Simple Averaging Automaton

Instructions

1. Set up the spreadsheet to be a square grid, 13 columns and 13 rows (column width 4, row height 22.5).
2. Set up Excel for iteration.
    1. Go to Tools/Options/Calculations and
        a. Set calculation to Manual.
        b. Notice the Calc Now button (F9). This means to calculate manually press F9. Notice also the Calc Sheet button for further reference.
        c. Select Iteration; deselect Recalculate Before Save.
        d. Set Maximum Iterations to 100 and Maximum Change to 0.001.
    2. **Nearest-neighbor averaging**: Each interior cell will have a formula that averages the 4 cells sharing an edge with it, (above cell + right cell + below cell + left cell)/4. (For example, the formula in E5 would be =(E4+F5+E6+D5)/4.)
    3. Edge and corner cells will use only the active cells around them (for example the formula in A3 would be =(A2+B3+A4)/3).
    4. It is possible to copy and paste the formula into blank cells.
3. Save the spreadsheet as Simple Averaging Automaton (SAA).
4. Try out the spreadsheet to make sure you have entered formulas correctly.
    1. Enter 13 in a center cell; what will happen when you iterate?
    2. Enter 13 across all top cells and 1 across all bottom cells; what will happen when you iterate?
5. Making a chart (graph) of the averaged data: cross-corner example.
    1. Enter 13 in the upper left corner cell and –13 in the lower right corner cell.
    2. Iterate; before you do, what do you think will happen?
    3. Once the values are in place, create a graph of the data.
        1. Highlight the cells containing the data.
        2. Select the chart wizard tool (in the toolbar it looks like a 3-D bargraph).
        3. Step 1 of 4: Chart Type.
            a. Select Surface under Chart Type.
            b. Select Contour (not 3D) under Chart Sub-type.
        4. Step 2 of 4: Chart Source Data.
            a. Verify Data Range.
            b. Select Series in Rows.
        5. Step 3 of 4: Chart Options: give names to the Chart Title and the Axes names (if you want).
        6. Step 4 of 4: Chart Location: select As A New Sheet, this will place the chart on a different sheet from the data.
        7. Does the chart make fine enough distinctions? If not, double-click the Legend to modify it.
            a. Select the Scale tab.
            b. Change the Major Unit to 2 (or whatever you like).
        8. Examine the chart. Compare to data numbers. Does it look right?
            a. Double click on vertical axis.
            b. In the Format Axis window, click on Scale tab; select Series in Reverse Order.