Day 6 - Manhattan metric

Init

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

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

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

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

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

Part 1 - find largest finite set

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

In[•]:= data = input;

In[•]:= minmax[data]

Out[•]= {{40, 353}, {45, 358}}

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

Determine a large enough area to search

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

In[•]:= {{x1, x2}, {y1, y2}} = area[data, 2]

Out[•]= {{-586, 979}, {-581, 984}}
```

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

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

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

In[•]:= Dimensions[tab]
Out[•]= {1566, 1566}

In[•]:= x2 - x1
Out[•]= 1565

In[•]:= edges =
         Union[tab[[1, All]], tab[[x2 - x1 + 1, All]], tab[[All, 1]], tab[[All, y2 - y1 + 1]]]
Out[•]= {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[•]:= finite = Complement[Range[1, Length[data]], edges]
Out[•]= {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[•]:= countMarkers[tab_, list_] := {#, Count[tab, #, {2}]} & /@ list

In[•]:= counts = SortBy[countMarkers[tab, finite], -#[[2]] &]
Out[•]= {{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}}
```

Part 2 - identify a compact set

```
In[•]:= data = input;

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

In[•]:= sumDistance[data, {4, 3}]
Out[•]= 20 609

In[•]:= {{x1, x2}, {y1, y2}} = area[data, 2]
Out[•]= {{-586, 979}, {-581, 984}}

In[•]:= limit = 10 000
Out[•]= 10 000

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

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

Out[•]=
```
36 136
```