Heat Map

The array below was used to generate this heat map:

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	1	1	1	1	2	2	2	1	1	1	1	1	1	1	1	1
1	1	2	2	2	4	5	2	2	1	1	1	1	1	2	1	1
2	1	2	2	3	4	3	3	1	1	1	1	1	1	1	2	1
3	1	1	2	3	3	2	1	1	1	1	1	1	1	3	1	1
4	1	1	2	2	2	2	1	1	2	1	1	1	1	1	1	1
5	1	1	1	2	1	1	1	1	1	2	1	1	2	1	1	1
6	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1
7	1	1	1	1	1	1	1	1	1	1	3	3	3	1	2	1
8	1	2	2	2	1	1	1	1	3	3	4	4	4	3	2	1
9	1	2	2	3	5	1	1	1	3	4	6	6	4	3	1	1
10	1	1	2	4	5	5	1	1	3	6	7	8	5	4	2	1
11	1	1	3	3	5	5	3	1	1	5	6	7	5	4	2	1
12	1	1	1	2	3	3	1	1	3	4	4	6	5	3	2	1
13	1	1	1	2	3	3	1	1	3	3	4	4	4	3	2	1
14	1	2	1	1	2	2	1	2	1	1	3	3	1	3	1	1
15	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1

```
int row = 16;
int col = 16;
int heatmap[] [] = {{1, 1, 1, 1, 2, 2, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1},
        {1, 2, 2, 2, 4, 5, 2, 2, 1, 1, 1, 1, 1, 2, 1, 1},
        {1, 2, 2, 3, 4, 3, 3, 1, 1, 1, 1, 1, 1, 1, 2, 1},
        {1, 1, 2, 3, 3, 2, 1, 1, 1, 1, 1, 1, 1, 3, 1, 1},
        {1, 1, 2, 2, 2, 2, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1},
        {1, 1, 1, 2, 1, 1, 1, 1, 1, 2, 1, 1, 2, 1, 1, 1},
        {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 2, 1, 1, 1},
        {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 3, 3, 3, 1, 2, 1},
        {1, 2, 2, 2, 1, 1, 1, 1, 3, 3, 4, 4, 4, 3, 2, 1},
        {1, 2, 2, 3, 5, 1, 1, 1, 3, 4, 6, 6, 4, 3, 1, 1},
        {1, 1, 2, 4, 5, 5, 1, 1, 3, 6, 7, 8, 5, 4, 2, 1},
        {1, 1, 3, 3, 5, 5, 3, 1, 1, 5, 6, 7, 5, 4, 2, 1},
        {1, 1, 1, 2, 3, 3, 1, 1, 3, 4, 4, 6, 5, 3, 2, 1},
        {1, 1, 1, 2, 3, 3, 1, 1, 3, 3, 4, 4, 4, 3, 2, 1},
        {1, 2, 1, 1, 2, 2, 1, 2, 1, 1, 3, 3, 1, 3, 1, 1},
        {1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 1}};
```

Heat Map #1 – Printing

Print out the Heat Map Array so it looks like this:

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

Heat Map #2 – Template Functions

This is the 1D array template for integers:
http://www.gorskicompsci.ca/ICS4C/2_Arrays/intArrayFormula.java

Adapt the 1D array template for integers so that it can be used to do the following with the heat map array:

1. Find the Sum or Total of the array
2. Find the Average
3. Find the Maximum, Largest value
4. Find the Minimum, Smallest value

Heat Map #3 – Locations

Print out the location of the maximum.

```
The maximum is found in location (3, 4).
```

Print out all of the locations of the minimum:

```
The minimums are found in:

(4,5)

(6,7)

(3,2)
```

Both of these functions should work with any array. This is a second array that you can paste over top of the first one to test that your code is adaptable.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1
1	1	1	2	2	2	2	1	2	1	1	1	1	2	2	2	1
2	1	2	3	3	3	1	2	1	1	1	2	2	3	2	2	1
3	1	1	1	2	2	1	1	1	1	2	3	2	2	2	1	1
4	1	1	1	1	1	1	2	1	2	2	3	2	2	1	2	1
5	2	1	2	1	1	1	1	1	2	3	3	2	1	1	1	2
6	2	3	3	1	2	2	1	1	1	2	2	2	1	1	1	1
7	1	2	3	1	4	4	4	1	1	1	1	1	1	1	1	2
8	1	1	3	4	6	6	6	6	1	1	1	3	1	1	2	1
9	1	1	4	6	5	6	6	6	4	1	1	2	1	2	2	1
10	1	2	4	6	5	6	8	7	7	4	1	1	1	3	3	1
11	1	2	4	5	5	6	7	7	7	5	4	1	1	4	3	2
12	2	1	4	5	5	5	5	4	3	4	1	1	2	3	3	2
13	1	2	2	4	4	3	4	4	3	1	1	1	3	3	2	1
14	2	1	1	1	1	3	3	1	1	1	1	2	2	2	1	1
15	1	1	1	1	3	3	1	1	1	1	1	2	1	1	1	1

```
int heatmap[][]={{1, 1, 1, 1, 2, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1},
        {1, 1, 2, 2, 2, 2, 1, 2, 1, 1, 1, 1, 2, 2, 2, 1},
        {1, 2, 3, 3, 3, 1, 2, 1, 1, 1, 2, 2, 3, 2, 2, 1},
        {1, 1, 1, 2, 2, 1, 1, 1, 1, 2, 3, 2, 2, 2, 1, 1},
        {1, 1, 1, 1, 1, 1, 2, 1, 2, 2, 3, 2, 2, 1, 2, 1},
        {2, 1, 2, 1, 1, 1, 1, 1, 2, 3, 3, 2, 1, 1, 1, 2},
        {2, 3, 3, 1, 2, 2, 1, 1, 1, 2, 2, 2, 1, 1, 1, 1},
        {1, 2, 3, 1, 4, 4, 4, 1, 1, 1, 1, 1, 1, 1, 1, 2},
        {1, 1, 3, 4, 6, 6, 6, 6, 1, 1, 1, 3, 1, 1, 2, 1},
        {1, 1, 4, 6, 5, 6, 6, 6, 4, 1, 1, 2, 1, 2, 2, 1},
        {1, 2, 4, 6, 5, 6, 8, 7, 7, 4, 1, 1, 1, 3, 3, 1},
        {1, 2, 4, 5, 5, 6, 7, 7, 7, 5, 4, 1, 1, 4, 3, 2},
        {2, 1, 4, 5, 5, 5, 5, 4, 3, 4, 1, 1, 2, 3, 3, 2},
        {1, 2, 2, 4, 4, 3, 4, 4, 3, 1, 1, 1, 3, 3, 2, 1},
        {2, 1, 1, 1, 1, 3, 3, 1, 1, 1, 1, 2, 2, 2, 1, 1},
        {1, 1, 1, 1, 3, 3, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1}};
```

Heat Map #4 – Process Image

Value	Icon
1	
2	.
3	,
4	;
5	*
6	#
7	&
8	%

- Print out both heatmaps, in the same program.
- Instead of outputting the values 1-8, output the icons shown in the chart above.
- Note: 1 is a space.
- This will make an ASCII art image that will correspond to the values in the heat map. It is essentially the process behind making a real heat map (only colours would be used instead of ASCII characters)

The first heat map looked something like this when it was printed out using ASCII characters.