Day 6 - Manhattan metric

Init

In[53]:=
```
SetDirectory[NotebookDirectory[]];
```

In[54]:=
```
(input = Import["input.txt", "CSV"]) ~Take~ 10
```

Out[54]=
```
{{278, 314}, {282, 265}, {252, 59}, {62, 70}, {192, 100},
 {299, 172}, {310, 347}, {283, 113}, {342, 59}, {293, 260}}
```

In[55]:=
```
(example = Import["example.txt", "CSV"])
```

Out[55]=
```
{{1, 1}, {1, 6}, {8, 3}, {3, 4}, {5, 5}, {8, 9}}
```

Part 1 - find largest finite set

In[79]:=
```
minmax[set_] :=
 {{Min[set[[All, 1]]], Max[set[[All, 1]]]}, {Min[set[[All, 2]]], Max[set[[All, 2]]]}}
```

In[80]:=
```
data = input;
```

In[81]:=
```
minmax[data]
```

Out[81]=
```
{{40, 353}, {45, 358}}
```

In[82]:=
```
manhattanDist[{x_, y_}, {i_, j_}] := Abs[x - i] + Abs[y - j]
```

Determine a large enough area to search

In[83]:=
```
area[set_, factor_: 0.25] := Module[{dx, dy},
  mm = minmax[set];
  dx = mm[[1, 2]] - mm[[1, 1]];
  dy = mm[[2, 2]] - mm[[2, 1]];
  {{mm[[1, 1]] - Ceiling[dx * factor], mm[[1, 2]] + Ceiling[dx * factor]},
   {mm[[2, 1]] - Ceiling[dy * factor], mm[[2, 2]] + Ceiling[dy * factor]}}
 ]
```

In[84]:=
```
{{x1, x2}, {y1, y2}} = area[data]
```

Out[84]=
```
{{-39, 432}, {-34, 437}}
```

The marker is the id of the reference point unless it is equidistant to two points in which case it it zero

In[85]:=
```
marker[set_, {x_, y_}] := Module[{dist, s},
  dist = MapIndexed[{#2[[1]], manhattanDist[{x, y}, #1]} &, set];
  s = SortBy[dist, #[[2]] &];
  If[s[[1, 2]] == s[[2, 2]], 0, s[[1, 1]]]
 ]
```

In[86]:=
```
marker[data, {1, 1}]
```
Out[86]=
```
4
```

In[87]:=
```
(tab = Table[marker[data, {x, y}], {x, x1, x2}, {y, y1, y2}]);
```

In[88]:=
```
Dimensions[tab]
```
Out[88]=
```
{472, 472}
```

In[89]:=
```
x2 - x1
```
Out[89]=
```
471
```

In[90]:=
```
edges = Union[tab[[1, All]], tab[[x2 - x1 + 1, All]], tab[[All, 1]], tab[[All, y2 - y1 + 1]]]
```
Out[90]=
```
{0, 3, 4, 5, 7, 9, 16, 19, 20, 27, 29, 32, 34, 35, 38, 39, 42, 43, 44, 45, 46, 48}
```

Finite regions are those not found along the edges

In[91]:=
```
finite = Complement[Range[1, Length[data]], edges]
```
Out[91]=
```
{1, 2, 6, 8, 10, 11, 12, 13, 14, 15, 17, 18, 21,
 22, 23, 24, 25, 26, 28, 30, 31, 33, 36, 37, 40, 41, 47, 49, 50}
```

In[92]:=
```
countMarkers[tab_, list_] := {#, Count[tab, #, {2}]} & /@ list
```

In[93]:=
```
counts = SortBy[countMarkers[tab, finite], -#[[2]] &]
```
Out[93]=
```
{{8, 4060}, {23, 3899}, {40, 3102}, {25, 3063}, {36, 3004}, {33, 2778}, {21, 2776},
 {6, 2381}, {18, 2380}, {47, 2308}, {50, 2292}, {14, 2150}, {13, 1843}, {31, 1819},
 {26, 1688}, {41, 1659}, {12, 1603}, {28, 1569}, {15, 1448}, {2, 1417}, {1, 1377},
 {17, 1300}, {22, 1144}, {30, 1113}, {24, 839}, {10, 756}, {49, 734}, {37, 465}, {11, 73}}
```

Graph it

In[96]:=
```
ColorData[]
```
Out[96]=
```
{Gradients, Indexed, Named, Physical}
```

In[101]:=
```
ArrayPlot[tab, ColorFunction → "Rainbow", ImageSize → 472, Frame → False]
```

Out[101]=

Part 2 - identify a compact set

In[71]:=
```
data = input;
```

In[72]:=
```
sumDistance[set_, {x_, y_}] := Module[{sum},
  sum = Sum[manhattanDist[{x, y}, p], {p, set}]
 ]
```

In[73]:=
```
sumDistance[data, {4, 3}]
```

Out[73]= 20 609

In[74]:=
```
{{x1, x2}, {y1, y2}} = area[data]
```

Out[74]= {{-39, 432}, {-34, 437}}

In[75]:=
```
limit = 10 000
```

Out[75]= 10 000

In[76]:=
```
tab = Table[sumDistance[data, {x, y}], {x, x1, x2}, {y, y1, y2}];
```

In[77]:=
```
Table[Select[t, # < limit &], {t, tab}] // Flatten // Length
```

Out[77]= 36 136

In[78]:=
```
ArrayPlot[tab]
```

Out[78]=