G492 GIS Applications in Earth Science
In-Class Exercise on Map Algebra

I.　　Introduction
　　A.　　Map algebra is based on matrix algebra, which is the algebraic manipulation of matrices or grid networks.
　　B.　　Application to GIS
　　　　1.　　Raster Grid data structures are particularly amenable to algebraic manipulation
　　C.　　In ArcView Spatial Analyst
　　　　1.　　Map algebra is conducted with the Analysis-Map Calculator Tool

In-Class Demonstration of Map Algebra Techniques

Start ArcView-Check Spatial Analyst Extension - enter View
Add the following Grid Theme to View - V:\esri\av_gis30\avtutor\spatial\elevgrd
Use the inquire tool to explore the grid theme and see the range of elevations on the grid

Analysis-Map Query-([Elevgrd]>2000)　　　Evaluate

(note: you are asking spatial analyst to find all pixels with elevations > 2000 ft above sea level on the Elevgrd theme)

Activate new grid theme Map Query 1, check the box, turn off Elevgrd theme

Use the inquire tool to check the cell values of the new Map Query 1 theme, you will see that all elev > 2000 have been assigned a "1" and all <2000 ft a "0"

You now have two grid themes that overlap in space, Elevgrd and Map Query 1. We will now multiple the two together, cell-by-cell...

Analysis - Map Calculator - ([Map Query 1]*[Elevgrd])　　　evaluate

Turn off Map Query 1 and Elevgrd themes, activate the new Map Calulation 1 theme, use the inquire tool and explain the results of your map algebra experiment. Compare this theme to the other tool. Describe your results here:

Use Layout, label and print a nice looking map (you know what to do, include in portfolio)

Now try other map algebra operations on the Elevgrd and explore the results. Try dividing the two themes, adding the two themes, subtracting the two themes, take the log of all values in the Elevgrd theme. Print your results.

Paper and Pencil Work with Map Algebra

Work the following map algebra problems with grid 1 and 2 on the following pages (use only the grid cells highlighted in the box). Place your results on the blank grid answer sheets.
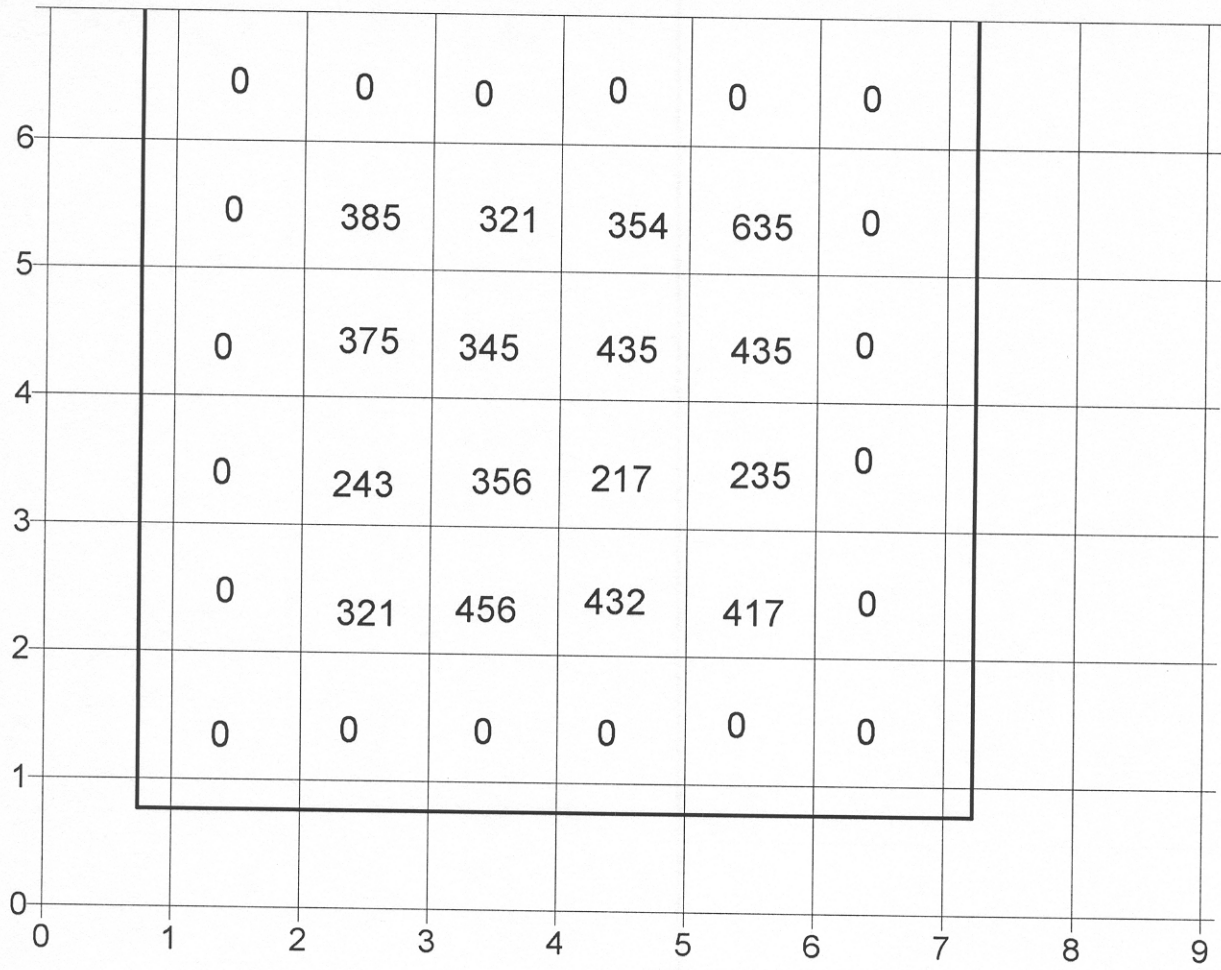
grid 1 x grid 2
grid 1 / grid 2
grid 1 + grid 2
grid 1 - grid 2
log (grid 1)
grid 1 x 333

0	0	0	0	0	0
0	385	321	354	635	0
0	375	345	435	435	0
0	243	356	217	235	0
0	321	456	432	417	0
0	0	0	0	0	0

Grid 1

2	2	2	2	2	2
2	2	2	2	2	2
2	2	2	2	2	2
2	2	2	2	2	2
2	2	2	2	2	2
2	2	2	2	2	2