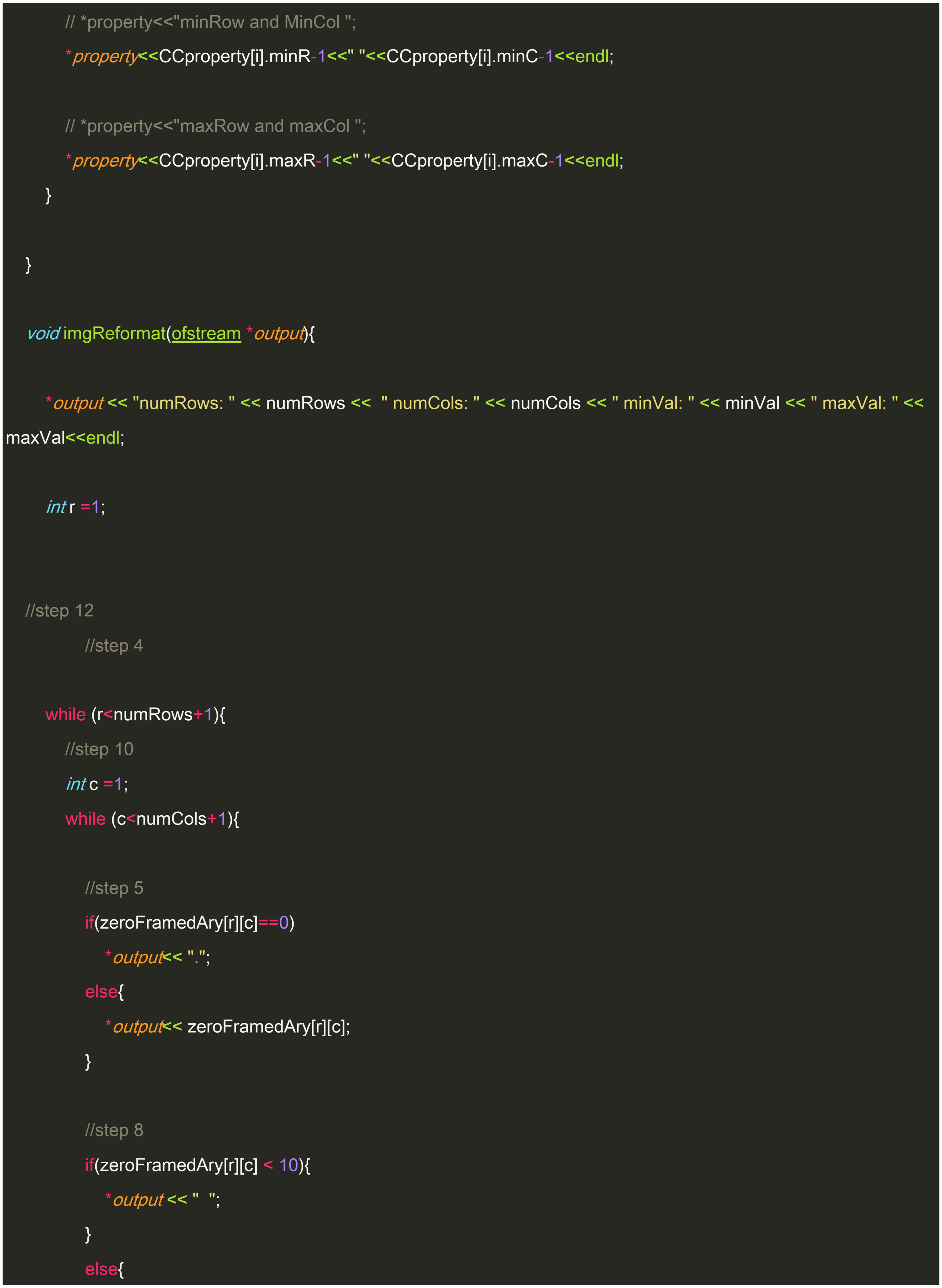
void printProperty(ofstream *property){

    //Image heade
    *property<<numRows<<" "<<numCols<<" "<<minVal<<" "<<maxVal<<endl;
    //number of CCs
    // *property<<"trueNumCC: ";
    *property<<trueNumCC<<endl;


    for (int i = 1; i <= trueNumCC; i++){

        // *property<<"Label: ";
        *property<<CCproperty[i].label<<endl;

        // *property<<"numPix: ";
        *property<<CCproperty[i].numPixels<<endl;
```



```
            // *property<<"minRow and MinCol ";
            *property<<CCproperty[i].minR-1<<" "<<CCproperty[i].minC-1<<endl;

            // *property<<"maxRow and maxCol ";
            *property<<CCproperty[i].maxR-1<<" "<<CCproperty[i].maxC-1<<endl;
        }

    }

    void imgReformat(ofstream *output){

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

        int r =1;



    //step 12
                //step 4

        while (r<numRows+1){
            //step 10
            int c =1;
            while (c<numCols+1){

                //step 5
                if(zeroFramedAry[r][c]==0)
                    *output<< ".";
                else{
                    *output<< zeroFramedAry[r][c];
                }

                //step 8
                if(zeroFramedAry[r][c] < 10){
                    *output << "  ";
                }
                else{
```

```
                *output << " ";
            }

            //step 9
            c++;
        }
        *output << endl;
        //step 11
        r++;
    }

}

void printArr(ofstream *out){

    *out<<"____PRINTING ZERO FRAMED ARR____"<<endl;

    for (int i = 0; i < numRows+2; i++){
        for (int j = 0; j < numCols+2; j++){
            *out<<zeroFramedAry[i][j]<< " ";
      }
      *out<<endl;
    }
    *out<<endl<<endl<<endl;
}

void drawBoxes(){
    //step 1
    int index = 1;

        // cout<<"trueNumCC is " << trueNumCC<<endl;
    while (index <=trueNumCC){
        // cout<<"index is " << index<<endl;
        //step 2
        int minRow = CCproperty[index].minR,
            minCol = CCproperty[index].minC,
            maxRow = CCproperty[index].maxR,
            maxCol = CCproperty[index].maxC,
            label = CCproperty[index].label;
        // cout<<"\tCCproperty["<<index<<"].minR+1: "<< CCproperty[index].minR <<endl;
        // cout<<"\tCCproperty["<<index<<"].minC+1: "<< CCproperty[index].minC <<endl;
        // cout<<"\tCCproperty["<<index<<"].maxR+1: "<< CCproperty[index].maxR <<endl;
        // cout<<"\tCCproperty["<<index<<"].maxC+1 "<< CCproperty[index].maxC <<endl;
        // cout<<"\tCCproperty[numPixels] "<< CCproperty[index].numPixels <<endl;
        // cout<<"\tCCproperty["<<index<<"].label "<< CCproperty[index].label<<endl;

        //step 3
        for (int r= minRow; r < maxRow+1; r++){
            zeroFramedAry[r][minCol] = label;
             zeroFramedAry[r][maxCol] = label;
        }

        for (int c = minCol; c < maxCol+1; c++){

            zeroFramedAry[minRow][c] = label;
            zeroFramedAry[maxRow][c] = label;
        }



        //step 4
        index++;
    }
}

void printImg(ofstream *out){

    *out<<"-----Printing image-----"<<endl;
    *out<<numRows<<" " << numCols <<" " << minVal <<" " << maxVal<<endl;
    for(int i = 1; i < numRows+1; i++){
        for (int j = 1; j < numCols+1; j++){

            if(zeroFramedAry[i][j]==0)
                *out << ".";
            else
```

```
                *out << zeroFramedAry[i][j];

            if(zeroFramedAry[i][j] < 10){
                *out << "  ";
            }
            else{
                 *out << " ";
            }
        }
        *out<<endl;
    }
    *out<<endl<<endl<<endl;
}

void printEQarr(ofstream *out){


     *out<<endl<<"-----Printing EQ Table-----"<<endl;
     for (int i = 1; i <= newLabel; i++){
        if(i<10)
        *out<< i << "   ";
        else
        *out<< i << "  ";
    }
    *out<<endl;

    for (int i = 1; i <= newLabel; i++){
        if(EQAry[i]<10)
            *out<<EQAry[i] << "   ";
        else
            *out<<EQAry[i] << "  ";
    }
    *out<<endl<<endl;

}

void printEQAll(){
     cout<<endl<<"-----Printing EQ all Table-----"<<endl;
     for (int i = 0; i < (int)(numRows * numCols) / 4; i++){
        if(i<10)
        cout<< i << "   ";
        else
        cout<< i << "  ";
    }
    cout<<endl;

    for (int i = 0; i < (int)(numRows * numCols) / 4; i++){
        if(EQAry[i]<10)
            cout<<EQAry[i] << "   ";
        else
            cout<<EQAry[i] << "  ";
    }
    cout<<endl<<endl;

}

bool case2(int a, int b, int cl, int d, int r, int c){

    // if(r==5 && c==4){
    // cout<<"\ta:" << a<<endl;
    // cout<<"\tb:" << b<<endl;
    // cout<<"\tc:" << cl<<endl;
    // cout<<"\td:" << d<<endl;
    // cout<<endl<<endl<<endl;
    // }



    int arr[] = {a,cl,b,d};
    int last_non_0 = 0,
        zeroCount = 0,
        sum =0;
    for (int i = 0; i < 4; i++){

        if(arr[i]!=0){
           last_non_0 = arr[i];
        }
        if(arr[i]==0){
            zeroCount++;
        }
        sum+=arr[i];
    }

    // cout<<a<<b<<cl<<d<<sum<<sum/(4-zeroCount)<<last_non_0<<endl;
    // cout<< (sum/(4-zeroCount)==last_non_0)<<"Reee"<<endl;

    // if(r==5 && c==4){
    // cout<<"sum is: " << sum<<endl;
    // cout<<"zeroCOunt is: " << zeroCount<<endl;
    // cout<<"last nonzero is: " << last_non_0<<endl;
    // cout<<"4-zeroCount:" << 4-zeroCount<<endl;
    // cout<<"sum/4-zeroCount:" << sum/(4-zeroCount)<<endl;
    // cout<<"\ta:" << a<<endl;
    // cout<<"\tb:" << b <<endl;
    // cout<<"\tc:" << cl<<endl;
    // cout<<"\td:" << d<<endl;


    // }

    return (double) sum/(4-zeroCount)==last_non_0;


    // return false;
}

int case3(int a, int b, int cl, int d){
    int arr[] = {a,b,cl,d};

    int min = 99999;

    for (int i = 0; i < 4; i++)
    {
        if(arr[i]<min && arr[i]!=0){
            min = arr[i];
        }
    }


    // cout<<"min is: " << min<<endl;
    // cout<<"\ta:" << a<<endl;
    // cout<<"\tb:" << b<<endl;
    // cout<<"\tc:" << cl<<endl;
    // cout<<"\td:" << d<<endl;


    return min;
}

bool case2Pass2(int e,int f,int g,int h,int pix,int r,int c){

    int arr[] = {e,f,g,h,pix};
     int last_non_0 = 0,
        zeroCount = 0,
        sum =0;

    for (int i = 0; i < 4; i++){

        if(arr[i]!=0){
           last_non_0 = arr[i];
        }
        if(arr[i]==0){
            zeroCount++;
        }
        sum+=arr[i];
    }

    return (double) sum/(5-zeroCount)==last_non_0;


}

int case3Pass2(int e,int f,int g,int h,int pix,int r,int c){

    int arr[] = {e,f,g,h,pix};

    int min = 99999;

    for (int i = 0; i < 4; i++)
    {
        if(arr[i]<min && arr[i]!=0){
            min = arr[i];
        }
    }


    // cout<<"min is: " << min<<endl;
    // cout<<"\ta:" << a<<endl;
    // cout<<"\tb:" << b<<endl;
    // cout<<"\tc:" << cl<<endl;
    // cout<<"\td:" << d<<endl;



    return min;
}
void connect8pass1(){

    //step 0
    newLabel = 0;
    int pix, i=1;
    //step 4
    for (int r = 1; r < numRows+1; r++){
        for (int c = 1; c < numRows+1; c++){

            //step 1
            pix = zeroFramedAry[r][c];



                int a = zeroFramedAry[r-1][c-1];
                int b = zeroFramedAry[r-1][c];
                int cl = zeroFramedAry[r-1][c+1];
                int d = zeroFramedAry[r][c-1];

            // step 2
            if(pix>0){

                //case 1
                if( a==0 && b==0 && cl==0 && d==0){
                    newLabel++;
                    pix = newLabel;
                    zeroFramedAry[r][c] = pix;
                    //step 3
                    // cout<<"case 1"<<endl<< zeroFramedAry[r][c] <<"   Row and Col:  ("
<<r<<","<<c<<")"<<"====>"<<endl;
                    EQAry[i] =  pix;
                    i++;
                    // cout<<zeroFramedAry[r][c] <<endl;
                    //     cout<<"\ta:" << a<<endl;
                    //     cout<<"\tb:" << b<<endl;
                    //     cout<<"\tc:" << cl<<endl;
                    //     cout<<"\td:" << d<<endl;

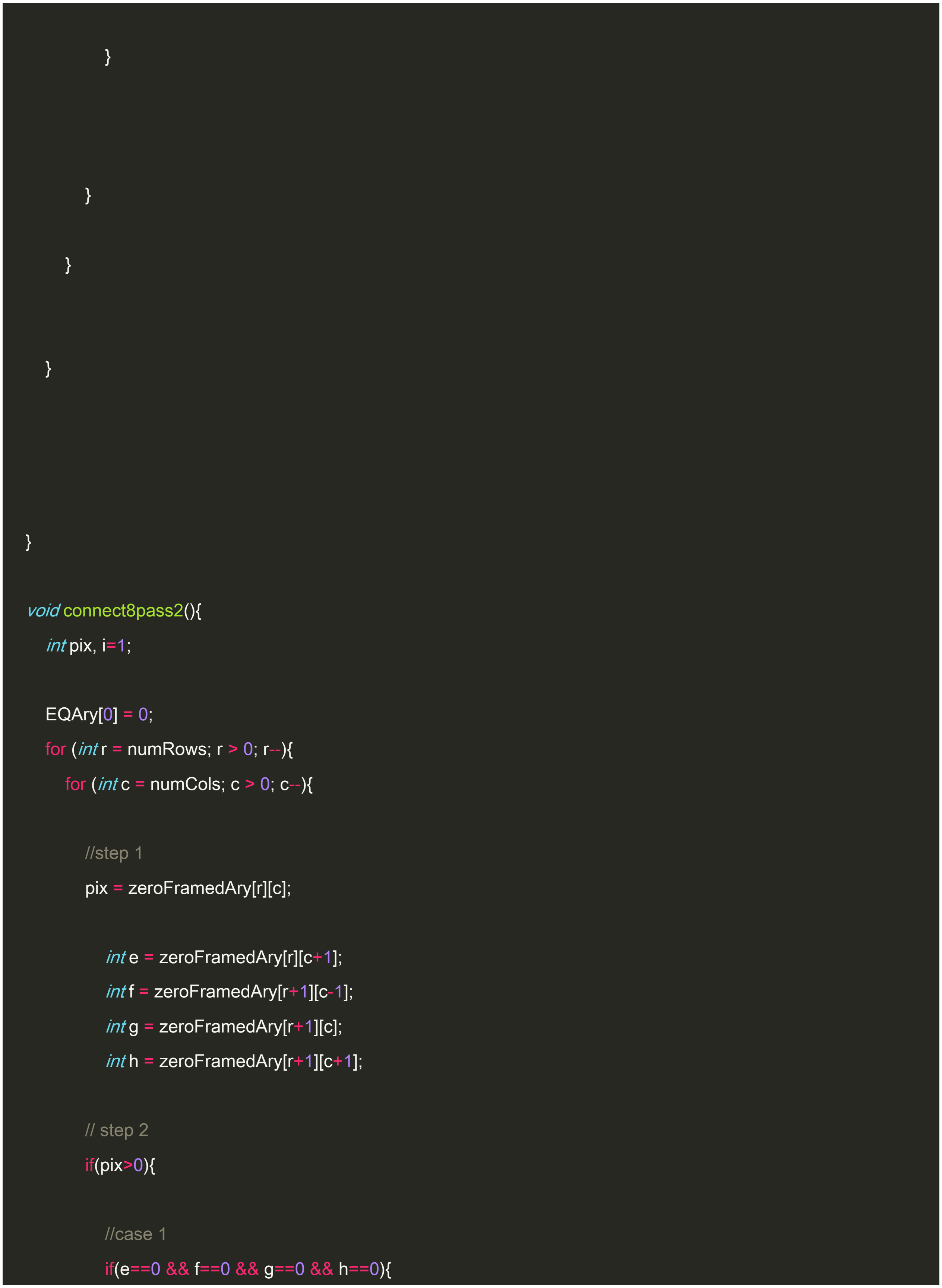
                }

                //case 2 this is not right comebcak to it
                else if(case2(a,b,cl,d, r, c)==true){
                    // cout<<"case2"<<endl;
                    // if(r==5 && c==4){
                    //     cout<<"case 2"<<endl<< zeroFramedAry[r][c] <<"   Row and Col:  ("
<<r<<","<<c<<")"<<"====>"<<endl;
                    //     cout<<"\ta:" << a<<endl;
                    //     cout<<"\tb:" << b<<endl;
                    //     cout<<"\tc:" << cl<<endl;
                    //     cout<<"\td:" << d<<endl;
                    //     cout<<"\t\tMIN is: "<<case3(a,b,cl,d)<<endl;
                    // }
                    pix = case3(a,b,cl,d);

                    zeroFramedAry[r][c] = pix;

                    // if(r==5 && c==4)
                    // cout<<zeroFramedAry[r][c] <<endl;
                }

                //case 3
                else{
                    // cout<<"case 3"<<endl<< zeroFramedAry[r][c] <<"   Row and Col:  ("
<<r<<","<<c<<")"<<"====>"<<endl;
                    pix = case3(a,b,cl,d);
                    zeroFramedAry[r][c] = pix;
                    // cout<<zeroFramedAry[r][c] <<endl;
                    //     cout<<"\ta:" << a<<endl;
                    //     cout<<"\tb:" << b<<endl;
                    //     cout<<"\tc:" << cl<<endl;
                    //     cout<<"\td:" << d<<endl;
                    // //step 3
                    // // EQAry[i] =  pix;
                    // cout<<"I: "<< i<<endl;
                    EQAry[a] = pix;
                    EQAry[b] = pix;
                    EQAry[cl] = pix;
                    EQAry[d] = pix;
```



```
                }



            }

        }


    }




}

void connect8pass2(){
    int pix, i=1;

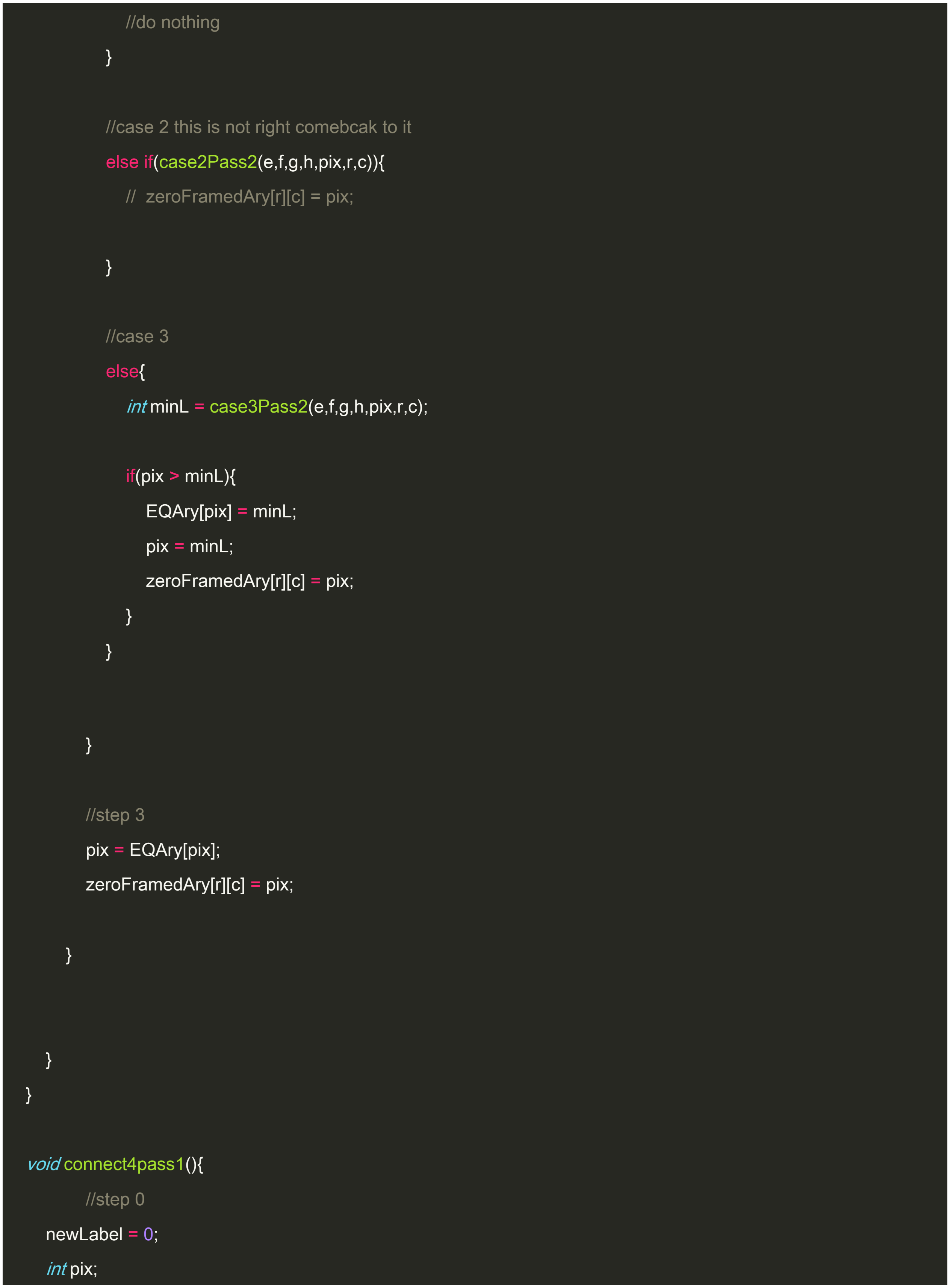
    EQAry[0] = 0;
    for (int r = numRows; r > 0; r--){
        for (int c = numCols; c > 0; c--){

            //step 1
            pix = zeroFramedAry[r][c];

                int e = zeroFramedAry[r][c+1];
                int f = zeroFramedAry[r+1][c-1];
                int g = zeroFramedAry[r+1][c];
                int h = zeroFramedAry[r+1][c+1];

            // step 2
            if(pix>0){

                //case 1
                if(e==0 && f==0 && g==0 && h==0){
```



```
                    //do nothing
                }

                //case 2 this is not right comebcak to it
                else if(case2Pass2(e,f,g,h,pix,r,c)){
                    //  zeroFramedAry[r][c] = pix;

                }

                //case 3
                else{
                    int minL = case3Pass2(e,f,g,h,pix,r,c);

                    if(pix > minL){
                        EQAry[pix] = minL;
                        pix = minL;
                        zeroFramedAry[r][c] = pix;
                    }
                }

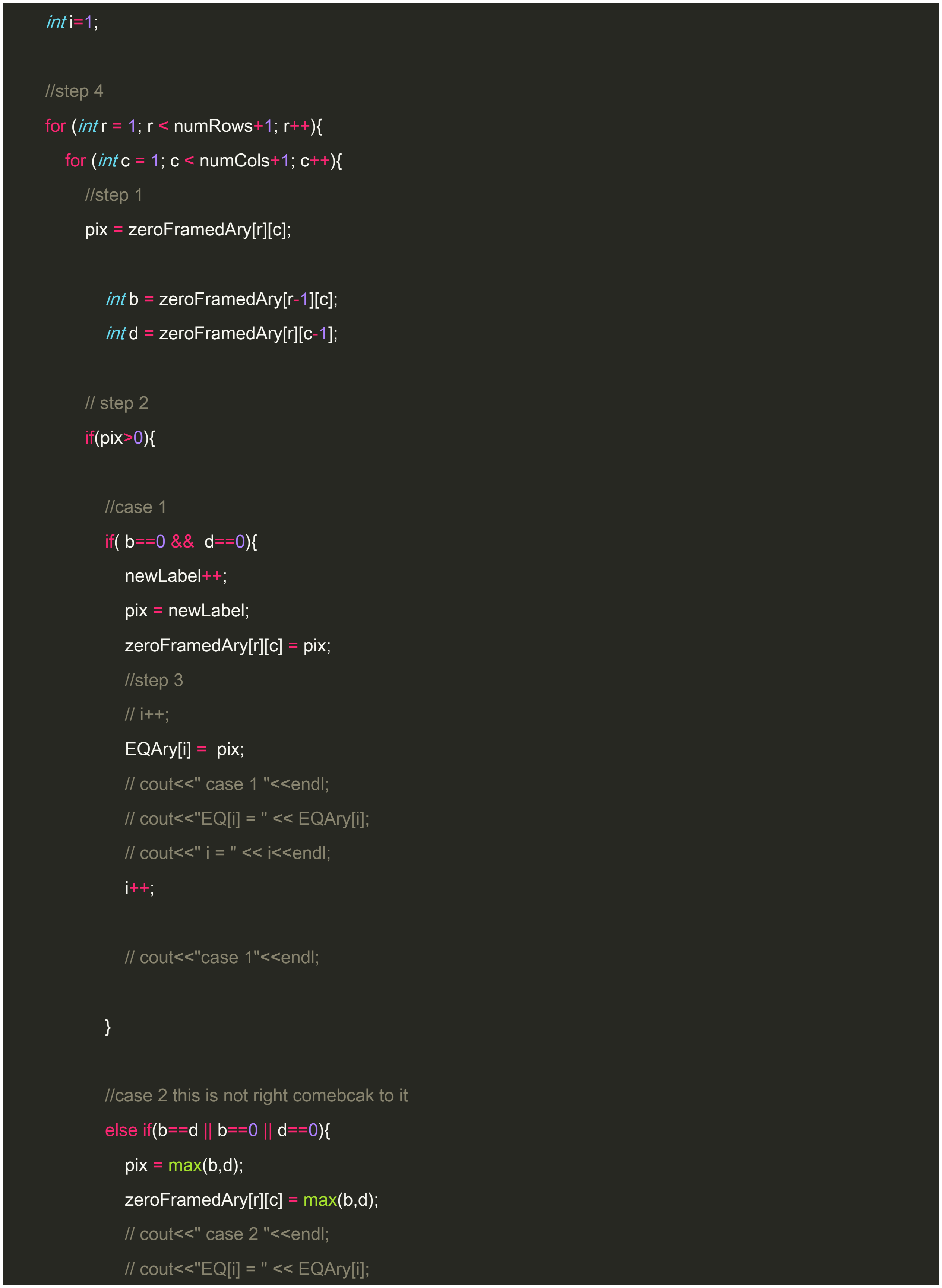

            }

            //step 3
            pix = EQAry[pix];
            zeroFramedAry[r][c] = pix;

        }


    }
}

void connect4pass1(){
            //step 0
    newLabel = 0;
    int pix;
```



```
int i=1;

//step 4
for (int r = 1; r < numRows+1; r++){
    for (int c = 1; c < numCols+1; c++){
        //step 1
        pix = zeroFramedAry[r][c];

            int b = zeroFramedAry[r-1][c];
            int d = zeroFramedAry[r][c-1];

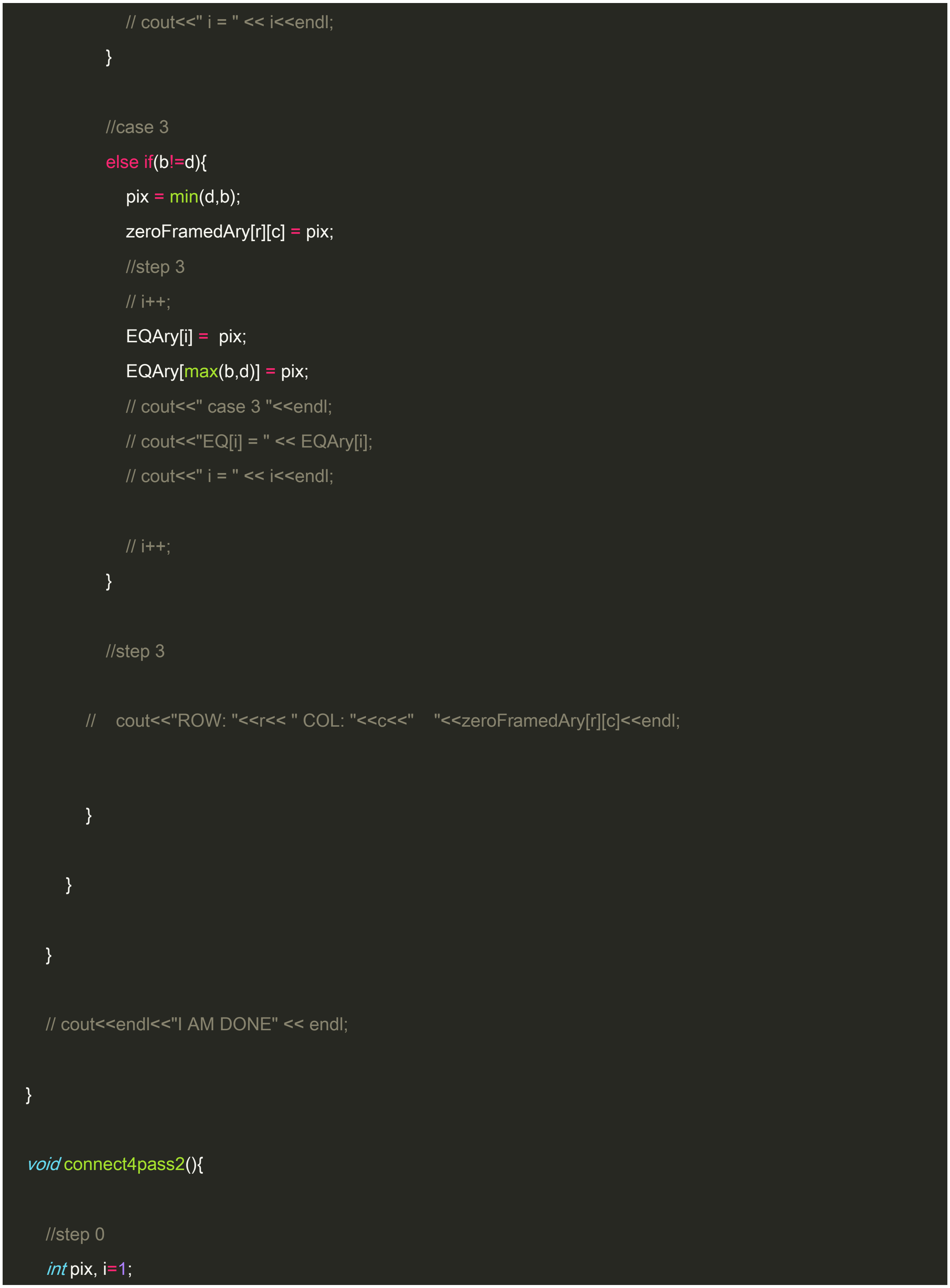
        // step 2
        if(pix>0){

            //case 1
            if( b==0 &&  d==0){
                newLabel++;
                pix = newLabel;
                zeroFramedAry[r][c] = pix;
                //step 3
                // i++;
                EQAry[i] =  pix;
                // cout<<" case 1 "<<endl;
                // cout<<"EQ[i] = " << EQAry[i];
                // cout<<" i = " << i<<endl;
                i++;

                // cout<<"case 1"<<endl;

            }

            //case 2 this is not right comebcak to it
            else if(b==d || b==0 || d==0){
                pix = max(b,d);
                zeroFramedAry[r][c] = max(b,d);
                // cout<<" case 2 "<<endl;
                // cout<<"EQ[i] = " << EQAry[i];
```



```
                    // cout<<" i = " << i<<endl;
                }

                //case 3
                else if(b!=d){
                    pix = min(d,b);
                    zeroFramedAry[r][c] = pix;
                    //step 3
                    // i++;
                    EQAry[i] =  pix;
                    EQAry[max(b,d)] = pix;
                    // cout<<" case 3 "<<endl;
                    // cout<<"EQ[i] = " << EQAry[i];
                    // cout<<" i = " << i<<endl;

                    // i++;
                }

                //step 3

            //    cout<<"ROW: "<<r<< " COL: "<<c<<"    "<<zeroFramedAry[r][c]<<endl;


            }

        }

    }

    // cout<<endl<<"I AM DONE" << endl;

}

void connect4pass2(){

    //step 0
    int pix, i=1;
```

```
//step 4
for (int r = numRows; r > 0; r--){
  for (int c = numCols; c > 0; c--){

    //step 1
    pix = zeroFramedAry[r][c];

      int e = zeroFramedAry[r][c+1];
      int g = zeroFramedAry[r+1][c];

    // step 2
    if(pix>0){

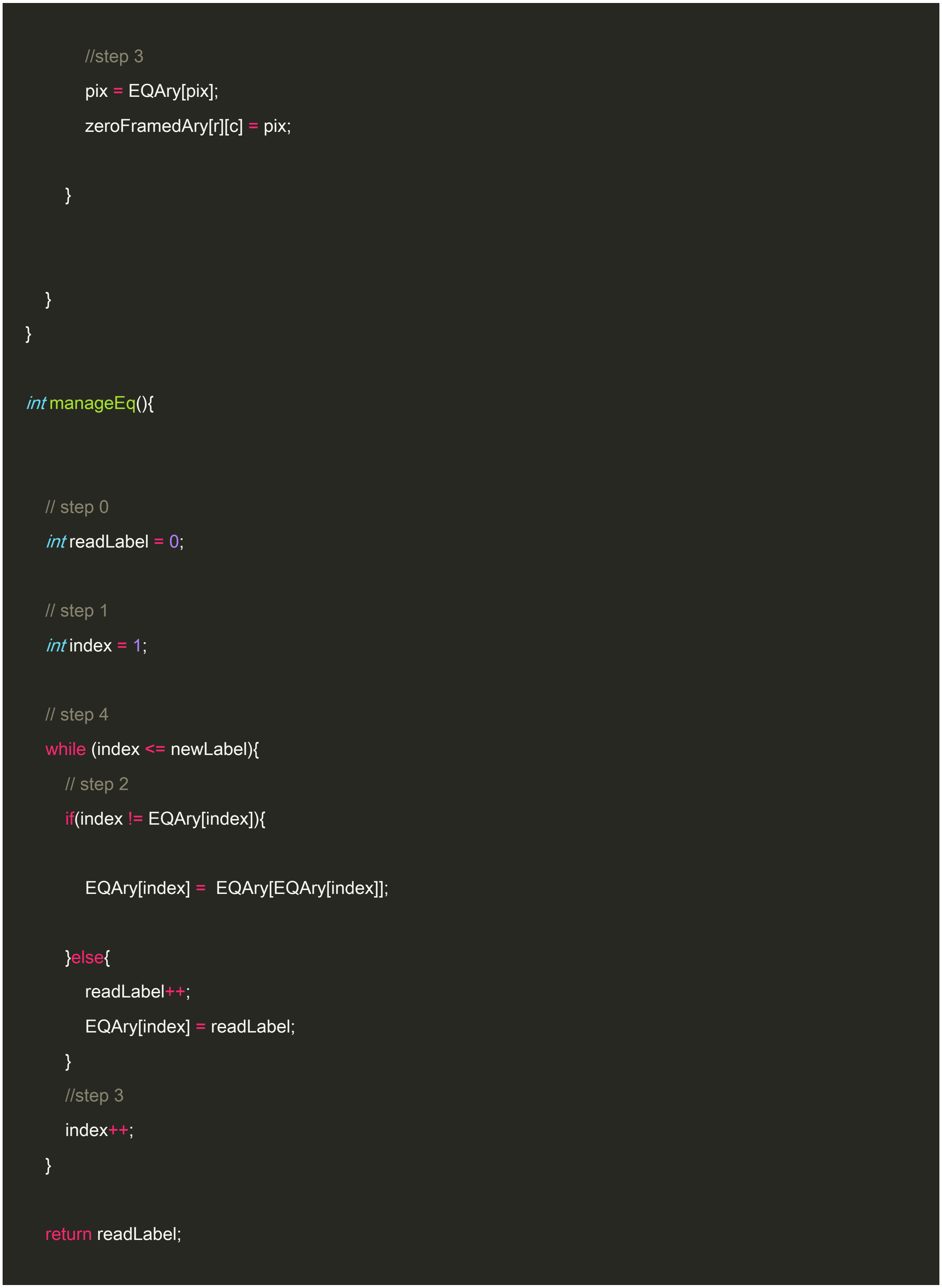
      //case 1
      if(e==0 && g==0){
        //do nothing
      }

      //case 2 this is not right comebcak to it
      else if( (e==g && g==pix) || (e==pix && g==0) || (g==pix && e==0) || (e==0 || g==0)){
         zeroFramedAry[r][c] = pix;
      }

      //case 3
      else{
        int minL = min(e,g);

        if(pix > minL){
          EQAry[pix] = minL;
          pix = minL;
          zeroFramedAry[r][c] = pix;
        }
      }


    }
```



```
            //step 3
            pix = EQAry[pix];
            zeroFramedAry[r][c] = pix;

        }


    }
}

int manageEq(){


    // step 0
    int readLabel = 0;

    // step 1
    int index = 1;

    // step 4
    while (index <= newLabel){
        // step 2
        if(index != EQAry[index]){

            EQAry[index] =  EQAry[EQAry[index]];

        }else{
            readLabel++;
            EQAry[index] = readLabel;
        }
        //step 3
        index++;
    }

    return readLabel;
```

```
}

void connected4(ofstream *pretty, ofstream *debug){

    *debug << "------entering connected 4 method------"<<endl;
    *pretty<<"----Printing Original Table-----"<<endl;
    imgReformat(pretty);

    //step 1
    connect4pass1();
    *debug << endl<<"After Connected4Pass1, newLabel = " << newLabel<<endl;
    *pretty << endl<< "After Connected4Pass1, newLabel = " << newLabel<<endl;
    imgReformat(pretty);
    printEQarr(pretty);

    imgReformat(debug);
    printEQarr(debug);

    //step 2
    connect4pass2();
    *debug << "After Connected4Pass2, newLabel = " << newLabel<<endl;
    *pretty << "After Connected4Pass2, newLabel = " << newLabel<<endl;
    imgReformat(pretty);
    printEQarr(pretty);

    imgReformat(debug);
    printEQarr(debug);

    //step 3
    *debug << "----Running Managing EQ ARRAY----  ";
    *pretty << "----Running Managing EQ ARRAY----  ";
    trueNumCC = manageEq();
    printEQarr(pretty);
    printEQarr(debug);
    newMin = 0;
    newMax = trueNumCC;
    CCproperty = new Property[trueNumCC+1];
    *debug <<endl<< "In Connected4, after manage EQarr, trueNumCC = " << trueNumCC <<endl;
    *pretty <<endl<< "In Connected4, after manage EQarr, trueNumCC = " << trueNumCC <<endl<<endl;

    //step 4
    connectPass3(debug);



    //step 5
    *debug <<endl<< "-----After Pass3-----"<<endl;
    *pretty <<endl<< "-----After Pass3-----"<<endl;
    imgReformat(pretty);
    imgReformat(debug);
    //step 6
    printEQarr(pretty);
    printEQarr(debug);
    //step 7
    *debug << "Leaving connected4 method" <<endl;


}

void connected8(ofstream *pretty, ofstream *debug){

    *debug << "------entering connected 8 method------"<<endl;
    *pretty<<"----Printing Original Table-----"<<endl;

    //step 1
    connect8pass1();
    *debug << "After Connected8Pass1, newLabel = " << newLabel<<endl;
    *pretty << endl<< "After Connected4Pass1, newLabel = " << newLabel<<endl;
    imgReformat(pretty);
    printEQarr(pretty);

    imgReformat(debug);
    printEQarr(debug);

    //step 2
    connect8pass2();
    *debug << "After Connected8Pass2, newLabel = " << newLabel<<endl;
    *pretty << "After Connected4Pass2, newLabel = " << newLabel<<endl;
    imgReformat(pretty);
    printEQarr(pretty);

    imgReformat(debug);
    printEQarr(debug);

    //step 3
    *debug << "----Running Managing EQ ARRAY----  ";
    *pretty << "----Running Managing EQ ARRAY----  ";
    trueNumCC = manageEq();
    printEQarr(pretty);
     printEQarr(debug);
    newMin = 0;
    newMax = trueNumCC;
    CCproperty = new Property[trueNumCC+1];
    *debug << "In Connected8, after manageEQarr, trueNumCC = " << trueNumCC <<endl;
    *pretty <<endl<< "In Connected4, after manage EQarr, trueNumCC = " << trueNumCC <<endl<<endl;

    //step 4
    connectPass3(debug);

    //step 5
    *debug <<endl<< "-----After Pass3-----"<<endl;
    *pretty <<endl<< "-----After Pass3-----"<<endl;
    imgReformat(pretty);
    imgReformat(debug);



    //step 6
    printEQarr(pretty);
    printEQarr(debug);
    //step 7
    *debug << "Leaving connected8 method" <<endl;
}
```

```
};



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

    ifstream infile;
    infile.open(argv[1]);

    int connectness = stoi(argv[2]);

    char option = *argv[3];

    ofstream pretty, label, property, debug;

    pretty.open(argv[4]); //pretty print
    label.open(argv[5]); //label print
    property.open(argv[6]); //property print
    debug.open(argv[7]); //debug print



    int numRows, numCols, minVal, maxVal, newLabel = 0;
    infile >> numRows >> numCols>>minVal>>maxVal;

    ccLabel *proj = new ccLabel(numRows, numCols, minVal, maxVal ,option);

    //step 2
    proj->loadImage(&infile, &pretty);

    //step 3
    if(option == 'y' || option == 'Y'){
        proj->conversion();
    }

    //step 4
    if(connectness == 4){
        proj->connected4(&pretty, &debug);
    }



    //step 5
    if(connectness == 8){
        proj->connected8(&pretty, &debug);
    }


    //step 6
    label << "numRows: " << numRows<< " numCols: " << numCols<< " minVal: " <<  minVal << " maxVal: "<<
maxVal<<endl;

    //step 7
    proj->printImg(&label);

    //step 8
    property << "CCProperties"<<endl;

    pretty <<endl<<"Number of Conected Components: " << proj->trueNumCC<<endl<<endl;
    //step 9
    proj->drawBoxes();
    debug<<endl<<"-----Result of Drawing Boxes-----"<<endl;
    pretty<<endl<<"-----Result of Drawing Boxes-----"<<endl;
    proj->imgReformat(&debug);
    proj->printProperty(&property);

    //step 10
    proj->imgReformat(&pretty);
    //step 11




    proj->connect8pass1();
    //step 12
    pretty.close(); //pretty print
    label.close(); //label print
    property.close(); //property print
    debug.close();













}
```