ANALYSIS REPORT

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Pseudocode

Functions Used : 1) readwritefile()
2) greedy_SeparatingPoints()
3) checksplitH()
4) checksplitV()

Create : List vert
List horz
List solution
int XC[], YC[]

```
function readwritefile()
1       File folder = new File("input")
2       File[] listOfFiles = folder.listFiles()

3       for (i = 0 to listOfFiles.length )
4           if (file.isFile())
5               String filename= file.getName()
                numlines = 0
6               br = new BufferedReader(new
                    FileReader("input/" + filename));
7               line = br.readLine();
8               numlines : get number of points
                    from first line of file.
9               Create array XC[], YC[] of
                length numlines.
10              Read x and y coordinates line
                by line into XC, YC.
11              br.close.
12          end if
```

```
        // output file creation.
12      outfilename = "greedysolution_"
13      if i < 10
14          outfilename = outfilename + "0" + (i+1)
        else
15          outfilename = outfilename + (i+1)

        // create file in output_greedy folder.
16      File outfile = new File("output_greedy",
                                outfilename)
17      outfile.createNewFile();

18      bw: BufferedWriter object to write into file

        // call algorithm to select lines

19      greedy_SeparatingPoints(xc, yc, 0, xc.length-1)

        // write the number of lines and solution to
        // file.

20      bw.write(solution.size())

21      for z = 0 to solution.size()
            bw.write(solution.get(z) + "\n");
        end for

22      bw.close
    end for
end method
```

Analysis

1. Line 1 and 2 are initialization and takes O(1) time
2. Line 3 has 1 initialization, comparisons upto to number of files in folder say "f"
3. Lines 4 to 18 will run for "f" times.
4. Line 19 is the call to greedy_SeparatingPoints() which will itself take time. The call to this method will be for the number of files in the folder
5. Lines 20 to 22 will ~~we~~ be executed 'f' times.

Method 2

```
greedy_SeparatingPoints(int X[], int Y[], int
                        start, int end)
1       length = X.length
2       boolean splitH = false, splitV = false
3       diff = end - start
4       if diff > 0
5           vertical = 0, horizontal = 0
6           firstvalue = X[start]
7           lastvalue = X[end]
8           splitmid = firstvalue + lastvalue
9           if (splitmid % 2 != 0)
10                  vertical = splitmid/2
11                  horizontal = splitmid/2
            end if
```

```
                else
12                  vertical = splitmod - 1 / 2
13                  horizontal = splitmod - 1 / 2
                end if
14              if (vert.isEmpty())
15                  vert.add (vertical)
16                  solution.add ("v " + vertical)
                else
17                  splitV = checksplitV (x, y, vertical)
18                  if (splitV == true)
19                      vert.add (vertical)
20                      solution.add ("v " + vertical)
                    end if
                end if
21              splitH = checksplitH (x, y, horizontal)
22              if (splitH == true)
23                  horz.add (horizontal)
24                  solution.add ("h " + horizontal)
                end if
25              upstart = vertical - 0.5
26              downend = vertical - 1.5

27              greedy_SeparatingPoints (x, y, start, downend)
28              greedy_SeparatingPoints (x, y, upstart, end)

            end if
        end
```

Method 3

```
boolean checkSplitH(int X1[], Y1[], splitpoint)
1     flagsplit = 0
2     for i = 0 to Y1.length
3         for j = i+1 to Y1.length
4             if flagsplit == 0
5                 if ((Y1[i] > splitpoint && Y1[j] < splitpoint)
                      || (Y1[i] < splitpoint && Y1[j] >
                      splitpoint))
6                     x1 = X1[i]
7                     x2 = X1[j]
8                     y1 = Y1[i]
9                     y2 = Y1[j]
10                    splitvertfound = 0
11                    for k = 0 to vert.size()
12                        if splitvertfound = 0
13                            vertival = vert.get(k)
14                            if (x1 < vertival && x2 > vertival)
15                                splitvertfound = 1
                              end if
                          end if
                      end for
16                    if splitvertfound = 0
17                        if horz.isEmpty()
18                            flagsplit = 1
                          end if
19                        flagcount = 0
20                        for l = 0 to horz.size()
21                            if flagcount = 0
```

```
22              horzval = horz.get(l)
23              if((y1>horzval && y2<horzval)||(y1<horzval &&
                                                y2>horzval)
24                  flagcount=1
                end if
              end if
            end for
25          if flagcount = 1
26              flagsplit = 0
            else
27              flagsplit = 1
            end if
          end if
        end if
      end for
    end for
28  if  flagsplit = 0
29      return false
    else
30      return true.
    end method
```

Method 4

```
boolean checksplitV(x1[], y1[], splitpoint)
1     flagsplit = 0
2     x1 = splitpoint - 1.5
3     x2 = splitpoint - 0.5
4     for k = 0 to horz.size()
5         if flagsplit = 0
6             betweenline = horz.get(k)
7             if ((y1[x1] > betweenline && y1[x2] <
                betweenline) || (y1[x1] < betweenline &&
                                 y1[x2] > betweenline))
8                 flagsplit = 1
              else
9                 flagsplit = 0
              end if
          end if
      end for
10    if flagsplit = 1
11        return false
      else
12        return true
end method.
```

Analysis of the procedures

greedy_SeparationPoints()

1. The greedy_SeparationPoints() executes for each file in the folder (f times)
2. It also executes recursively for every split.
3. Since the split is done from 0 to 9 it is called n times. i.e. number of coordinate points.
4. The function List.add() has time complexity O(1)
5. Also isEmpty() has constant time

checksplitH()

1. The checksplitH() function is called for every horizontal splitpoint to check whether it should be added to solution
2. Line 1 takes O(1)
3. The two for loops are nested hence every line in this loop takes n^2
4. Line 11 is a for loop will execute till size of the vertical list.
   Hence say if size is n. Everystatement in this loop will execute for n^3 times.
5. Line 16 to 20 runs n^2 times.
6. Line 20 is for loop, hence statements 21 to 24 runs n^3 times.

7 Line 25 to 27 runs n^2 times.
8 Line 28 to 30 takes $O(1)$ time,
9 The list's get() takes $O(1)$ time.
Hence complexity of this function is $O(n^3)$

* checksplitV()
This function checks whether vertical split line is to be added in the solution.

1 Line 1 to 3 takes $O(1)$
2 The for loop in line 4 has 1 initialization comparisons equal to number of points in horz solution say n.
3 Line inside for runs $O(n)$ times (Line 5 to 10)
4 Line 10 to 12 runs $O(1)$ times.

This function takes $O(n)$ time.

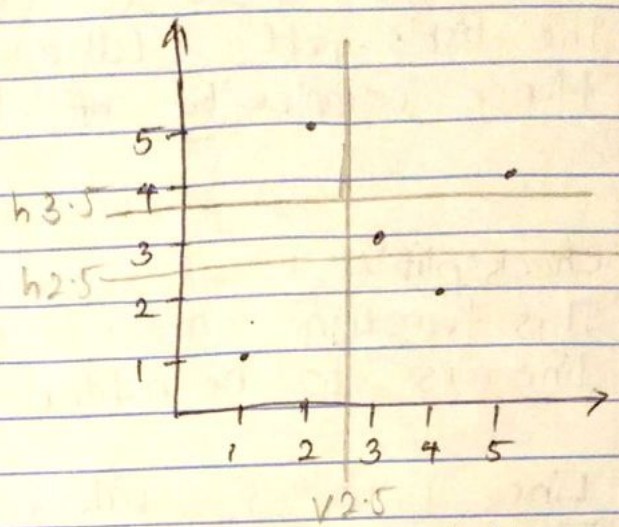
The overall complexity of the algorithm goes to n^4. as separating points function i.e. greedy_Separatingpoints() takes $O(n)$ & checksplitH() takes $O(n^3)$.
Therefore total time is $O(n^4)$

If we also consider number of files say n, then complexity rises to $O(n^5)$

* Algorithm analysis using instance
* Points 5

Input

5
1 1
2 5
3 3
4 2
5 4



The algorithm gives optimum solution

Output

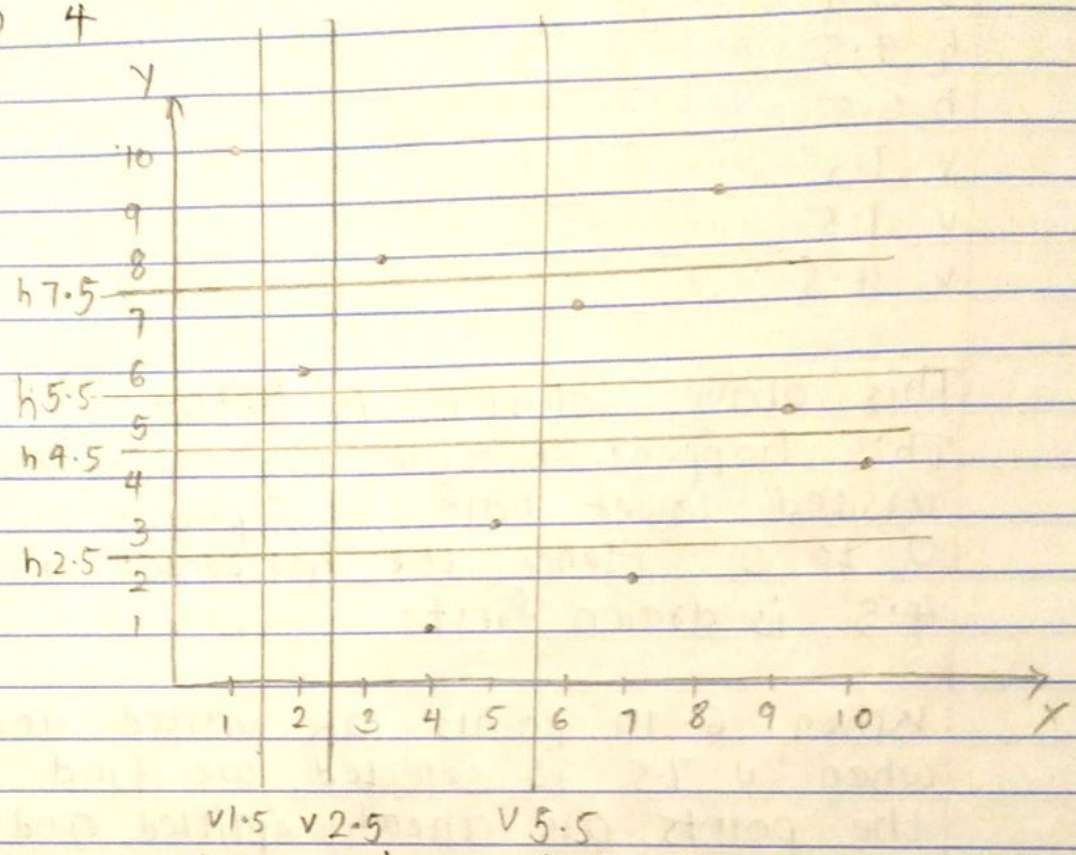
3
v 2.5
h 2.5
h 3.5

* Algorithm fails for:
* The algorithm does not give optimum solution for 10 points.
It gives one split point extra.

Input

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

9 5
10 4



The algorithm gives following output

7
v 5.5
h 5.5
v 2.5
h 2.5
v 1.5
h 4.5
h 7.5

The above solution is not optimal. The number of lines that can be used to split the above 10 points is

6
v 5.5
h 4.5
h 6.5
v 7.5
v 1.5
v 4.5

This above solution is better.
This happens because my algorithm first visited lower half i.e. points on x coordinate 0 to 5. Hence the horizontal line 2.5 and 4.5 is drawn first.

When 6-10 points are visited and when v 7.5 is selected, we find that the points are already splitted and line is not drawn or selected in solution.