Day 11 - Power that rack

Init

In[1]:=
```
SetDirectory[NotebookDirectory[]];
```

In[2]:=
```
mySerial = 3628;
```

In[3]:=
```
take100[x_] := Module[{y, z},
  y = Floor[x / 100];
  z = Floor[y / 10];
  y - z * 10
 ]
```

In[4]:=
```
take100[12 345]
```

Out[4]=
```
3
```

In[5]:=
```
powerLevel[x_, y_, serial_: mySerial] := Module[{rackId, power},
  rackId = x + 10;
  power = rackId * y;
  power += serial;
  power *= rackId;
  power = take100[power];
  power - 5
 ]
```

In[6]:=
```
powerLevel[3, 5, 8]
```

Out[6]=
```
4
```

In[16]:=
```
cells = Table[
   powerLevel[x, y],
   {y, 1, 300}, {x, 1, 300}
  ];
```

In[8]:=
```
cells[[50, 50]]
```

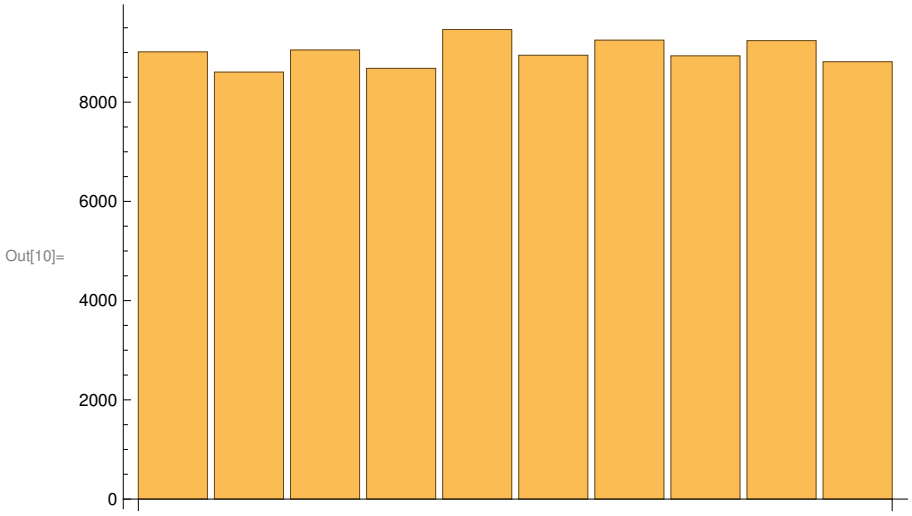
Out[8]=
```
1
```

In[9]:=
```
celldist = Tally[Flatten[cells]] ~SortBy~ (#[[1]] &)
```

Out[9]=
```
{{-5, 9014}, {-4, 8606}, {-3, 9052}, {-2, 8681},
 {-1, 9464}, {0, 8945}, {1, 9250}, {2, 8933}, {3, 9240}, {4, 8815}}
```

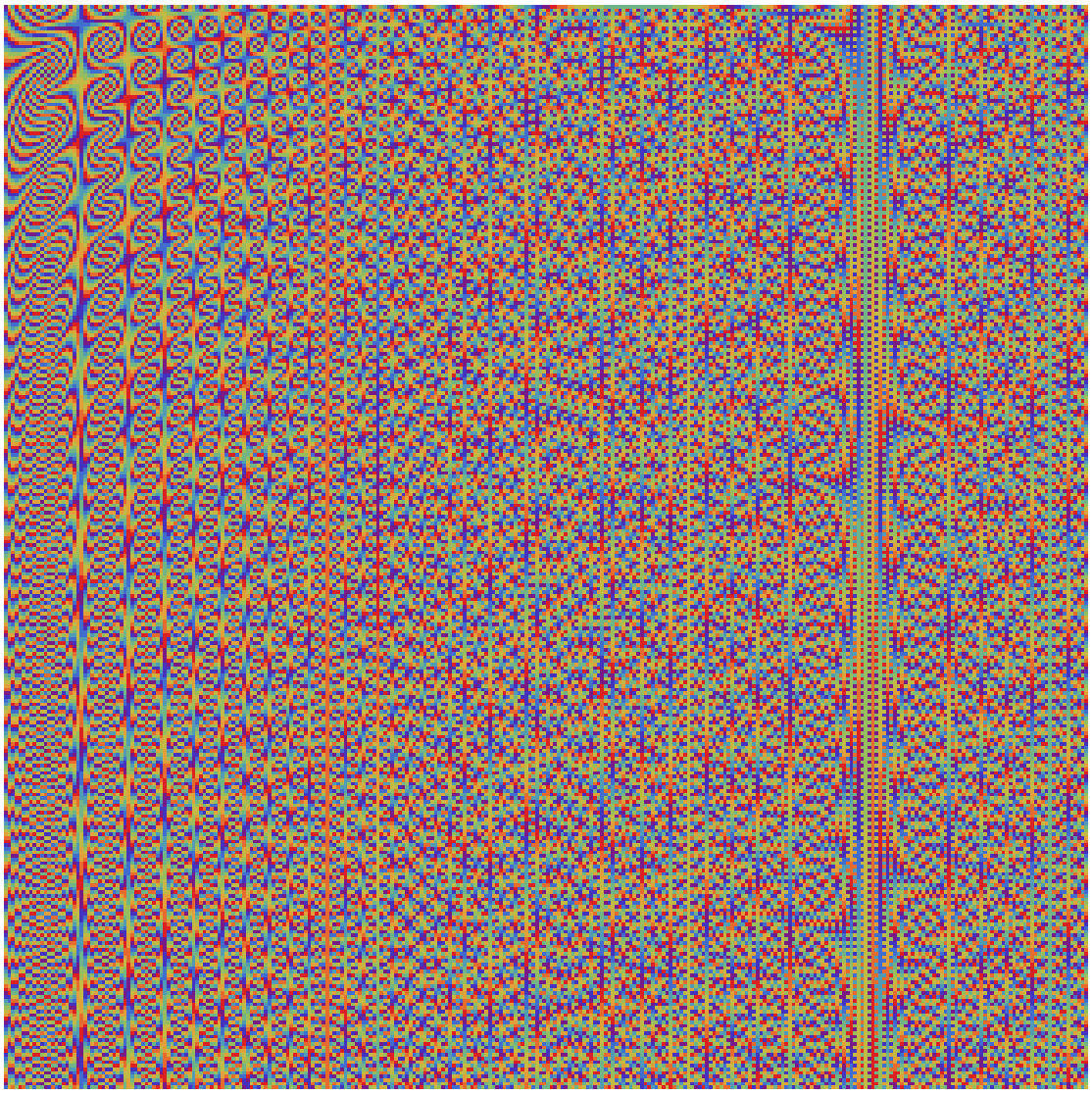
In[10]:=
```
BarChart[celldist[[All, 2]]]
```

Out[10]=



In[18]:=
```
ArrayPlot[cells, ColorFunction → "Rainbow", ImageSize → 600]
```

Out[18]=



In[13]:=
```
Plus @@ Flatten[cells] / 300^2 // N
```

Out[13]=
```
-0.482
```

Part 1

In[19]:=
```
sum3x3[cells_, x_, y_] := Sum[cells[[x + dx, y + dy]], {dx, 0, 2}, {dy, 0, 2}]
```

In[20]:=
```
sums = Table[{x, y, sum3x3[cells, x, y]}, {x, 1, 298}, {y, 1, 298}];
```

In[21]:=
```
sums[[1, 1]]
```

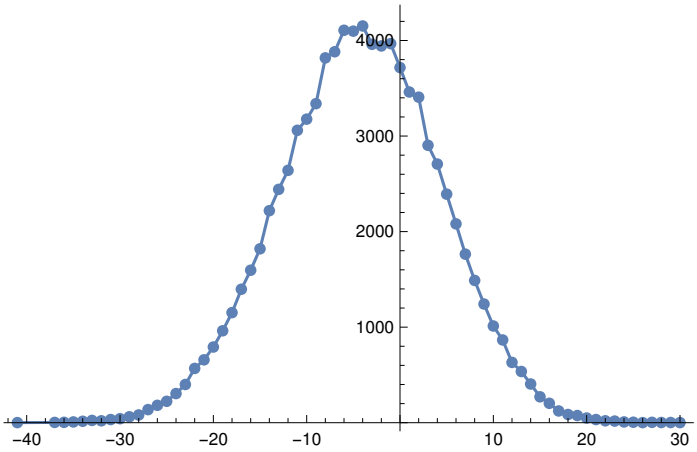
Out[21]=
```
{1, 1, -5}
```

In[22]:=
```
distOfSums[s_] := Tally[#[[3]] & /@ Flatten[s, 1]] ~SortBy~ (#[[1]] &)
```

In[23]:=
```
tally3 = distOfSums[sums];
```

In[24]:=
```
ListPlot[tally3, Joined → True, Mesh → All]
```

Out[24]=



In[25]:=
```
maxsum = Max[sums[[All, All, 3]]]
```

Out[25]=
```
30
```

In[26]:=
```
Select[Flatten[sums, 1], #[[3]] == maxsum &]
```

Out[26]=
```
{{12, 216, 30}}
```

Part 2

In[•]:=
```
valuez[cells_, x_, y_, z_] := Sum[cells[[x + dx, y + dy]], {dx, 0, z - 1}, {dy, 0, z - 1}]
```

In[•]:=
```
sumz[cells_, z_] :=
 Table[{x, y, valuez[cells, x, y, z]}, {x, 1, 300 - z + 1}, {y, 1, 300 - z + 1}]
```

In[•]:=
```
maxsumz[cells_, z_] := Module[{sums, maxsum, ret},
  sums = sumz[cells, z];
  maxsum = Max[sums[[All, All, 3]]];
  ret = Select[Flatten[sums, 1], #[[3]] == maxsum &][[1]];
  Append[ret, z]
 ]
```

In[•]:=
```
maxsumz[cells, 4]
```

Out[•]=
```
{231, 5, 37, 4}
```

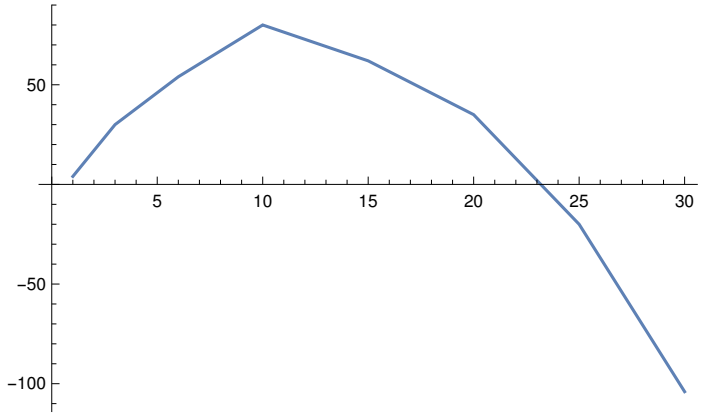
Over large areas the average will tend to the statistical mean (< 0) - find where the max peaks because of random variation:

In[•]:=
```
shape = {#, maxsumz[cells, #]} & /@ {1, 3, 6, 10, 15, 20, 25, 30}
```

Out[•]=
```
{{1, {1, 9, 4, 1}}, {3, {216, 12, 30, 3}}, {6, {242, 109, 54, 6}},
 {10, {236, 176, 80, 10}}, {15, {90, 186, 62, 15}}, {20, {86, 181, 35, 20}},
 {25, {218, 265, -20, 25}}, {30, {213, 261, -104, 30}}}
```

In[•]:=
```
ListPlot[{#[[1]], #[[2, 3]]} & /@ shape, Joined → True]
```

Out[•]=



In[•]:=
```
all25 = Parallelize[Table[{z, maxsumz[cells, z]}, {z, 1, 25}]];
```

In[•]:=
```
all = Join[all25, {}];
```

In[•]:=
```
maxall = Max[all[[All, 2, 3]]]
```

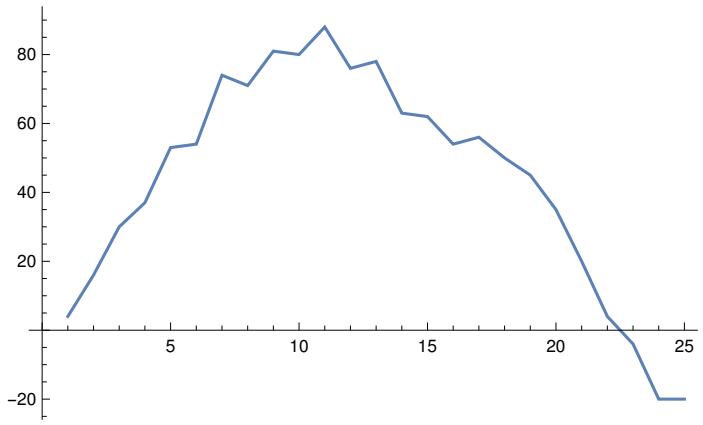
Out[•]=
```
88
```

In[•]:=
```
Select[all, #[[2, 3]] == maxall &]
```

Out[•]=
```
{{11, {236, 175, 88, 11}}}
```

In[•]:=
```
ListPlot[{#[[1]], #[[2, 3]]} & /@ all, Joined → True]
```

Out[•]=



Distribution at z = 10

In[•]:=
```
sums10 = sumz[cells, 10];
```

In[•]:=
```
tally10 = distOfSums[sums10];
```

In[•]:=
```
ListPlot[tally10, Joined → True, Mesh → All]
```

Out[•]=