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Project Due Date: 03/21/2021

Algorithm for Pass 1:

Step 0: image ← given the Binary Image
newLabel ← 0 (background is 0)
eqTable ← Equivalency Table
Step 1: scan the image Left→Right and Top→Bottom
P(i,j) ← next pixel
Step 2: if P(i,j) > 0 // skip 0s

look at: a, b, c, d
Case 1: a = b = c = d = 0

newLabel ++ //increment new label
P(i,j) ← newLabel
Case 2: some/all of a,b,c,d already have the same label

P(i,j) ← same label //give same label

Case 3: some/all of a,b,c,d already have labels but their
labels are NOT the same (excluding 0)
P(i,j) ← minLabel = min(a, b, c, d) //give smallest

Step 3: if case-1 or case-3, update the Equivalency Table

Algorithm for Pass 2:

Step 1: scan the result of Pass-1 Right→Left and Bottom→Top
P(i,j) ← next pixel
Step 2: if P(i,j) > 0 // skip 0s
look at: e, f, g, h, P(i,j)

Case 1: e = f = g = h = 0
do nothing P(i,j) keeps its label

Case 2: e = f = g = h = P(i,j) all/some have the same label
(excluding 0) do nothing P(i,j) keeps its label

Case 3: at least 2 among e, f, g, h, P(i,j) have different labels (excluding 0)
minLabel ← min(e, f, g, h, P(i,j)) (excluding 0) //

find smallest label if P(i,j) > minLabel
EQTable[P(i,j)] ← minLabel
P(i,j) ← minLabel

Step 3: use the Equivalency Table to update P(i,j) that was NOT updated in Step-2
Step 4: repeat steps 1 to 3 until ALL pixels are processed

Algorithm for Equivalency Table Management:

Step 0: readLabel ← 0
Step 1: index ← 1
Step 2: if index ≠ EQ[index]
EQ[index] ← EQ[EQ[index]]
else
readLabel++
EQ[index] ← readLabel
Step 3: index++
Step 4: repeat steps 2 to 3 until index > newLabel

Algorithm for Pass 3:

Step 0: PropertyFile - array of size maxLabel + 1
image ← result of Pass-2
Step 1: scan the image Left→Right and Top→Bottom
or Right→Left and Bottom→Top
P(i,j) ← next pixel
Step 2: if P(i,j) > 0
P(i,j) ← EquivalencyTable[P(i,j)]
PropertyFile[P(i,j)] PixelCount++
PropertyFile[P(i,j)] ← minRow minCol maxRow maxCol
Step 3: repeat steps 1 to 2 for ALL pixels

Source Code:

```
#include <iostream>
#include <fstream>
#include <string>
#include <cstdarg>
using namespace std;

//helper functions that returns first non zero value seen in a given list of params
template <class T>
```

```
T getNonZero(T n)
{
    if (n != 0)
    {
        return n;
    }
    else
    {
        return 0;
    }
}

template <class T, class... Args>
T getNonZero(T n, Args... args)
{
    if (n != 0)
    {
        return n;
    }
    return getNonZero(args...);
}

//helper functions that returns minimum value ignoring zero
template <class T>
T getMinVal(T a)
{
    return a;
}

template <class T>
T getMinVal(T a, T b)
{
    if (a == 0 && b == 0)
    {
        return 0;
    }
    if (a == 0)
    {
        return b;
    }
    if (b == 0)
    {
        return a;
    }
    if (a < b)
    {
        return a;
    }
    return b;
}
```

```
template <class T, class... Args>
T getMinVal(T a, T b, Args... args)
{
    if (a == 0 && b == 0)
    {
        return getMinVal(args...);
    }
    if (a == 0)
    {
        return getMinVal(b, args...);
    }
    if (b == 0)
    {
        return getMinVal(a, args...);
    }
    if (a < b)
    {
        return getMinVal(a, args...);
    }
    return getMinVal(b, args...);
}

//helper function that returns true if list of parameters includes all same values ignoring
zero else returns false
template <class T>
bool isSameValExZero(T a)
{
    return true;
}

template <class T>
bool isSameValExZero(T a, T b)
{

    if (b == 0 || a == 0)
    {
        return true;
    }
    if (a == b)
    {
        return true;
    }

    return false;
}

template <class T, class... Args>
bool isSameValExZero(T a, T b, Args... args)
{
```

```
    if (a == 0 && b == 0)
    {
        return isSameValExZero(args...);
    }
    else if (a == 0)
    {
        return isSameValExZero(b, args...);
    }
    else if (b == 0)
    {
        return isSameValExZero(a, args...);
    }
    else if (a == b)
    {
        return isSameValExZero(b, args...);
    }
    else
    {
        return false;
    }
}

struct Property
{
    int label;     // The component label
    int numPixels; // total number of pixels in the cc.
    int minR;
    int minC;
    int maxR;
    int maxC;

    Property()
    {
        label = -1;
        numPixels = 0;
        minC = 9999;
        minR = 9999;
        maxC = 0;
        maxR = 0;
    }
};

class CClabel
{
public:
    int numRows;
    int numCols;
    int minVal;
    int maxVal;
    int newMin;
```

```
    int newMax;
    int rowFrameSize;
    int colFrameSize;
    int extraRows;
    int extraCols;
    int newLabel;
    int trueNumCC; // the true number of connected components in the image
    int **zeroFramedAry;
    int NonZeroNeighborAry[5];
    int *EQAry; // an 1-D array, of size (numRows * numCols) / 4
    Property *CCproperty;

    CClabel(ifstream &input)
    {
        loadHeader(input);
        rowFrameSize = 1;
        colFrameSize = 1;
        extraRows = 2 * rowFrameSize;
        extraCols = 2 * colFrameSize;
        //dynamic allocation of zeroframeArray
        zeroFramedAry = new int *[numRows + extraRows];
        for (int i = 0; i < numRows + extraRows; i++)
        {
            zeroFramedAry[i] = new int[numCols + extraCols];
        }
        zero2D(zeroFramedAry, numRows + extraRows, numCols + extraCols);
    }

    void loadHeader(ifstream &input)
    {
        input >> numRows >> numCols >> minVal >> maxVal;
    }

    void loadImage(ifstream &input)
    {
        for (int i = rowFrameSize; i < numRows + rowFrameSize; i++)
        {
            for (int j = colFrameSize; j < numCols + colFrameSize; j++)
            {
                input >> zeroFramedAry[i][j];
            }
        }
    }

    void connect8Pass1()
    {
        newLabel = 0;
        //allocating EQTable
        int EQSize = (numRows * numCols) / 4;
        EQAry = new int[EQSize];
```

```
        for (int i = 0; i < EQSize; i++)
        {
            EQAry[i] = i;
        }

        newMax = 0;
        newMin = 9999;

        for (int i = rowFrameSize; i < numRows + rowFrameSize; i++)
        {
            for (int j = colFrameSize; j < numCols + colFrameSize; j++)
            {
                if (zeroFramedAry[i][j] > 0)
                {
                    int a = zeroFramedAry[i - 1][j - 1];
                    int b = zeroFramedAry[i - 1][j];
                    int c = zeroFramedAry[i - 1][j + 1];
                    int d = zeroFramedAry[i][j - 1];

                    //Case 1
                    if (a == 0 && b == 0 && c == 0 && d == 0)
                    {
                        newLabel++;
                        zeroFramedAry[i][j] = newLabel;

                        //updating EQ table
                        EQAry[newLabel] = newLabel;
                    }

                    //Case 2
                    else if (isSameValExZero(a, b, c, d))
                    {
                        zeroFramedAry[i][j] = getNonZero(a, b, c, d);
                    }

                    //Case 3
                    else
                    {
                        int minVal = getMinVal(a, b, c, d);
                        zeroFramedAry[i][j] = minVal;

                        //updating EQ Table
                        EQAry[a] = minVal;
                        EQAry[b] = minVal;
                        EQAry[c] = minVal;
                        EQAry[d] = minVal;
                    }

                    //Updating newMax and newMin
                    if (zeroFramedAry[i][j] < newMin)
```

```
                {
                    newMin = zeroFramedAry[i][j];
                }
                if (zeroFramedAry[i][j] > newMax)
                {
                    newMax = zeroFramedAry[i][j];
                }
            }
        }
    }
}

void connect4Pass1()
{
    newLabel = 0;
    //allocating EQTable
    int EQSize = (numRows * numCols) / 4;
    EQAry = new int[EQSize];
    for (int i = 0; i < EQSize; i++)
    {
        EQAry[i] = i;
    }

    newMax = 0;
    newMin = 9999;

    for (int i = rowFrameSize; i < numRows + rowFrameSize; i++)
    {
        for (int j = colFrameSize; j < numCols + colFrameSize; j++)
        {
            if (zeroFramedAry[i][j] > 0)
            {
                int a = zeroFramedAry[i - 1][j];
                int b = zeroFramedAry[i][j - 1];

                //Case 1
                if (a == 0 && b == 0)
                {
                    newLabel++;
                    zeroFramedAry[i][j] = newLabel;

                    //updating EQ table
                    EQAry[newLabel] = newLabel;
                }

                //Case 2
                else if (isSameValExZero(a, b))
                {
                    zeroFramedAry[i][j] = getNonZero(a, b);
                }
```

```
                //Case 3
                else
                {
                    int minVal = getMinVal(a, b);
                    zeroFramedAry[i][j] = minVal;

                    //updating EQ Table
                    EQAry[a] = minVal;
                    EQAry[b] = minVal;
                }

                //Updating newMax and newMin
                if (zeroFramedAry[i][j] < newMin)
                {
                    newMin = zeroFramedAry[i][j];
                }
                if (zeroFramedAry[i][j] > newMax)
                {
                    newMax = zeroFramedAry[i][j];
                }
            }
        }
    }
}

void connect8Pass2()
{
    newMax = 0;
    newMin = 9999;
    for (int i = numRows + rowFrameSize - 1; i >= rowFrameSize; i--)
    {
        for (int j = numCols + colFrameSize - 1; j >= colFrameSize; j--)
        {

            if (zeroFramedAry[i][j] > 0)
            {
                int e = zeroFramedAry[i][j + 1];
                int f = zeroFramedAry[i + 1][j - 1];
                int g = zeroFramedAry[i + 1][j];
                int h = zeroFramedAry[i + 1][j + 1];

                //Case 1
                if (e == 0 && f == 0 && g == 0 && h == 0)
                {
                    //do nothing
                }

                //Case 2
                else if (isSameValExZero(e, f, g, h, zeroFramedAry[i][j]))
```

```
                {
                    //do nothing
                }

                //Case 3
                else
                {
                    int minLabel = getMinVal(e, f, g, h, zeroFramedAry[i][j]);
                    zeroFramedAry[i][j] = minLabel;

                    //Updating EQ Table
                    if (zeroFramedAry[i][j] > minLabel)
                    {
                        EQAry[zeroFramedAry[i][j]] = minLabel;
                    }
                    EQAry[e] = minLabel;
                    EQAry[f] = minLabel;
                    EQAry[g] = minLabel;
                    EQAry[h] = minLabel;
                }

                //Updating newMax and newMin
                if (zeroFramedAry[i][j] < newMin)
                {
                    newMin = zeroFramedAry[i][j];
                }
                if (zeroFramedAry[i][j] > newMax)
                {
                    newMax = zeroFramedAry[i][j];
                }
            }
        }
    }
}

void connect4Pass2()
{
    newMax = 0;
    newMin = 9999;
    for (int i = numRows + rowFrameSize - 1; i >= rowFrameSize; i--)
    {
        for (int j = numCols + colFrameSize - 1; j >= colFrameSize; j--)
        {
            if (zeroFramedAry[i][j] > 0)
            {
                int c = zeroFramedAry[i][j + 1];
                int d = zeroFramedAry[i + 1][j];

                //Case 1
                if (c == 0 && d == 0)
```

```
                {
                    //do nothing
                }

                //Case 2
                else if (isSameValExZero(c, d, zeroFramedAry[i][j]))
                {
                    //do nothing
                }

                //Case 3
                else
                {
                    int minLabel = getMinVal(c, d, zeroFramedAry[i][j]);
                    zeroFramedAry[i][j] = minLabel;

                    //Updating EQ Table
                    if (zeroFramedAry[i][j] > minLabel)
                    {
                        EQAry[zeroFramedAry[i][j]] = minLabel;
                    }

                    EQAry[c] = minLabel;
                    EQAry[d] = minLabel;
                }

                //Updating newMax and newMin
                if (zeroFramedAry[i][j] < newMin)
                {
                    newMin = zeroFramedAry[i][j];
                }
                if (zeroFramedAry[i][j] > newMax)
                {
                    newMax = zeroFramedAry[i][j];
                }
            }
        }
    }
}

void connectPass3()
{
    newMax = 0;
    newMin = 9999;
    CCproperty = new Property[trueNumCC + 1]();
    for (int i = rowFrameSize; i < numRows + rowFrameSize; i++)
    {
        for (int j = colFrameSize; j < numCols + colFrameSize; j++)
        {
            if (zeroFramedAry[i][j] > 0)
```

```
            {
                zeroFramedAry[i][j] = EQAry[zeroFramedAry[i][j]];
                Property *p = &CCproperty[zeroFramedAry[i][j]];
                p->label = zeroFramedAry[i][j];
                p->numPixels = p->numPixels + 1;

                if (p->minR > i - 1)
                {
                    p->minR = i - 1;
                }
                if (p->maxR < i - 1)
                {
                    p->maxR = i - 1;
                }
                if (p->minC > j - 1)
                {
                    p->minC = j - 1;
                }
                if (p->maxC < j - 1)
                {
                    p->maxC = j - 1;
                }
            }
            //Updating newMax and newMin
            if (zeroFramedAry[i][j] < newMin)
            {
                newMin = zeroFramedAry[i][j];
            }
            if (zeroFramedAry[i][j] > newMax)
            {
                newMax = zeroFramedAry[i][j];
            }
        }
    }
}

void manageEQAry()
{
    int readLabel = 0;
    for (int i = 1; i <= newLabel; i++)
    {
        if (i != EQAry[i])
        {
            EQAry[i] = EQAry[EQAry[i]];
        }
        else
        {
            readLabel++;
            EQAry[i] = readLabel;
        }
```

```
        }
        trueNumCC = readLabel;
    }

    void zero2D(int **ary, int numOfRows, int numOfCols)
    {
        for (int i = 0; i < numOfRows; i++)
        {
            for (int j = 0; j < numOfCols; j++)
            {
                ary[i][j] = 0;
            }
        }
    }

    void minus1D(int *ary, int arrayLength)
    {
        for (int i = 0; i < arrayLength; i++)
        {
            ary[i] = -1;
        }
    }

    void print2DArray(int **ary, int numOfRows, int numOfCols)
    {
        cout << numRows << " " << numCols << " " << minVal << " " << maxVal << endl;
        for (int i = 0; i < numOfRows; i++)
        {
            for (int j = 0; j < numOfCols; j++)
            {
                cout << ary[i][j] << " ";
            }
            cout << endl;
        }
    }

    void imgReformat(ofstream &outFile)
    {
        outFile << numRows << " " << numCols << " " << newMin << " " << newMax << endl;
        string str = to_string(newMax);
        int width = str.length();
        for (int i = rowFrameSize; i < numRows + rowFrameSize; i++)
        {
            for (int j = colFrameSize; j < numCols + colFrameSize; j++)
            {
                if (zeroFramedAry[i][j] == 0)
                {
                    outFile << "."
                            << " ";
                }
```

```
            else
            {
                outFile << zeroFramedAry[i][j] << " ";
            }
            str = to_string(zeroFramedAry[i][j]);
            int ww = str.length();
            while (ww < width)
            {
                outFile << " ";
                ww++;
            }
        }
        outFile << endl;
    }
}

void printImg(ofstream &outFile)
{
    outFile << numRows << " " << numCols << " " << newMin << " " << newMax << endl;
    string str = to_string(newMax);
    int width = str.length();
    for (int i = rowFrameSize; i < numRows + rowFrameSize; i++)
    {
        for (int j = colFrameSize; j < numCols + colFrameSize; j++)
        {

            outFile << zeroFramedAry[i][j] << " ";
            str = to_string(zeroFramedAry[i][j]);
            int ww = str.length();
            while (ww < width)
            {
                outFile << " ";
                ww++;
            }
        }
        outFile << endl;
    }
}

void printEQAry(ofstream &outFile)
{
    for (int i = 1; i <= newLabel; i++)
    {
        outFile << i << " " << EQAry[i] << endl;
    }
}

void printCCproperty(ofstream &outFile)
{
    outFile << numRows << " " << numCols << " " << newMin << " " << newMax << endl;
```

```
    outFile << trueNumCC << endl;
    outFile << "---" << endl;
    for (int i = 1; i < trueNumCC + 1; i++)
    {
        Property *p = &CCproperty[i];
        outFile << p->label << endl;
        outFile << p->numPixels << endl;
        outFile << p->minR << " " << p->minC << endl;
        outFile << p->maxR << " " << p->maxC << endl;
        outFile << "---" << endl;
    }
}

void drawBoxes()
{
    int minRow, minCol, maxRow, maxCol, label;
    for (int i = 1; i < trueNumCC + 1; i++)
    {
        label = CCproperty[i].label;
        minRow = CCproperty[i].minR + 1;
        minCol = CCproperty[i].minC + 1;
        maxRow = CCproperty[i].maxR + 1;
        maxCol = CCproperty[i].maxC + 1;

        //drawing horizontal top line
        for (int j = minCol; j <= maxCol; j++)
        {
            zeroFramedAry[minRow][j] = label;
        }

        //drawing horizontal bottom line
        for (int j = minCol; j <= maxCol; j++)
        {
            zeroFramedAry[maxRow][j] = label;
        }

        //drawing vertical left line
        for (int i = minRow; i <= maxRow; i++)
        {
            zeroFramedAry[i][minCol] = label;
        }

        //drawing vertical right line
        for (int i = minRow; i <= maxRow; i++)
        {
            zeroFramedAry[i][maxCol] = label;
        }
    }
}
```

```
    ~CClabel()
    {
        //Cleaning up
        delete[] EQAry;
        delete[] CCproperty;

        for (int i = 0; i < numRows + extraRows; i++)
        {
            delete[] zeroFramedAry[i];
        }
    }
};

int main(int argc, const char *argv[])
{
    //READ
    string inputName = argv[1];
    ifstream input;
    input.open(inputName);
    int connectedness = stoi(argv[2]);

    //WRITES
    string rfPrettyPrintFileName = argv[3], labelFileName = argv[4], propertyFileName =
argv[5];
    ofstream rfPrettyPrint, labelFile, propertyFile;
    rfPrettyPrint.open(rfPrettyPrintFileName);
    labelFile.open(labelFileName);
    propertyFile.open(propertyFileName);

    //Checking if IO operations succeeds
    if (input.is_open())
    {
        if (rfPrettyPrint.is_open() && labelFile.is_open() && propertyFile.is_open())
        {
            CClabel cc(input);
            cc.loadImage(input);
            if (connectedness == 4)
            {
                cc.connect4Pass1();
                rfPrettyPrint << "Pass 1" << endl;
                cc.imgReformat(rfPrettyPrint);
                rfPrettyPrint << endl
                              << "Equivalency Array after: Pass 1" << endl;
                cc.printEQAry(rfPrettyPrint);
                cc.connect4Pass2();
                rfPrettyPrint << endl
                              << "Pass 2" << endl;
                cc.imgReformat(rfPrettyPrint);
                rfPrettyPrint << endl
                              << "Equivalency Array after: Pass 2" << endl;
```

```
            cc.printEQAry(rfPrettyPrint);
        }
        if (connectedness == 8)
        {
            cc.connect8Pass1();
            rfPrettyPrint << "Pass 1" << endl;
            cc.imgReformat(rfPrettyPrint);
            rfPrettyPrint << endl
                          << "Equivalency Array after: Pass 1" << endl;
            cc.printEQAry(rfPrettyPrint);
            cc.connect8Pass2();
            rfPrettyPrint << endl
                          << "Pass 2" << endl;
            cc.imgReformat(rfPrettyPrint);
            rfPrettyPrint << endl
                          << "Equivalency Array after: Pass 2" << endl;
            cc.printEQAry(rfPrettyPrint);
        }
        //Managing EQ table
        cc.manageEQAry();
        rfPrettyPrint << endl
                      << "Equivalency Array after: EQ Management" << endl;
        cc.printEQAry(rfPrettyPrint);

        //Third Pass
        cc.connectPass3();
        rfPrettyPrint << endl
                      << "Pass 3" << endl;
        cc.imgReformat(rfPrettyPrint);
        rfPrettyPrint << endl
                      << "Equivalency Array after: Pass 3" << endl;
        cc.printEQAry(rfPrettyPrint);

        //Printing final product of pass 3
        cc.printImg(labelFile);

        //Printing into CC Property File
        cc.printCCproperty(propertyFile);

        //drawing bounding box for each components
        cc.drawBoxes();
        rfPrettyPrint << endl
                      << "Drawing Boxes" << endl;
        cc.imgReformat(rfPrettyPrint);
    }
    else
    {
        cout << "ERROR: Some output files is missing or couldnt be opened." << endl;
    }
}
```

```
    else
    {
        cout << "ERROR: The input file with following name does not exists or there was
problem reading it: " << inputName << endl;
    }

    input.close();
    rfPrettyPrint.close();
    labelFile.close();
    propertyFile.close();
    return 0;
}
```

Outputs

8 Connectedness:

```
Pass 1
25 31 1 14
1  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  .  .  .  .  .  .  .  .  .  .  .  .  .  3  .
1  1  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  .  .  .  .  .  .  .  .  .  .  .  .  .  3  .
.  .  1  .  .  .  .  .  .  .  .  .  .  .  .  .  2  2  2  .  .  .  .  .  .  .  .  .  .  4  3  .  .
.  .  .  1  1  1  .  .  .  .  .  .  .  .  .  2  2  2  2  2  .  .  .  .  .  .  .  .  .  4  3  .  .  .
.  .  .  .  1  1  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  .  .  .  .  .  .  .  .  4  3  .  .  .
.  .  5  .  .  .  .  .  .  .  .  .  .  2  2  2  2  .  .  2  2  2  .  .  .  .  .  .  .  3  .  .  .  .
.  .  5  5  5  5  .  .  .  .  .  2  2  2  2  2  .  2  2  2  2  2  .  .  .  .  .  .  .  .  .  .  .
.  5  .  5  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  .  6  6  .  .  .
.  .  5  .  5  .  .  .  .  .  2  2  .  2  2  .  .  2  2  2  .  2  2  .  .  .  .  .  6  .  .  .  .
.  .  .  .  5  .  7  .  .  2  2  2  2  2  .  .  2  2  .  2  2  2  .  .  .  .  .  6  .  .  .  .
.  .  8  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  .  6  .  .  .  .
.  .  8  8  8  8  8  8  2  2  2  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .
.  .  .  .  .  8  .  .  .  2  2  2  2  2  2  2  .  .  2  2  2  2  .  .  .  .  .  .  .  .  .  .
.  .  .  .  8  .  .  .  .  2  2  2  2  .  2  2  2  .  2  2  2  2  .  .  .  .  .  .  .  .  .  .
.  .  .  8  .  .  .  .  .  .  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  2  .  .  .  .  .  .  2  .  .  .  .  .  .
.  .  .  .  .  .  .  2  .  .  .  .  .  .  .  2  2  2  .  .  9  .  .  .  .  2  2  .  .  .  .  .
.  .  .  .  .  .  2  .  .  .  .  .  .  .  .  .  2  .  .  .  .  9  .  .  .  .  .  .  .  .  .  .
.  .  .  .  .  .  .  .  .  .  .  .  .  10 .  .  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
.  .  .  11 .  .  .  .  .  .  .  .  .  10 .  .  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
.  .  11 11 11 .  .  .  .  .  .  .  .  10 .  .  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
.  .  11 11 11 .  .  .  .  12 12 10 10 10 2  2  2  .  .  .  .  .  .  .  13 .  14 .  .  .  .  .
.  .  .  11 .  .  .  .  .  .  .  .  .  .  .  2  2  2  .  .  .  .  .  .  .  13 13 .  .  .  .  .
.  .  .  .  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  .  .  .  .  .  .  13 .  .  .  .  .  .
```

```
Equivalency Array after: Pass 1
1 1
2 2
3 3
4 3
5 5
6 2
7 7
8 2
9 9
10 2
11 11
12 10
13 13
14 13
```

Pass 2
25 31 1 13

```
1  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  3  .
1  1  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  3  .
.  .  1  .  .  .  .  .  .  .  .  .  .  .  .  .  2  2  2  .  .  .  .  .  .  .  .  .  .  .  .  3  3  .  .
.  .  .  1  1  1  .  .  .  .  .  .  .  .  .  2  2  2  2  2  .  .  .  .  .  .  .  .  .  .  3  3  .  .  .
.  .  .  .  1  1  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  .  .  .  .  .  .  .  .  3  3  .  .  .  .
.  .  5  .  .  .  .  .  .  .  .  .  .  2  2  2  2  .  .  2  2  2  .  .  .  .  .  .  .  3  .  .  .  .  .
.  .  5  5  5  5  .  .  .  .  .  2  2  2  2  2  2  .  2  2  2  2  2  .  .  .  .  .  .  .  .  .  .  .  .
.  5  .  5  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  .  2  2  .  .  .
.  .  5  .  5  .  .  .  .  .  2  2  .  2  2  .  .  2  2  2  .  2  2  .  .  .  .  .  2  .  .  .  .
.  .  .  .  5  .  7  .  .  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  .  .  .  .
.  .  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  .  .  .
.  .  .  .  .  .  8  .  .  .  2  2  2  2  2  2  2  2  .  .  2  2  2  2  .  .  .  .  .  .  .  .  .  .
.  .  .  .  .  8  .  .  .  .  2  2  2  2  .  2  2  2  2  .  2  2  2  2  .  .  .  .  .  .  .  .  .  .
.  .  .  8  .  .  .  .  .  .  .  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  2  .  .  .  .  .  .  2  .  .  .  .  .  .  .
.  .  .  .  .  .  .  .  2  .  .  .  .  .  .  .  2  2  2  .  .  9  .  .  .  .  2  2  .  .  .  .  .  .
.  .  .  .  .  .  .  2  .  .  .  .  .  .  .  .  .  2  .  .  .  .  9  .  .  .  .  .  .  .  .  .  .  .
.  .  .  .  .  .  .  .  .  .  .  .  .  .  2  .  .  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
.  .  .  .  11 .  .  .  .  .  .  .  .  .  2  .  .  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
.  .  11 11 11 .  .  .  .  .  .  .  .  .  2  .  .  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
.  .  11 11 11 .  .  .  .  .  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  .  13 .  13 .  .  .  .  .
.  .  .  11 .  .  .  .  .  .  .  .  .  .  .  .  2  2  2  .  .  .  .  .  .  .  13 13 .  .  .  .  .  .
.  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  .  .  .  .  .  .  13 .  .  .  .  .  .  .
```

Equivalency Array after: Pass 2

```
1 1
2 2
3 3
4 3
5 5
6 2
7 7
8 2
9 9
10 2
11 11
12 10
13 13
14 13
```

Equivalency Array after: EQ Management

```
1 1
2 2
3 3
4 3
5 4
6 2
7 5
8 2
9 6
10 2
11 7
12 2
13 8
14 8
```

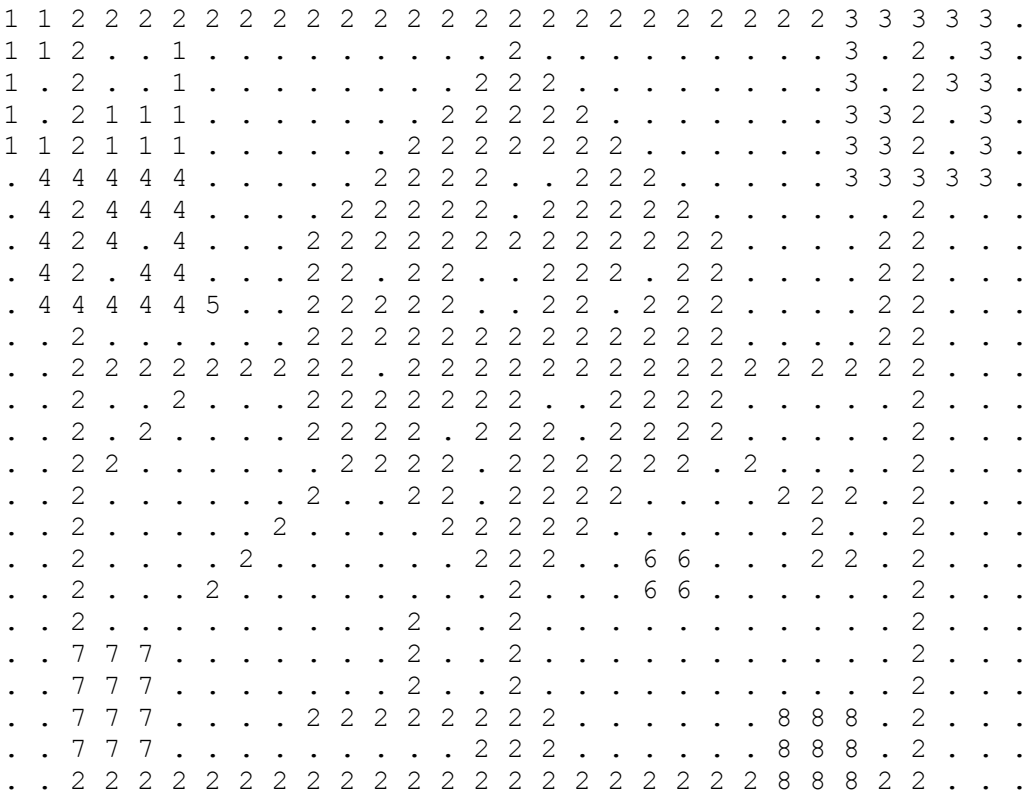
Pass 3
25 31 0 8

```
1 . . . . . . . . . . . . . . . . 2 . . . . . . . . . . . . . . . . 3 .
1 1 . . . . . . . . . . . . . . . . 2 . . . . . . . . . . . . . . . . 3 .
. . 1 . . . . . . . . . . . . . . . 2 2 2 . . . . . . . . . . . . . 3 3 . .
. . . 1 1 1 . . . . . . . . . . . 2 2 2 2 2 . . . . . . . . . . 3 3 . . .
. . . . 1 1 . . . . . . . . . . . 2 2 2 2 2 2 2 . . . . . . . . 3 3 . . . .
. . 4 . . . . . . . . . . . . . 2 2 2 2 . . 2 2 2 . . . . . . 3 . . . . . .
. . 4 4 4 4 . . . . . 2 2 2 2 2 2 . 2 2 2 2 2 2 . . . . . . . . . . . . .
. 4 . 4 . . . . . . 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 . . . . 2 2 . . .
. . 4 . 4 . . . . . 2 2 . 2 2 . . 2 2 2 . 2 2 . . . . . 2 . . . . .
. . . . . 4 . 5 . . 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 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 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 . 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 2 . . . . . .
. . . . . . . . . 2 . . . . . 2 2 2 2 2 . . . . . 2 . . . . . . .
. . . . . . . . 2 . . . . . . . 2 2 2 . . 6 . . . . 2 2 . . . . . .
. . . . . . 2 . . . . . . . . . 2 . . . . 6 . . . . . . . . . . .
. . . . . . . . . . . . . 2 . . 2 . . . . . . . . . . . . . . . . . .
. . . 7 . . . . . . . . . 2 . . 2 . . . . . . . . . . . . . . . . . .
. . 7 7 7 . . . . . . . . 2 . . 2 . . . . . . . . . . . . . . . . . .
. . 7 7 7 . . . . 2 2 2 2 2 2 2 2 . . . . . 8 . 8 . . . . .
. . . 7 . . . . . . . . . . . 2 2 2 . . . . . 8 8 . . . . . .
. . . . . . . . . . . . . . 2 2 2 2 2 . . . . . 8 . . . . . . .
```

Equivalency Array after: Pass 3

```
1 1
2 2
3 3
4 3
5 4
6 2
7 5
8 2
9 6
10 2
11 7
12 2
13 8
14 8
```

Drawing Boxes



Property File

```
25 31 0 8
8
---
1
9
0 0
4 5
---
2
193
0 2
24 27
---
3
9
0 25
5 29
---
4
10
5 1
9 5
---
```

```
5
1
9 6
9 6
---
6
2
17 19
18 20
---
7
8
20 2
23 4
---
8
5
22 23
24 25
---


Label File
25 31 0 8
1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 3 0
1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 3 0
0 0 1 0 0 0 0 0 0 0 0 0 0 0 2 2 2 0 0 0 0 0 0 0 0 0 0 3 3 0 0
0 0 0 1 1 1 0 0 0 0 0 0 0 0 2 2 2 2 2 0 0 0 0 0 0 0 0 3 3 0 0 0
0 0 0 0 1 1 0 0 0 0 0 0 0 2 2 2 2 2 2 2 0 0 0 0 0 0 3 3 0 0 0 0
0 0 4 0 0 0 0 0 0 0 0 2 2 2 2 0 0 2 2 2 0 0 0 0 0 3 0 0 0 0 0
0 0 4 4 4 4 0 0 0 0 2 2 2 2 2 0 2 2 2 2 2 0 0 0 0 0 0 0 0 0 0
0 4 0 4 0 0 0 0 0 2 2 2 2 2 2 2 2 2 2 2 2 2 0 0 0 0 2 2 0 0 0
0 0 4 0 4 0 0 0 0 2 2 0 2 2 0 0 2 2 2 0 2 2 0 0 0 0 2 0 0 0 0
0 0 0 0 4 0 5 0 0 2 2 2 2 2 0 0 2 2 0 2 2 2 0 0 0 0 2 0 0 0 0
0 0 2 0 0 0 0 0 0 2 2 2 2 2 2 2 2 2 2 2 2 2 0 0 0 0 2 0 0 0 0
0 0 2 2 2 2 2 2 2 2 2 2 0 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 0 0 0
0 0 0 0 0 2 0 0 0 2 2 2 2 2 2 2 2 0 0 2 2 2 2 0 0 0 0 0 0 0 0
0 0 0 0 2 0 0 0 0 2 2 2 2 0 2 2 2 0 2 2 2 2 0 0 0 0 0 0 0 0 0
0 0 0 2 0 0 0 0 0 0 0 2 2 2 2 0 2 2 2 2 2 2 0 2 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 2 0 0 2 2 0 2 2 2 2 0 0 0 0 2 2 2 0 0 0 0 0
0 0 0 0 0 0 0 0 0 2 0 0 0 0 0 2 2 2 2 2 0 0 0 0 0 0 2 0 0 0 0 0
0 0 0 0 0 0 0 0 2 0 0 0 0 0 0 0 2 2 2 0 0 6 0 0 0 0 2 2 0 0 0 0
0 0 0 0 0 0 0 2 0 0 0 0 0 0 0 0 0 2 0 0 0 0 6 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 7 0 0 0 0 0 0 0 0 0 2 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 7 7 7 0 0 0 0 0 0 0 0 2 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 7 7 7 0 0 0 0 2 2 2 2 2 2 2 2 2 0 0 0 0 0 0 8 0 8 0 0 0 0 0
0 0 0 7 0 0 0 0 0 0 0 0 0 0 0 2 2 2 0 0 0 0 0 0 8 8 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 0 0 0 0 0 8 0 0 0 0 0 0 0
```

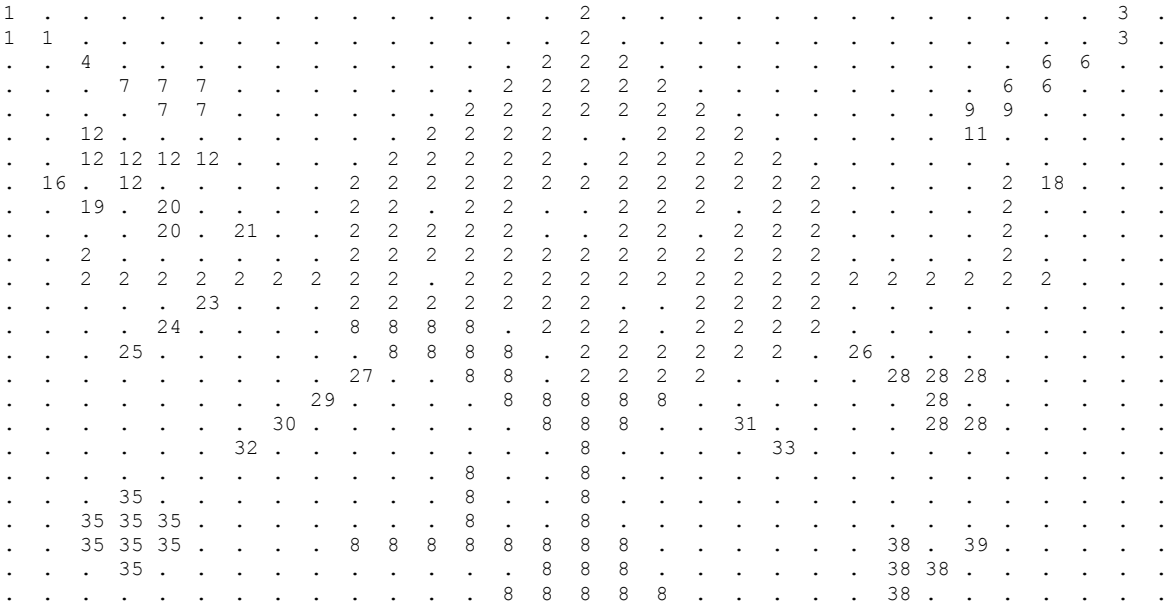
4 Connectedness:

```
Pass 1
25 31 1 40
1  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  3  .
1  1  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  3  .
.  .  4  .  .  .  .  .  .  .  .  .  .  .  .  .  .  5  2  2  .  .  .  .  .  .  .  .  .  .  .  .  6  6  .  .
.  .  .  7  7  7  .  .  .  .  .  .  .  .  .  8  5  2  2  2  .  .  .  .  .  .  .  .  .  .  9  6  .  .  .
.  .  .  .  7  7  .  .  .  .  .  .  .  .  10 8  5  2  2  2  2  .  .  .  .  .  .  .  .  11 9  .  .  .  .
.  .  12 .  .  .  .  .  .  .  .  .  .  13 10 8  5  .  .  2  2  2  .  .  .  .  .  .  .  11 .  .  .  .  .
.  .  12 12 12 12 .  .  .  .  .  14 13 10 8  5  .  15 2  2  2  2  .  .  .  .  .  .  .  .  .  .  .  .  .
.  16 .  12 .  .  .  .  .  .  17 14 13 10 8  5  5  5  2  2  2  2  2  .  .  .  .  .  .  18 18 .  .  .  .
.  .  19 .  20 .  .  .  .  .  17 14 .  10 8  .  .  5  2  2  .  2  2  .  .  .  .  .  .  18 .  .  .  .  .
.  .  .  .  20 .  21 .  .  .  17 14 14 10 8  .  .  5  2  .  22 2  2  .  .  .  .  .  .  18 .  .  .  .  .
.  .  23 .  .  .  .  .  .  .  17 14 14 10 8  8  8  5  2  2  2  2  2  .  .  .  .  .  .  18 .  .  .  .  .
.  .  23 23 23 23 23 23 23 17 14 .  10 8  8  8  5  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .
.  .  .  .  .  .  23 .  .  .  17 14 14 10 8  8  8  .  .  2  2  2  2  .  .  .  .  .  .  .  .  .  .  .
.  .  .  .  .  24 .  .  .  .  17 14 14 10 .  8  8  8  .  2  2  2  2  .  .  .  .  .  .  .  .  .  .  .
.  .  .  25 .  .  .  .  .  .  .  14 14 10 10 .  8  8  8  2  2  2  .  26 .  .  .  .  .  .  .  .  .  .
.  .  .  .  .  .  .  .  .  27 .  .  10 10 .  8  8  8  2  .  .  .  .  .  28 28 28 .  .  .  .  .  .  .
.  .  .  .  .  .  .  .  29 .  .  .  .  10 10 8  8  8  .  .  .  .  .  .  .  28 .  .  .  .  .  .  .
.  .  .  .  .  .  .  30 .  .  .  .  .  .  .  10 8  8  .  .  31 .  .  .  .  28 28 .  .  .  .  .  .
.  .  .  .  .  .  32 .  .  .  .  .  .  .  .  .  8  .  .  .  .  33 .  .  .  .  .  .  .  .  .  .  .
.  .  .  .  .  .  .  .  .  .  .  .  .  34 .  .  8  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
.  .  .  35 .  .  .  .  .  .  .  .  .  34 .  .  8  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
.  .  36 35 35 .  .  .  .  .  .  .  .  34 .  .  8  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
.  .  36 35 35 .  .  .  .  .  37 37 37 34 34 34 8  8  .  .  .  .  .  .  .  38 .  39 .  .  .  .  .  .
.  .  .  35 .  .  .  .  .  .  .  .  .  .  .  34 8  8  .  .  .  .  .  .  .  38 38 .  .  .  .  .  .  .
.  .  .  .  .  .  .  .  .  .  .  .  .  .  40 34 8  8  8  .  .  .  .  .  .  38 .  .  .  .  .  .  .
```

```
Equivalency Array after: Pass 1
1 1
2 2
3 3
4 4
5 2
6 6
7 7
8 8
9 9
10 8
11 9
12 12
13 10
14 10
15 5
16 16
17 14
18 2
19 19
20 20
21 21
22 2
23 17
24 24
25 25
```

26 26
27 27
28 28
29 29
30 30
31 31
32 32
33 33
34 8
35 35
36 35
37 34
38 38
39 39
40 34

Pass 2
25 31 1 39



Equivalency Array after: Pass 2

1	1
2	2
3	3
4	4
5	2
6	6
7	7
8	2
9	6
10	8
11	9
12	12
13	10
14	10
15	5
16	16
17	14
18	2
19	19
20	20
21	21
22	2
23	2
24	24
25	25
26	26
27	27
28	28
29	29
30	30
31	31
32	32
33	33
34	8
35	35
36	35
37	34
38	38
39	39
40	34

Equivalency Array after: EQ Management

1	1
2	2
3	3
4	4
5	2
6	5
7	6
8	2
9	5
10	2
11	5
12	7
13	2
14	2
15	2
16	8
17	2
18	2
19	9
20	10
21	11
22	2
23	2
24	12
25	13
26	14
27	15
28	16
29	17
30	18
31	19
32	20
33	21
34	2
35	22
36	22
37	2
38	23
39	24
40	2

Pass 3
25 31 0 24

```
1  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  3  .
1  1  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  3  .
.  .  4  .  .  .  .  .  .  .  .  .  .  .  .  .  .  2  2  2  .  .  .  .  .  .  .  .  .  .  .  5  5  .  .
.  .  .  6  6  6  .  .  .  .  .  .  .  .  .  2  2  2  2  2  .  .  .  .  .  .  .  .  .  .  5  5  .  .  .
.  .  .  .  6  6  .  .  .  .  .  .  .  .  2  2  2  2  2  2  2  .  .  .  .  .  .  .  .  5  5  .  .  .  .
.  .  7  .  .  .  .  .  .  .  .  .  .  2  2  2  2  .  .  2  2  2  .  .  .  .  .  .  .  5  .  .  .  .  .
.  .  7  7  7  7  .  .  .  .  .  2  2  2  2  2  2  .  2  2  2  2  2  .  .  .  .  .  .  .  .  .  .  .  .
.  8  .  7  .  .  .  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  .  2  2  .  .  .
.  .  9  .  10 .  .  .  .  .  2  2  .  2  2  .  .  2  2  2  .  2  2  .  .  .  .  .  2  .  .  .  .
.  .  .  .  10 .  11 .  .  .  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  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  .  .  .  2  2  2  2  2  2  2  .  .  2  2  2  2  .  .  .  .  .  .  .  .  .  .  .
.  .  .  .  .  12 .  .  .  .  2  2  2  2  .  2  2  2  .  2  2  2  2  .  .  .  .  .  .  .  .  .  .  .
.  .  .  13 .  .  .  .  .  .  .  2  2  2  2  .  2  2  2  2  2  2  .  14 .  .  .  .  .  .  .  .  .  .
.  .  .  .  .  .  .  .  .  .  15 .  .  2  2  .  2  2  2  2  .  .  .  .  16 16 16 .  .  .  .  .  .  .
.  .  .  .  .  .  .  .  .  17 .  .  .  .  2  2  2  2  2  .  .  .  .  .  .  16 .  .  .  .  .  .  .  .
.  .  .  .  .  .  .  .  18 .  .  .  .  .  .  2  2  2  .  .  19 .  .  .  .  16 16 .  .  .  .  .  .  .
.  .  .  .  .  .  .  20 .  .  .  .  .  .  .  .  2  .  .  .  .  21 .  .  .  .  .  .  .  .  .  .  .  .
.  .  .  .  .  .  .  .  .  .  .  .  2  .  .  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
.  .  .  22 .  .  .  .  .  .  .  .  2  .  .  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
.  .  22 22 22 .  .  .  .  .  .  .  2  .  .  2  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
.  .  22 22 22 .  .  .  .  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  23 .  24 .  .  .  .  .
.  .  .  22 .  .  .  .  .  .  .  .  .  .  .  2  2  2  .  .  .  .  .  .  .  23 23 .  .  .  .  .  .
.  .  .  .  .  .  .  .  .  .  .  .  .  .  2  2  2  2  2  .  .  .  .  .  .  23 .  .  .  .  .  .  .
```

Equivalency Array after: Pass 3

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

26 14
27 15
28 16
29 17
30 18
31 19
32 20
33 21
34 2
35 22
36 22
37 2
38 23
39 24
40 2

Drawing Boxes
25 31 0 24

```
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  .  3  .
1  1  2  .  .  .  .  .  .  .  .  .  .  .  .  .  2  .  .  .  .  .  .  .  .  .  .  .  2  .  3  .
.  .  4  .  .  .  .  .  .  .  .  .  .  .  .  2  2  2  .  .  .  .  .  .  .  .  .  5  5  5  5  .  .
.  .  2  6  6  6  .  .  .  .  .  .  .  .  2  2  2  2  2  .  .  .  .  .  .  .  .  5  5  2  5  .  .
.  .  2  6  6  6  .  .  .  .  .  .  .  2  2  2  2  2  2  2  .  .  .  .  .  .  .  5  5  2  5  .  .
.  .  7  7  7  7  .  .  .  .  .  .  2  2  2  2  .  .  2  2  2  .  .  .  .  .  .  5  5  5  5  .  .
.  .  7  7  7  7  .  .  .  .  2  2  2  2  2  .  2  2  2  2  2  .  .  .  .  .  .  2  .  .  .
.  8  7  7  7  7  .  .  .  2  2  2  2  2  2  2  2  2  2  2  2  2  .  .  .  .  2  2  .  .  .
.  .  9  .  10 .  .  .  .  2  2  .  2  2  .  .  2  2  2  .  2  2  .  .  .  .  2  2  .  .  .
.  .  2  .  10 .  11 .  .  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  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  .  .  2  .  .  .  2  2  2  2  2  2  2  .  .  2  2  2  2  .  .  .  .  .  2  .  .  .
.  .  2  .  12 .  .  .  .  2  2  2  2  .  2  2  2  .  2  2  2  2  .  .  .  .  .  2  .  .  .
.  .  2  13 .  .  .  .  .  .  2  2  2  2  .  2  2  2  2  2  2  .  14 .  .  .  .  2  .  .  .
.  .  2  .  .  .  .  .  .  15 .  .  2  2  .  2  2  2  2  .  .  .  .  16 16 16 .  2  .  .  .
.  .  2  .  .  .  .  .  17 .  .  .  .  2  2  2  2  2  .  .  .  .  .  16 16 16 .  2  .  .  .
.  .  2  .  .  .  .  18 .  .  .  .  .  .  2  2  2  .  .  19 .  .  .  16 16 16 .  2  .  .  .
.  .  2  .  .  .  20 .  .  .  .  .  .  .  .  2  .  .  .  .  21 .  .  .  .  .  .  2  .  .  .
.  .  2  .  .  .  .  .  .  .  .  .  .  2  .  .  2  .  .  .  .  .  .  .  .  .  .  2  .  .  .
.  .  22 22 22 .  .  .  .  .  .  .  .  2  .  .  2  .  .  .  .  .  .  .  .  .  .  2  .  .  .
.  .  22 22 22 .  .  .  .  .  .  .  .  2  .  .  2  .  .  .  .  .  .  .  .  .  .  2  .  .  .
.  .  22 22 22 .  .  .  .  2  2  2  2  2  2  2  2  .  .  .  .  .  .  .  23 23 24 .  2  .  .  .
.  .  22 22 22 .  .  .  .  .  .  .  .  .  .  2  2  2  .  .  .  .  .  .  .  23 23 .  .  2  .  .  .
.  .  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  23 23 2  2  2  .  .  .
```

Label File

25 31 0 24

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

Property File

```
25 31 0 24
24
---
1
3
0 0
1 1
---
2
180
0 2
24 27
---
3
2
0 29
1 29
---
4
1
2 2
2 2
---
5
7
2 25
5 28
```

```
---
6
5
3 3
4 5
---
7
6
5 2
7 5
---
8
1
7 1
7 1
---
9
1
8 2
8 2
---
10
2
8 4
9 4
---
11
1
9 6
9 6
---
12
1
13 4
13 4
---
13
1
14 3
14 3
---
14
1
14 22
14 22
---
15
1
15 9
15 9
---
16
6
15 23
```

```
17 25
---
17
1
16 8
16 8
---
18
1
17 7
17 7
---
19
1
17 19
17 19
---
20
1
18 6
18 6
---
21
1
18 20
18 20
---
22
8
20 2
23 4
---
23
4
22 23
24 24
---
24
1
22 25
22 25
---
```