This module covers…

- Statistical Moments 1 - 4
  - 1st: mean / average / median
  - 2nd: standard deviation / variance
  - 3rd: skewness
  - 4rd: kurtosis
- Covariance, covariance matrices and correlation
- Multidimensional vector spaces

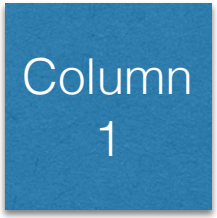
In this Video you will learn…

Covariance, Covariance Matrices, Correlation

covariance and correlation

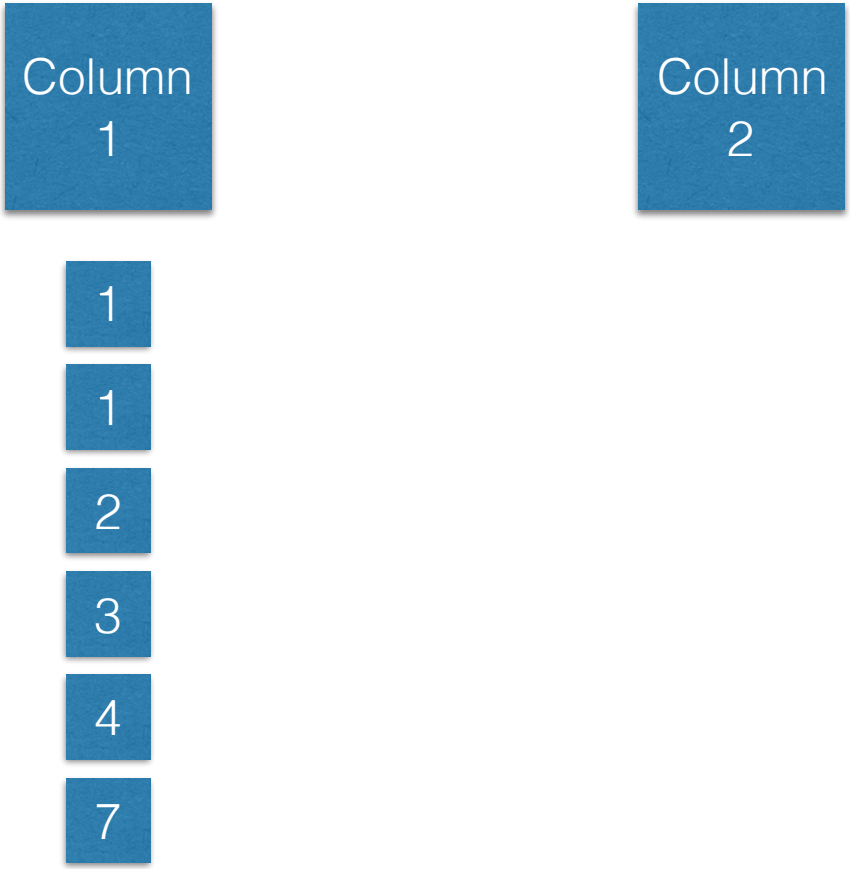
- how two columns interact with each other
- how all columns interact with each other

covariance and correlation

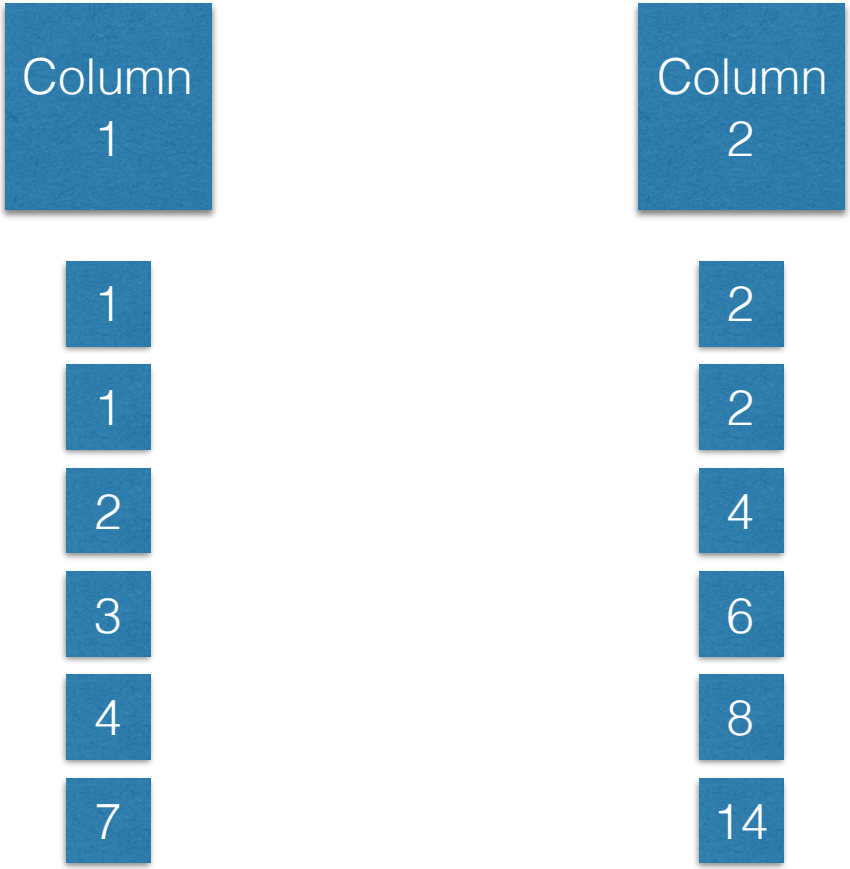


covariance and correlation

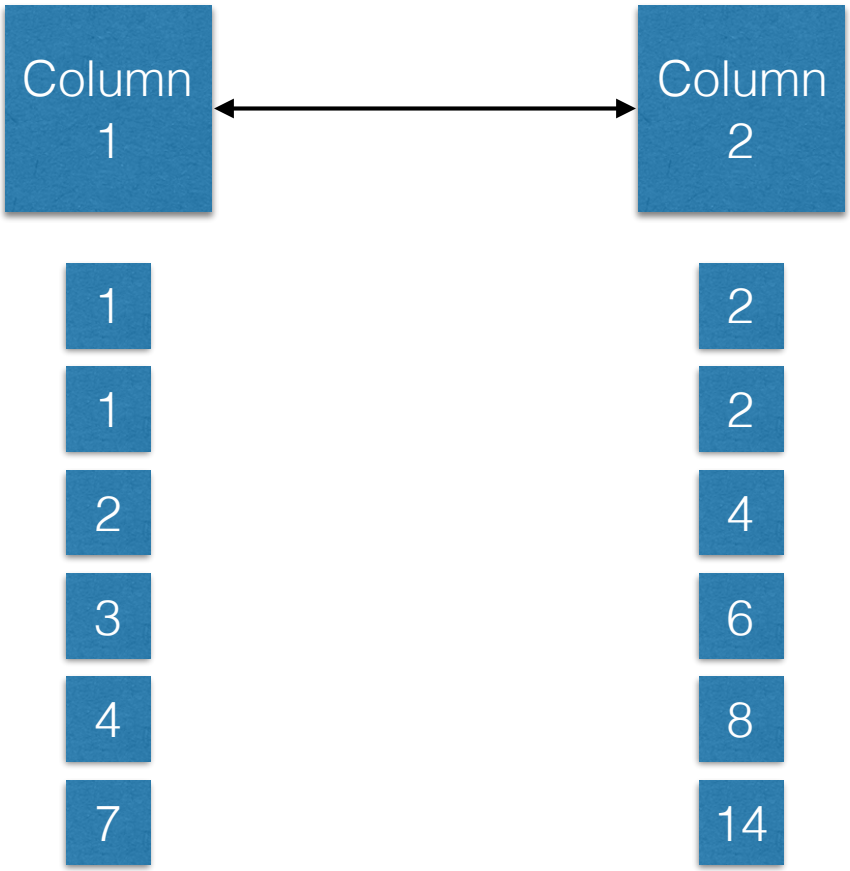
covariance and correlation



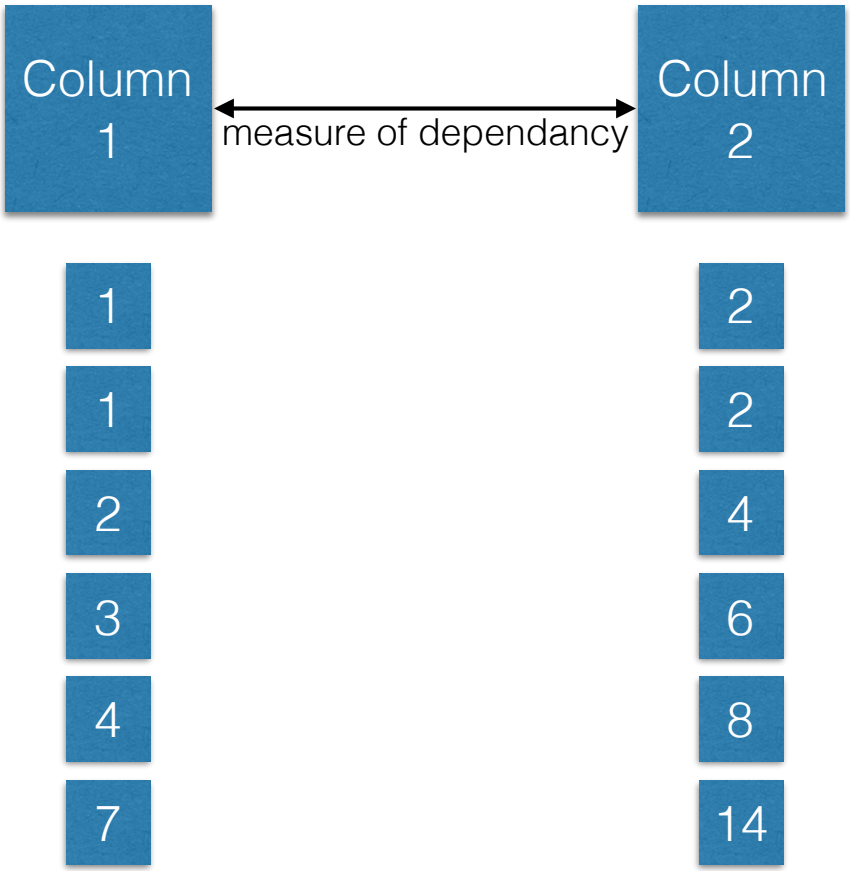
covariance and correlation



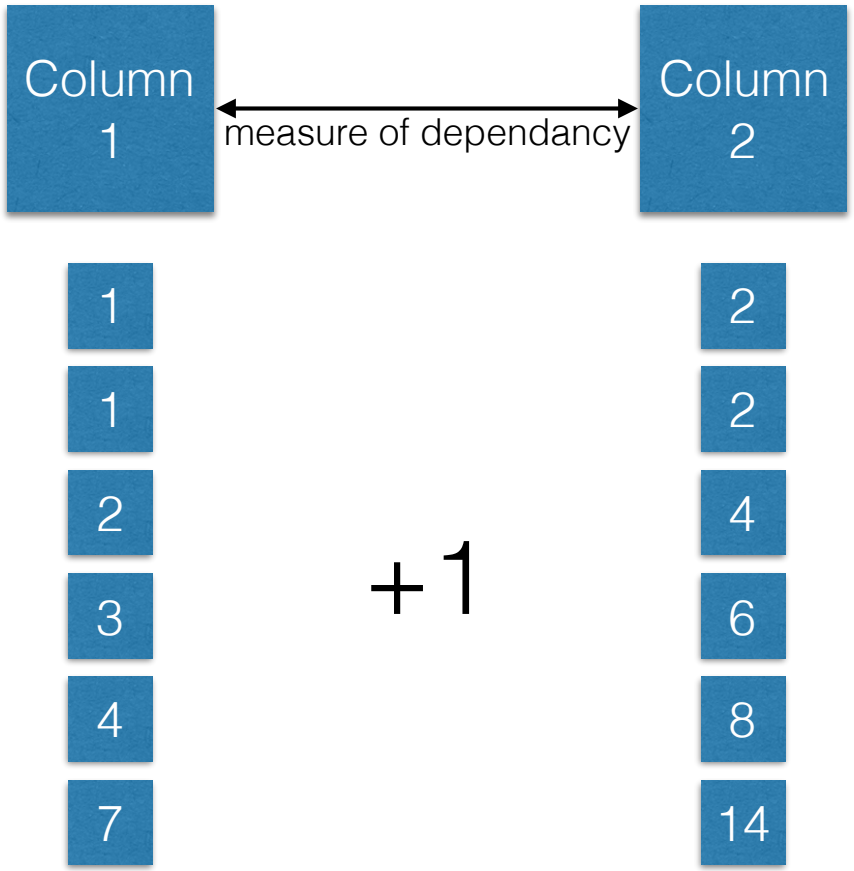
covariance and correlation



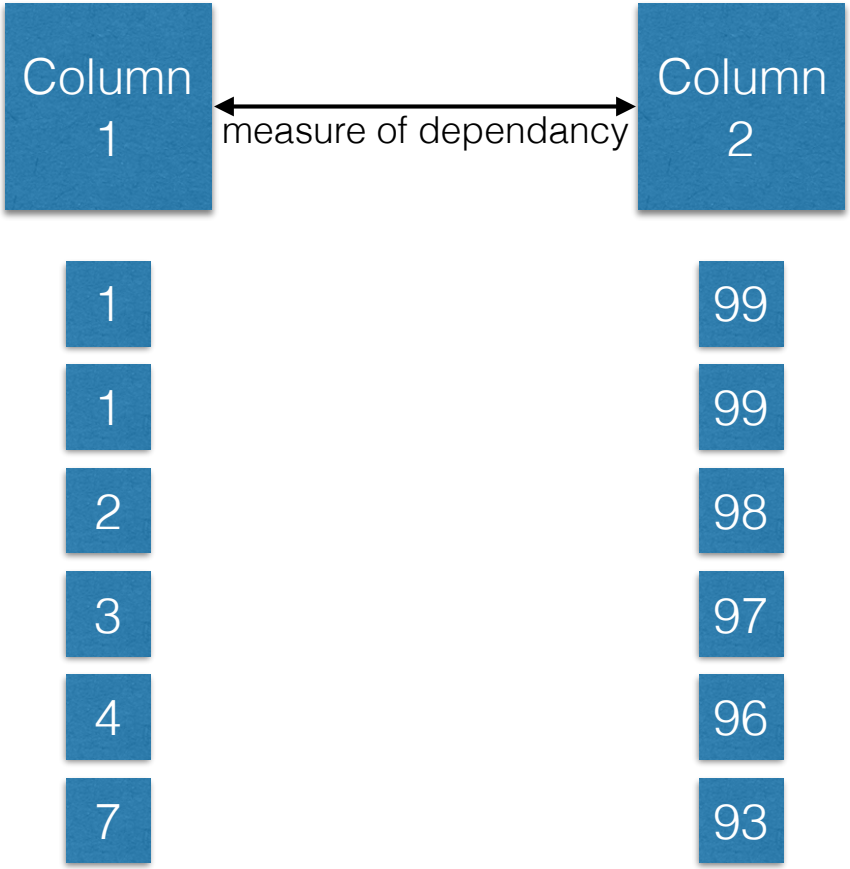
covariance and correlation



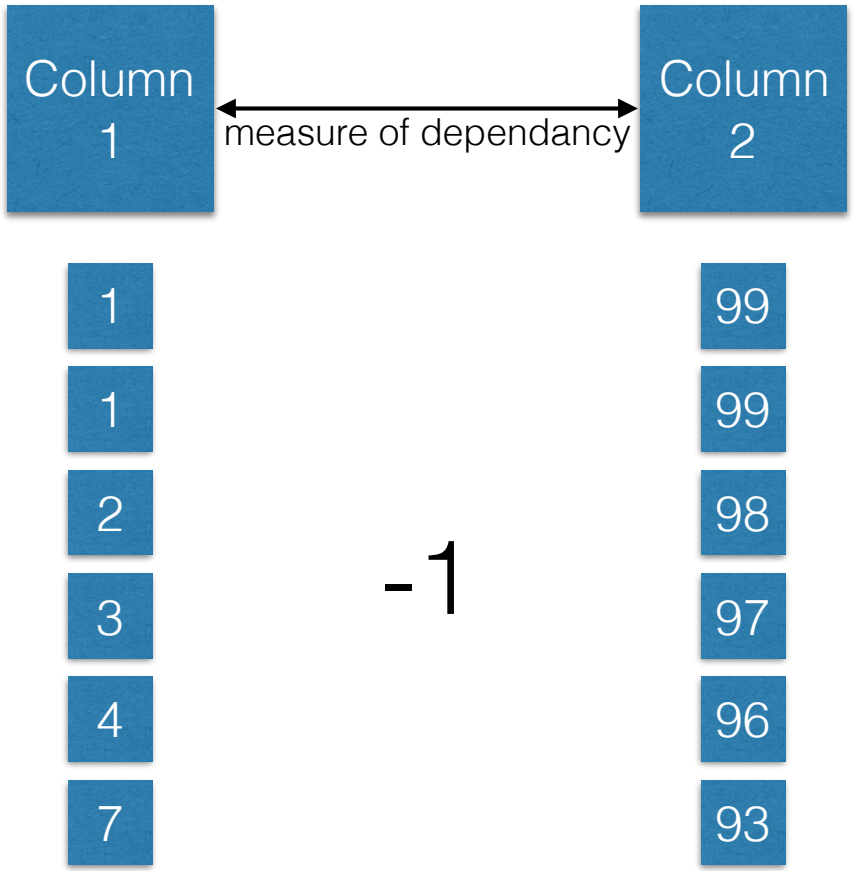
covariance and correlation



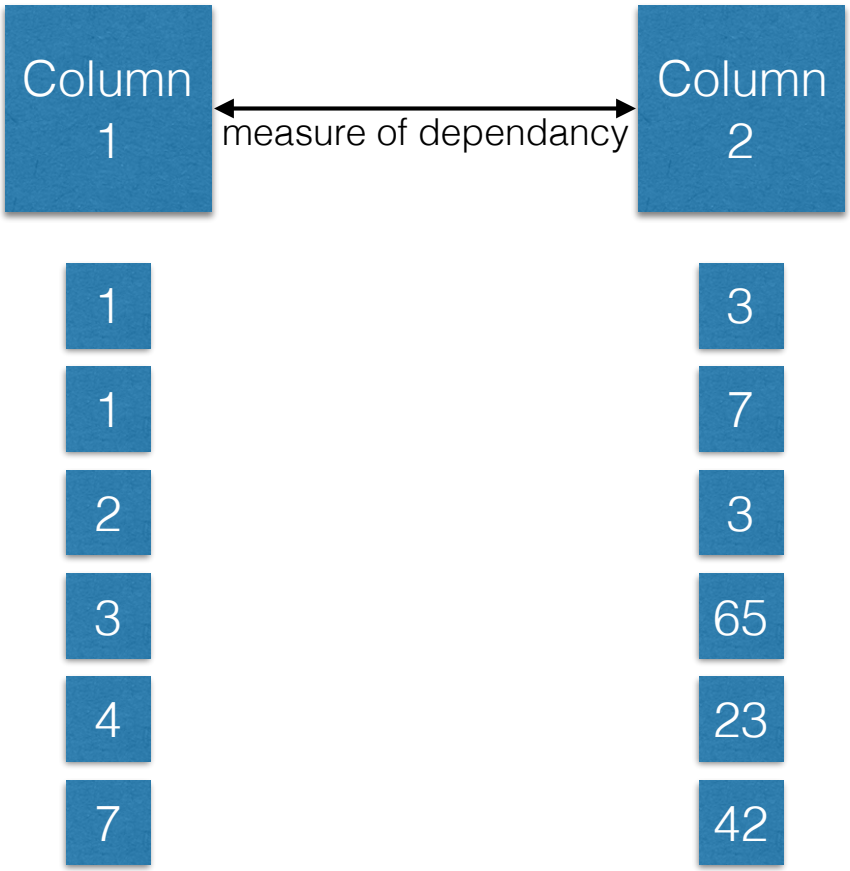
covariance and correlation



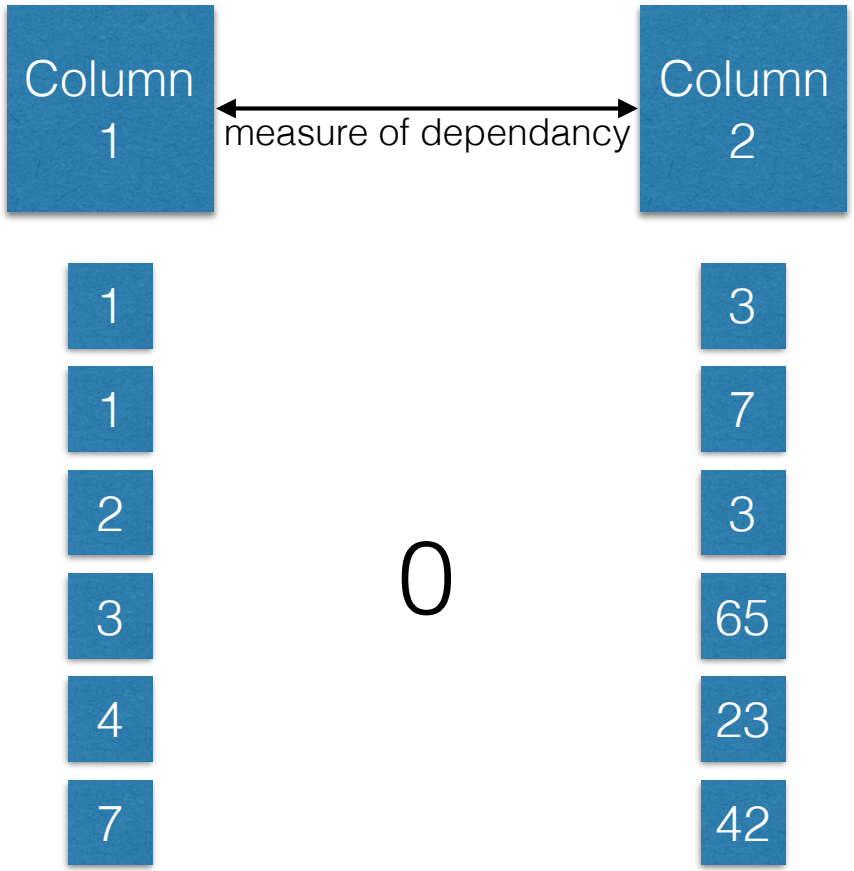
covariance and correlation



covariance and correlation



covariance and correlation



covariance

$$cov(X,Y) = \frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})$$

covariance

$$cov(X,Y) = \frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})$$

covariance

$$cov(X,Y) = \frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})$$

covariance

$$cov(X,Y) = \frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})$$

covariance

$$cov(X,Y) = \frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})$$

covariance

$$cov(X,Y) = \frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})$$

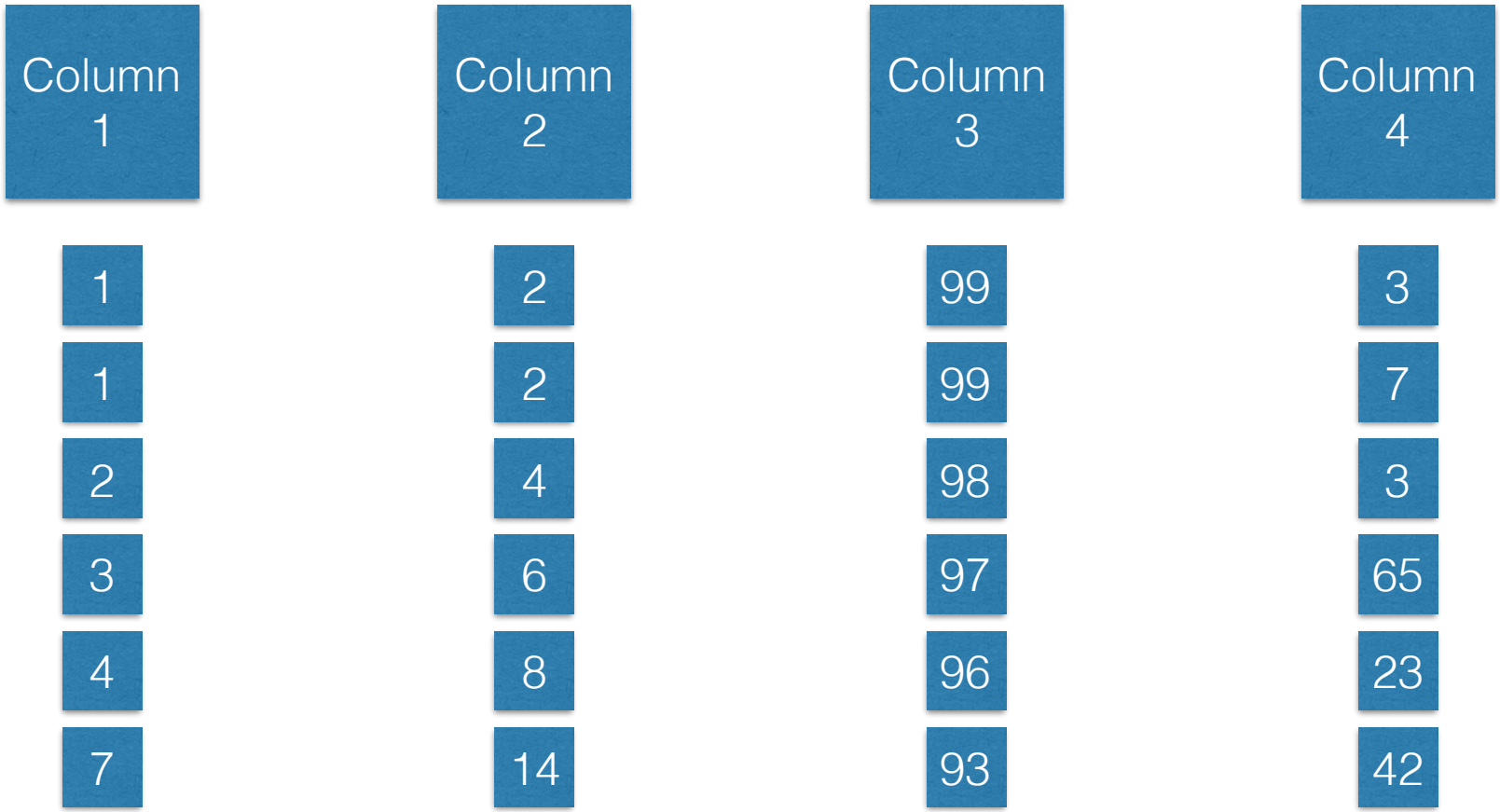
correlation

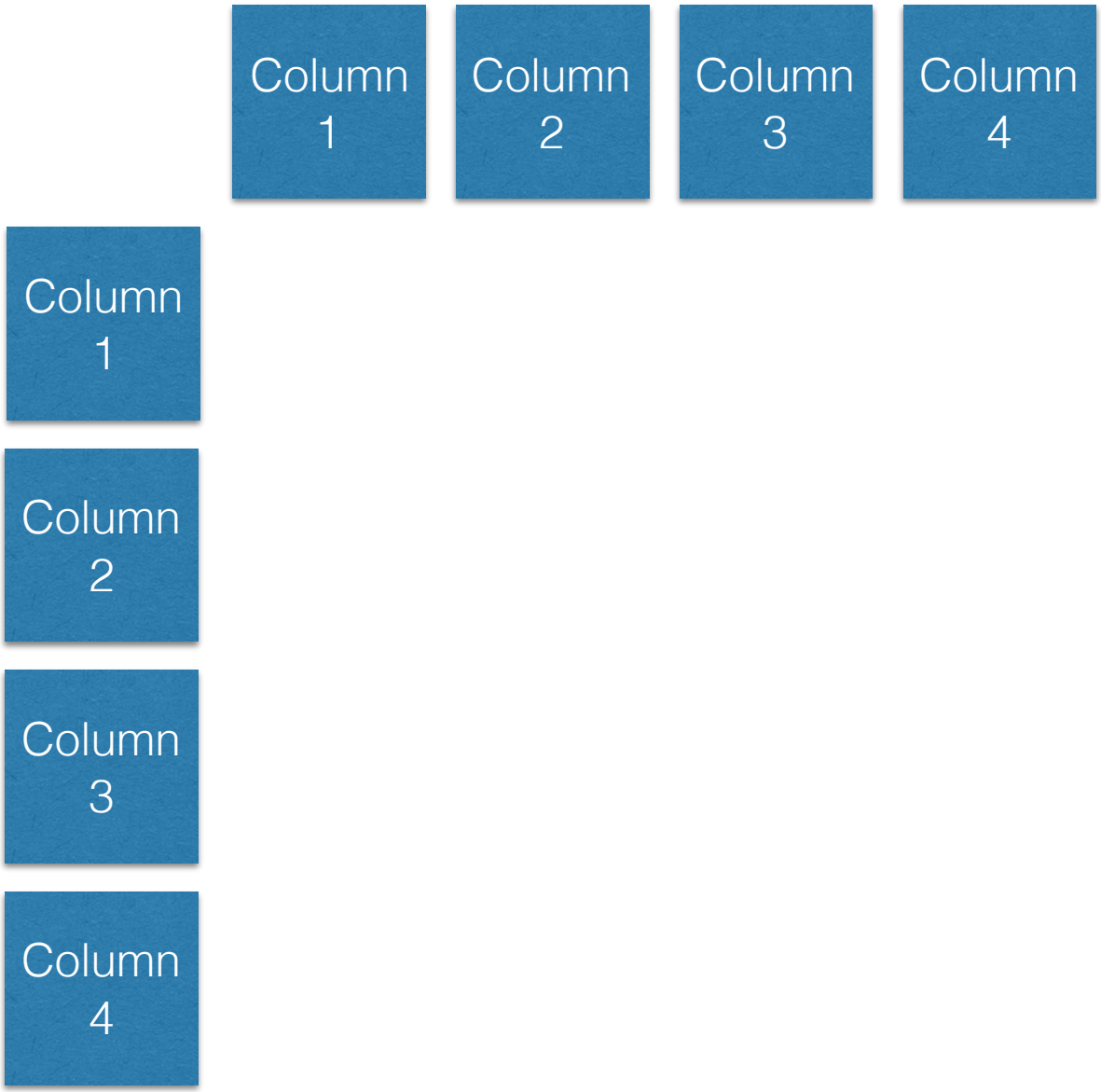
$$corr(X,Y) = \frac{cov(X,Y)}{\sigma_X \sigma_Y}$$

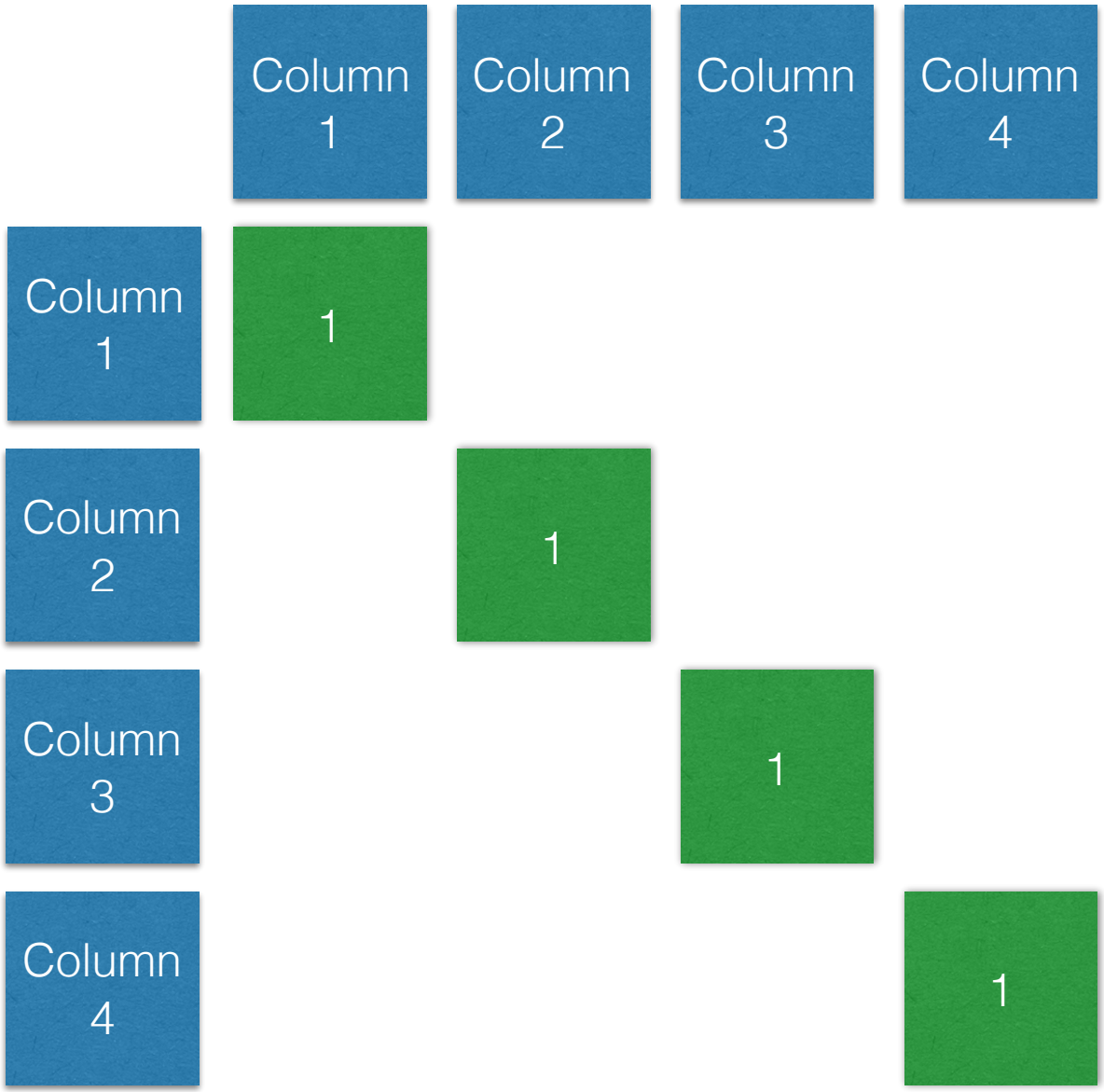
correlation matrix

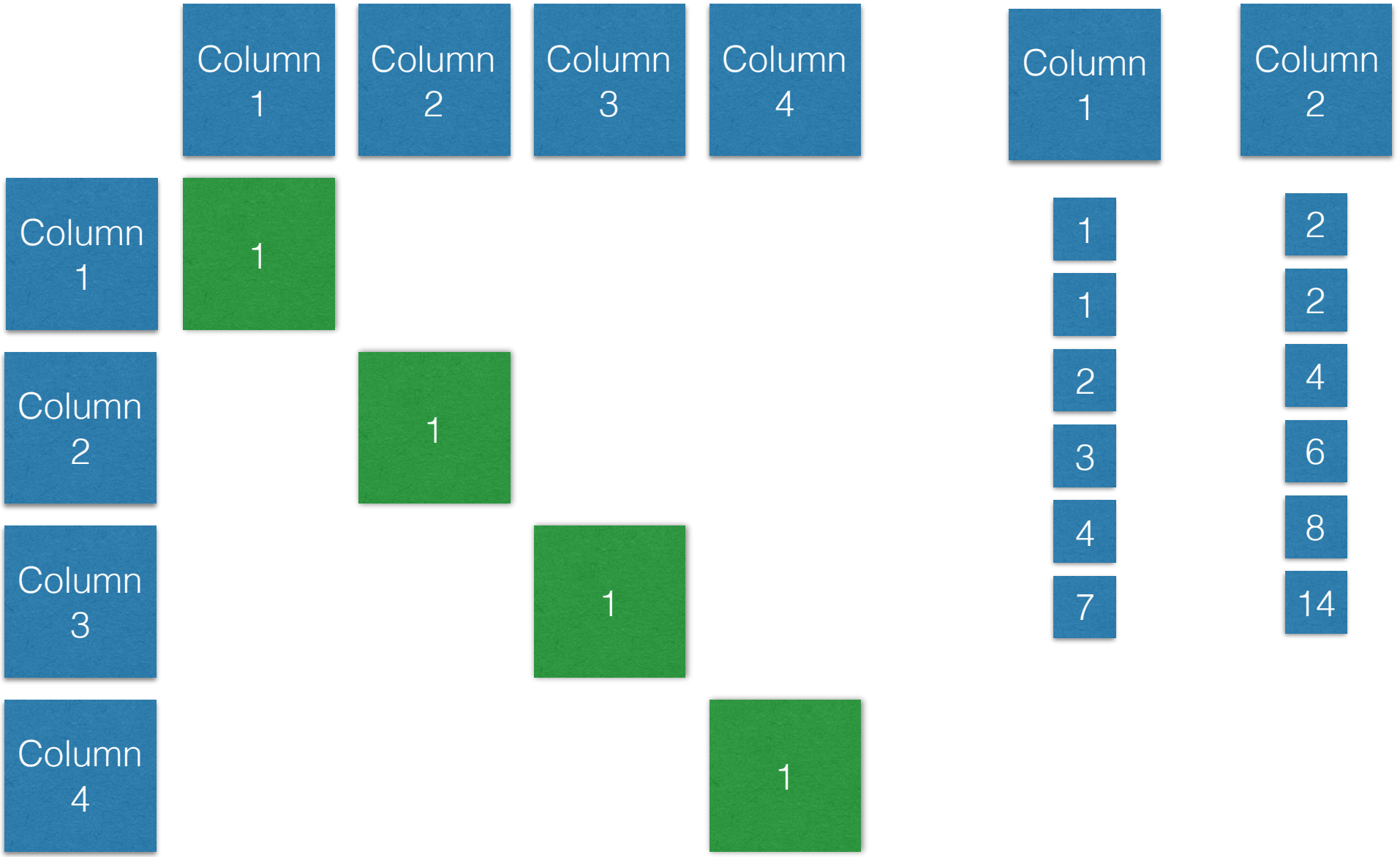
- covariance and correlation tell binary measures
- what if we want to view all at once?

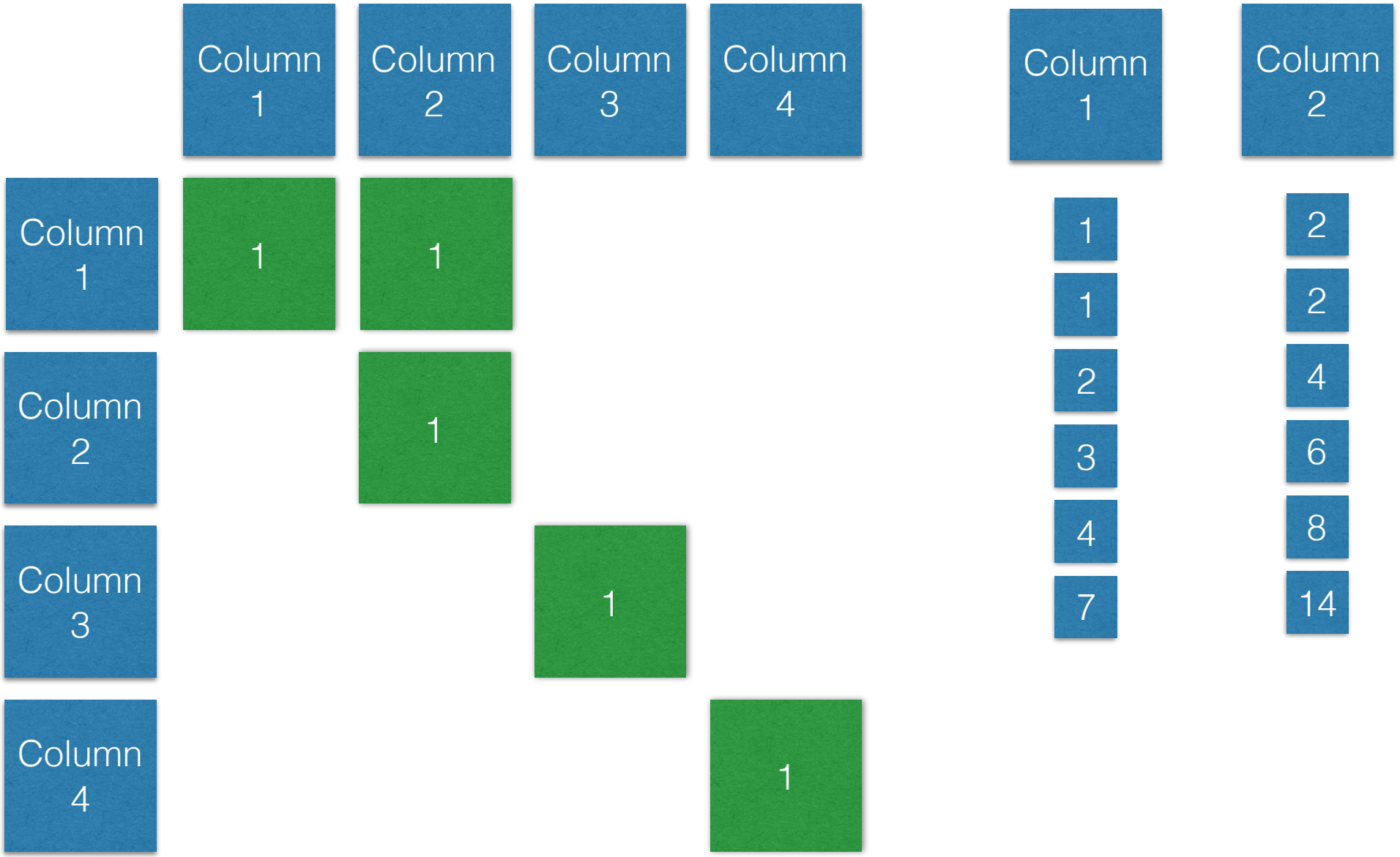
Column 1
Column 2
Column 3
Column 4

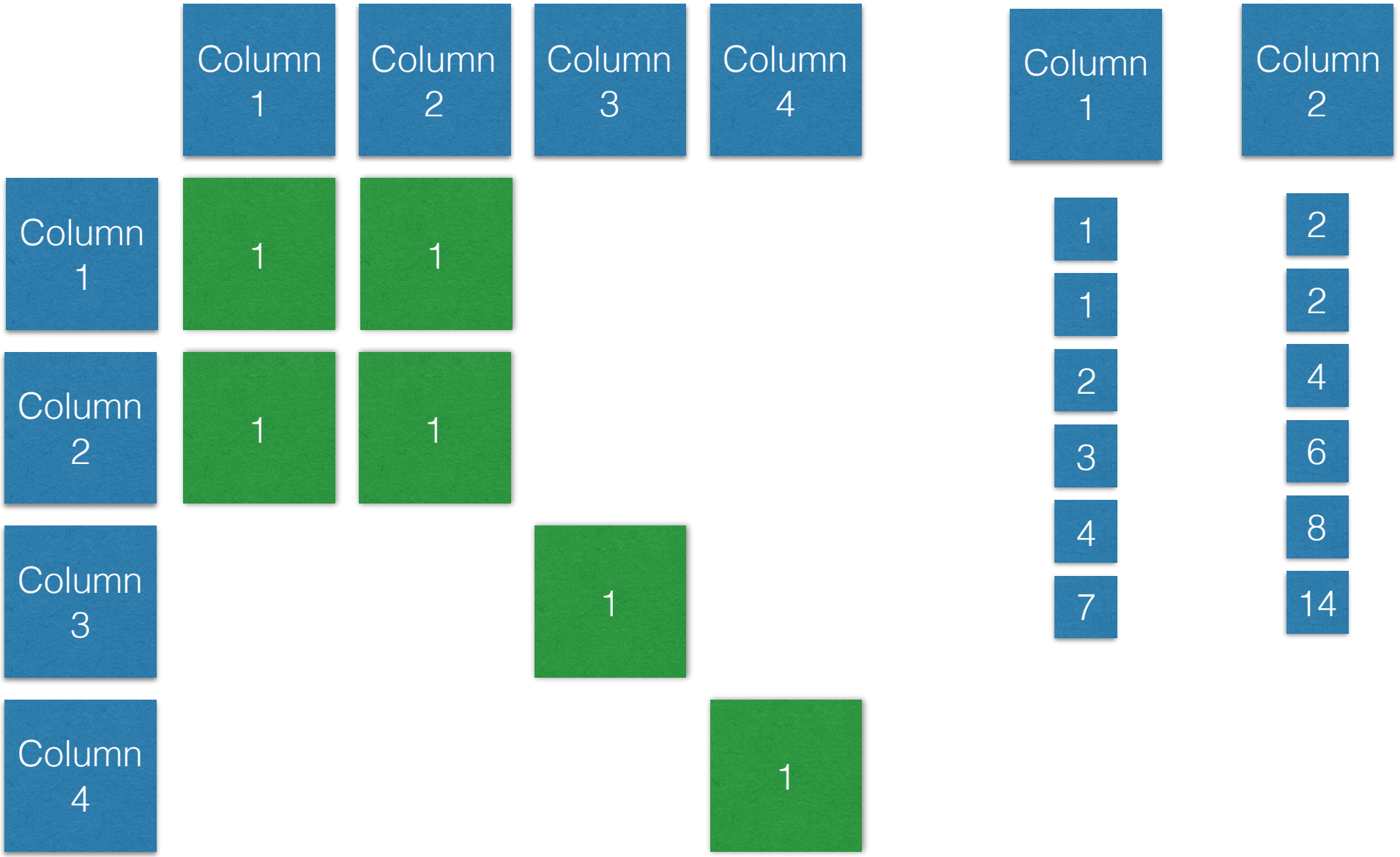

Column 1
Column 2
Column 3
Column 4
1
1
2
3
4
7
2
2
4
6
8
14
99
99
98
97
96
93
3
7
3
65
23
42

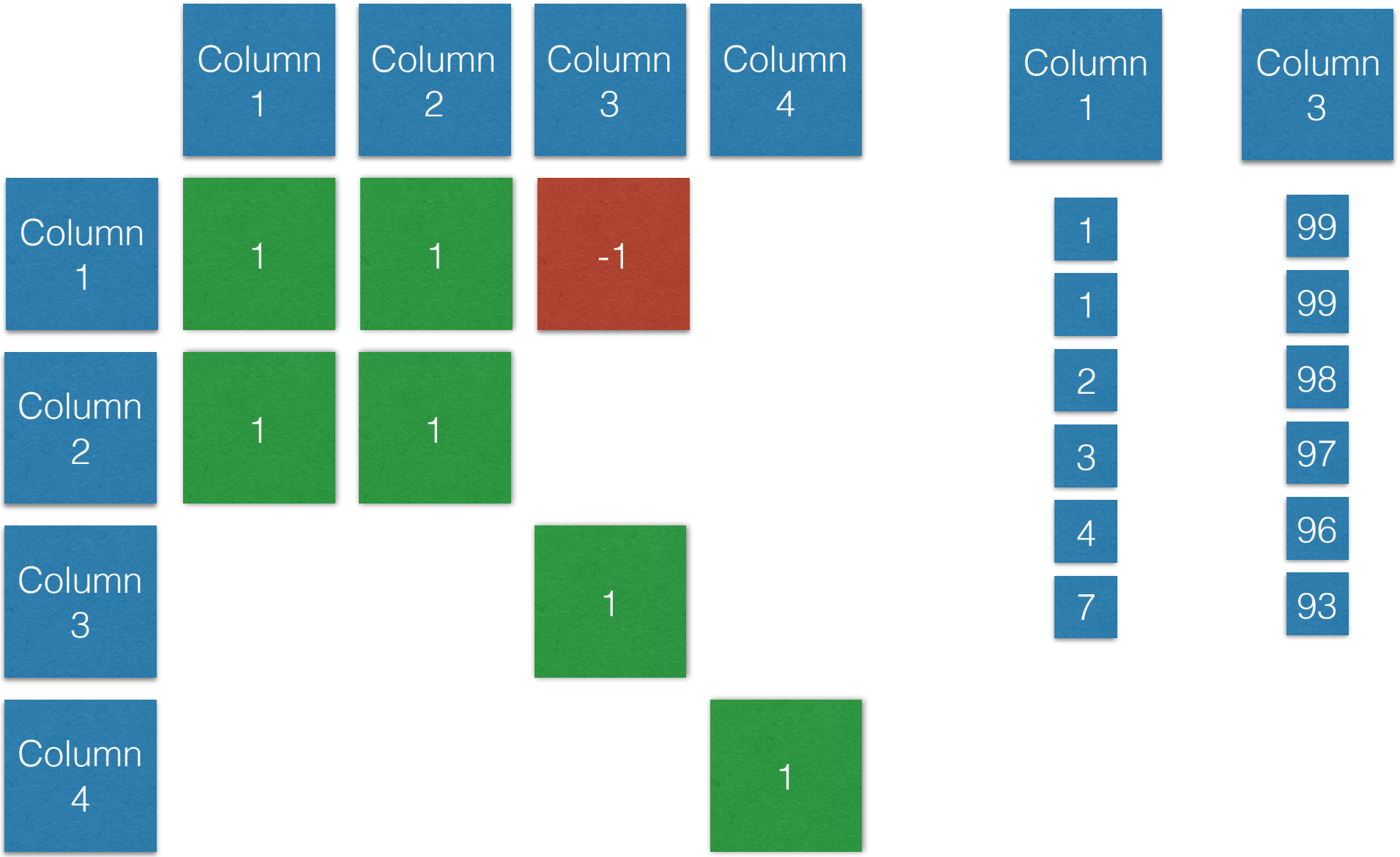

Column 1
Column 2
Column 3
Column 4
Column 1
Column 2
Column 3
Column 4


Column 1
Column 2
Column 3
Column 4
Column 1
1
Column 2
1
Column 3
1
Column 4
1


Column 1
Column 2
Column 3
Column 4
Column 1
Column 2
Column 1
Column 2
Column 3
Column 4
1
1
1
1
1
1
2
3
4
7
2
2
4
6
8
14

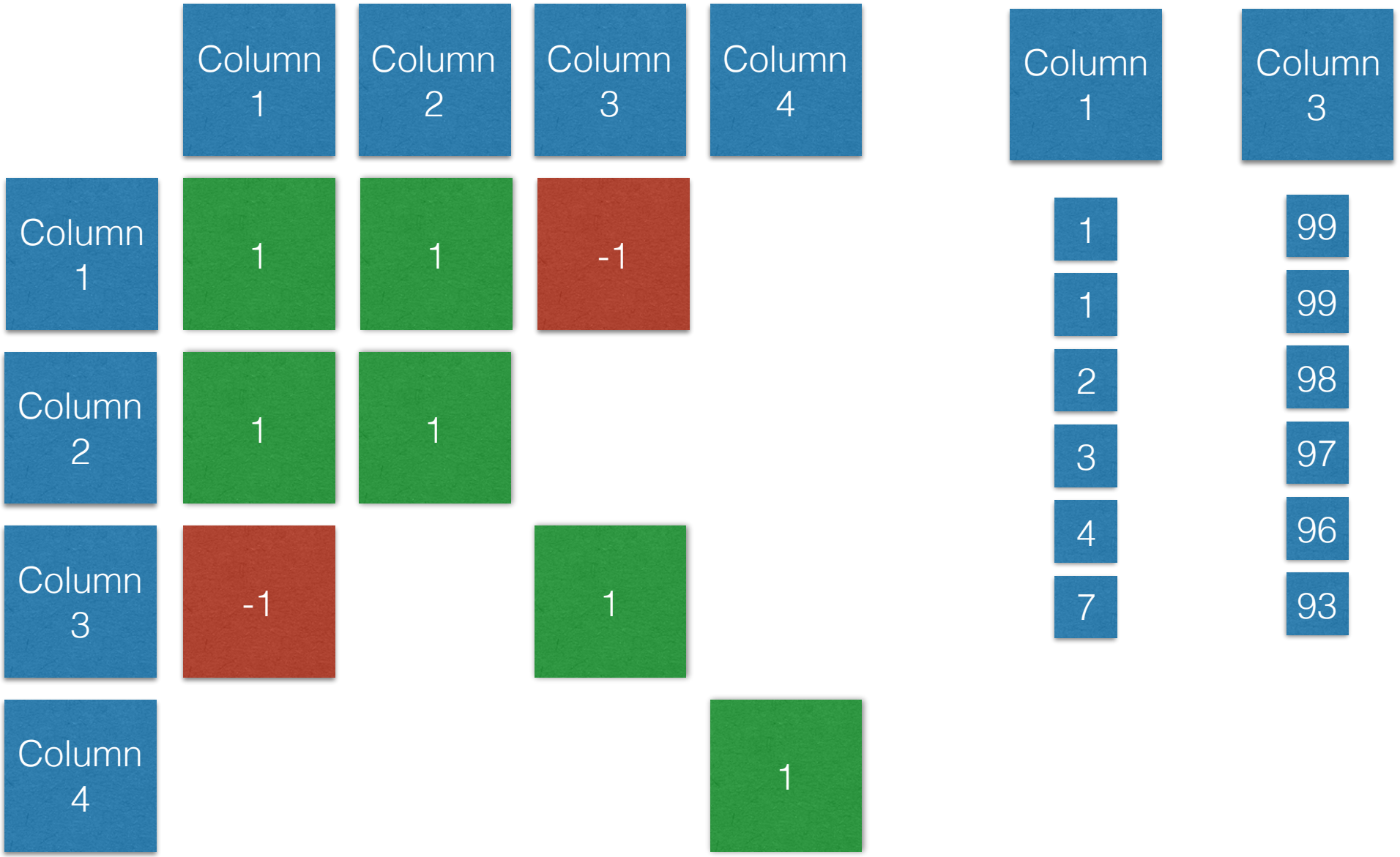

Column 1
Column 2
Column 3
Column 4
Column 1
Column 2
Column 1
Column 2
Column 3
Column 4
1
1
1
1
1
1
1
1
2
1
1
2
3
4
7
2
2
4
6
8
14

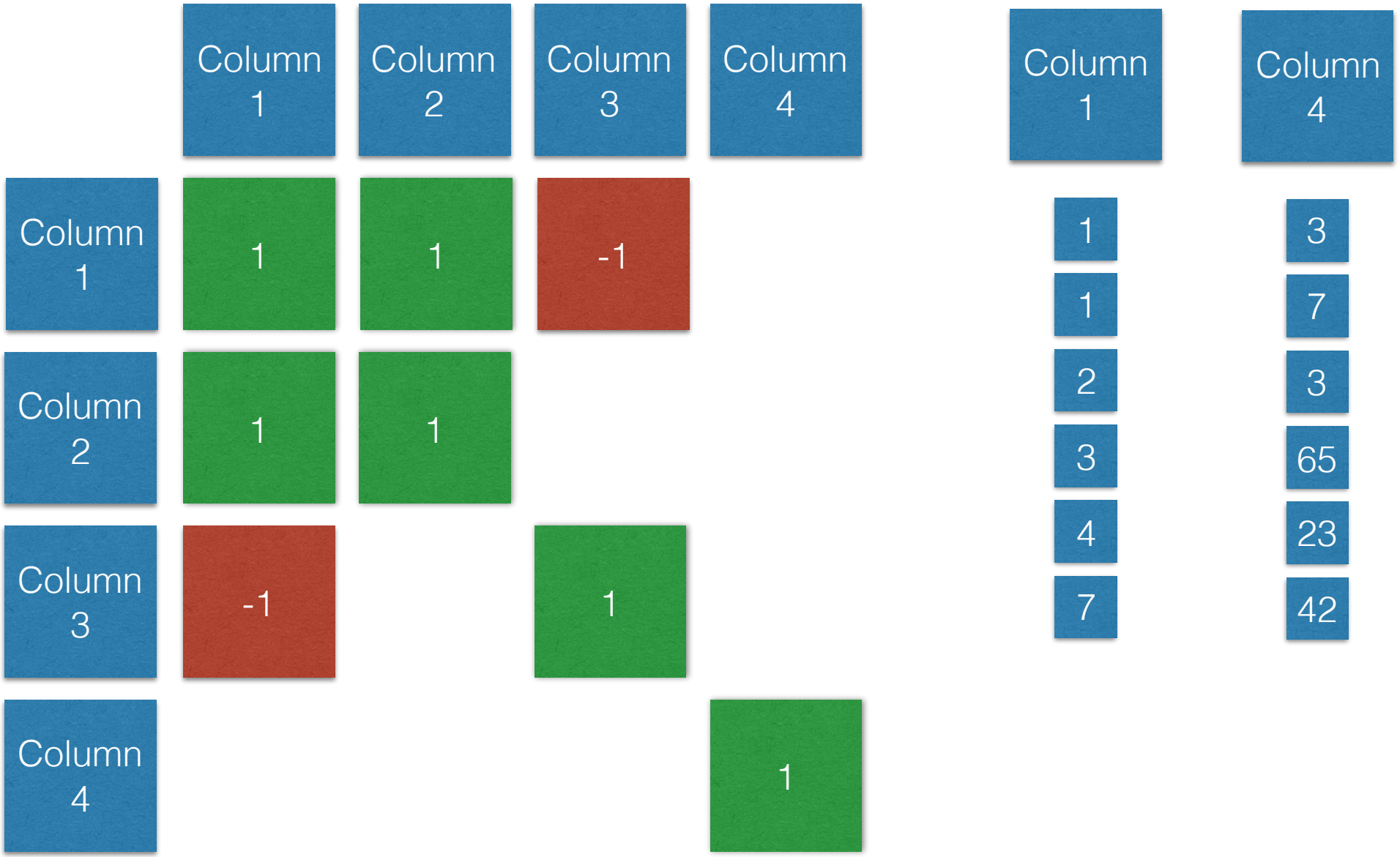

Column 1
Column 2
Column 3
Column 4
Column 1
Column 2
Column 1
1
1
Column 2
1
1
Column 3
1
Column 4
1
1
1
2
3
4
7
2
2
4
6
8
14

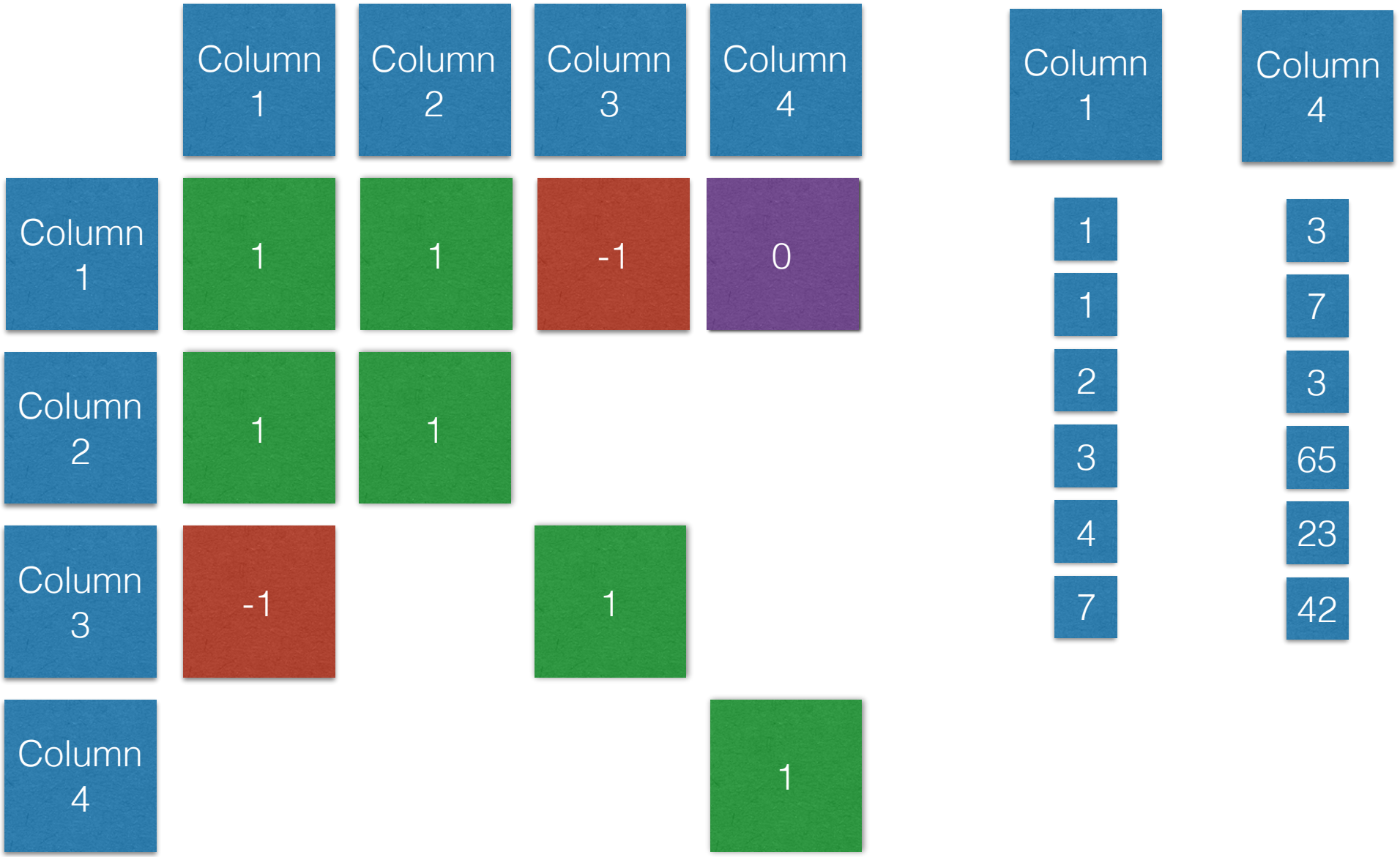


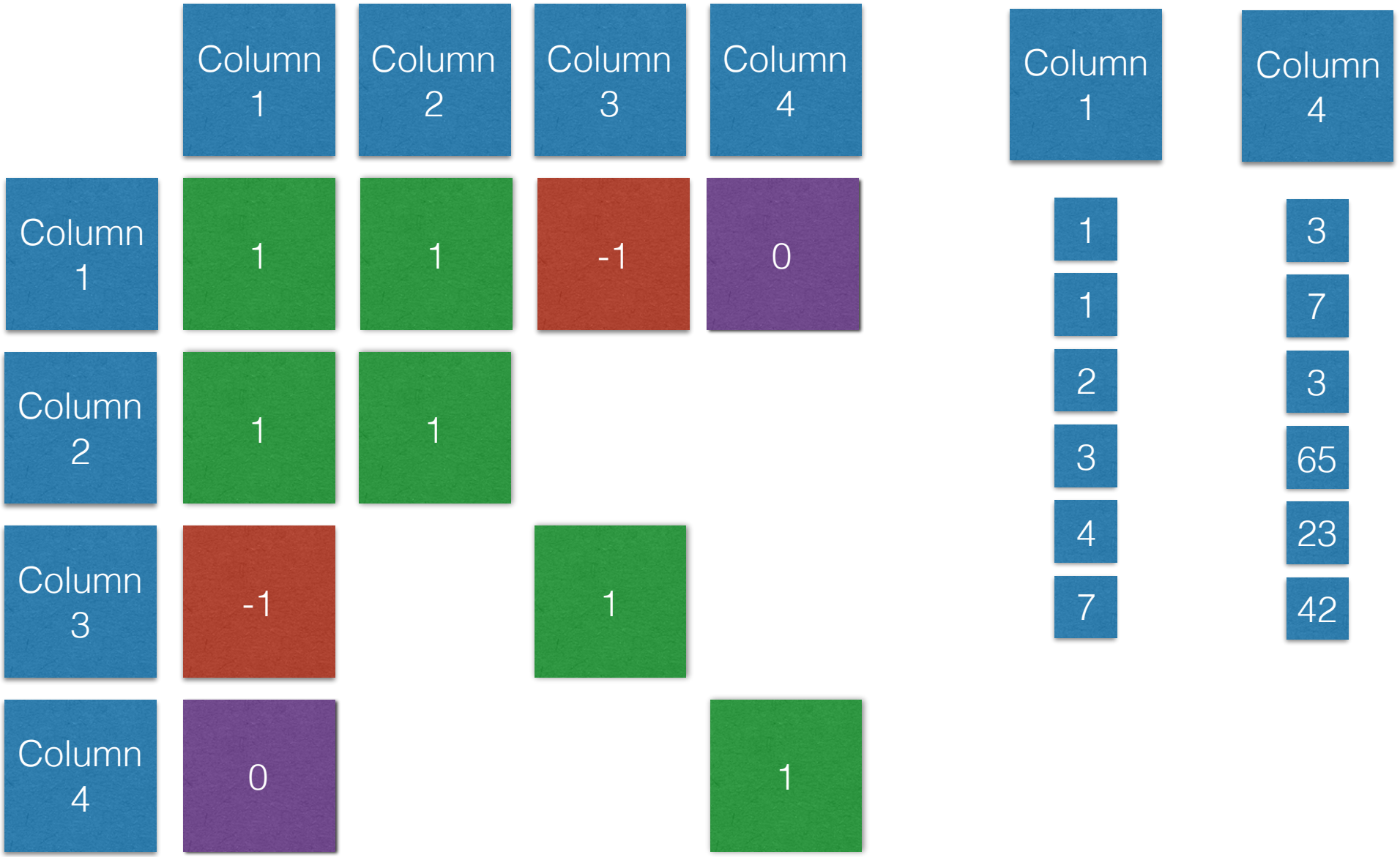
	Column 1	Column 2	Column 3	Column 4
Column 1	1	1	-1	
Column 2	1	1		
Column 3			1	
Column 4				1

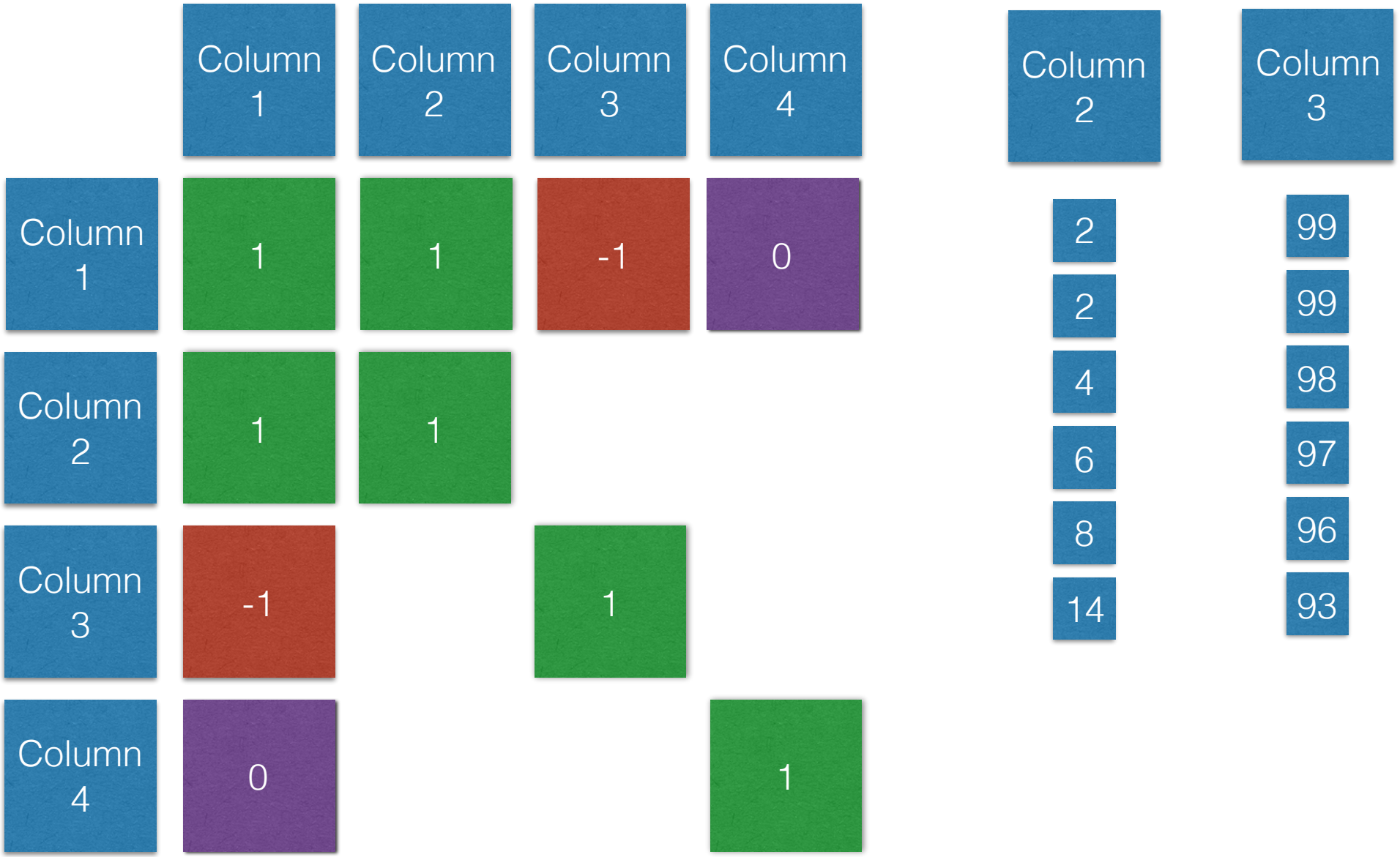
Column 1	Column 3
1	99
1	99
2	98
3	97
4	96
7	93

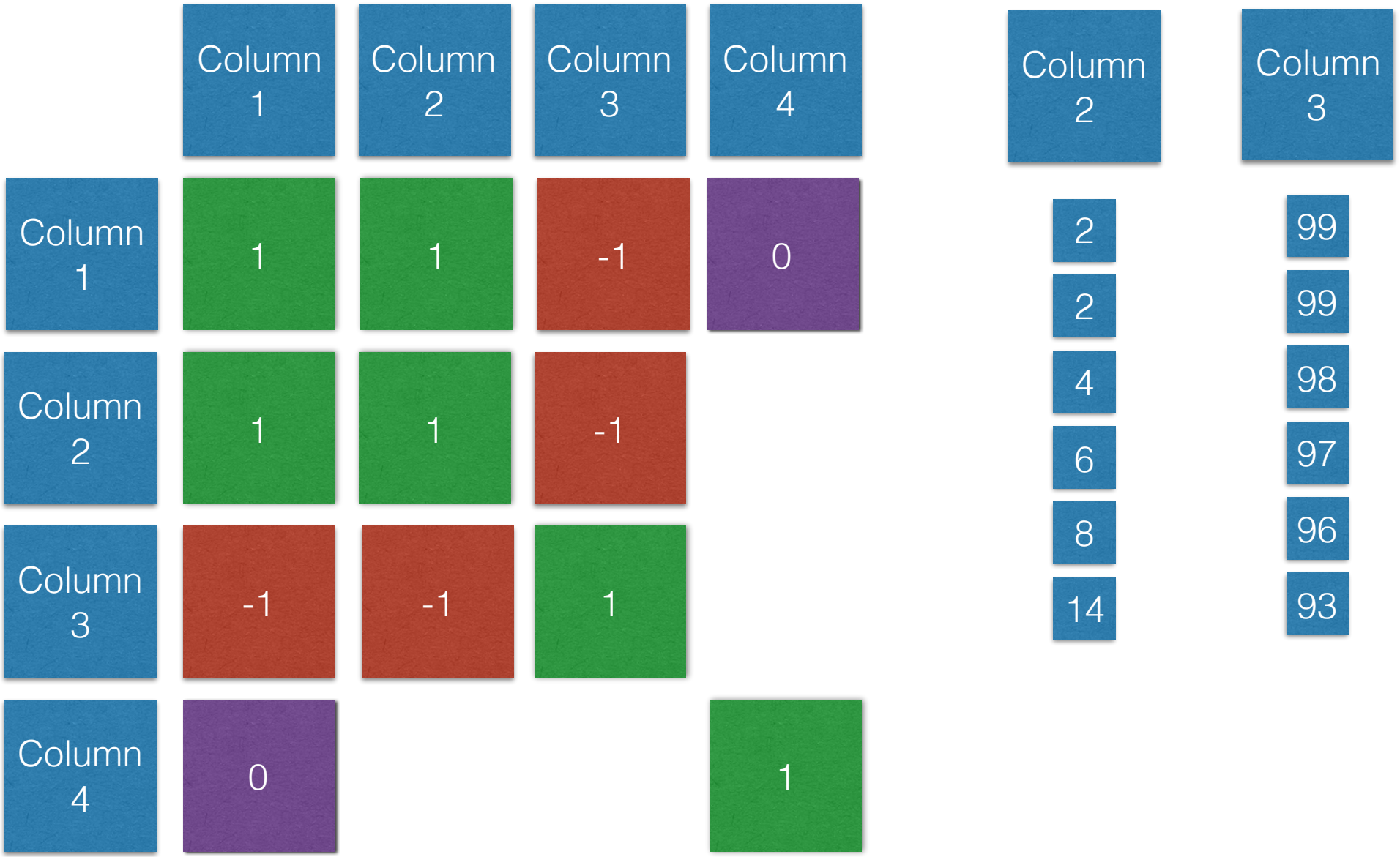

Column 1
Column 2
Column 3
Column 4
Column 1
Column 3
Column 1
1
1
-1
Column 2
1
1
Column 3
-1
1
Column 4
1
1
1
2
3
4
7
99
99
98
97
96
93

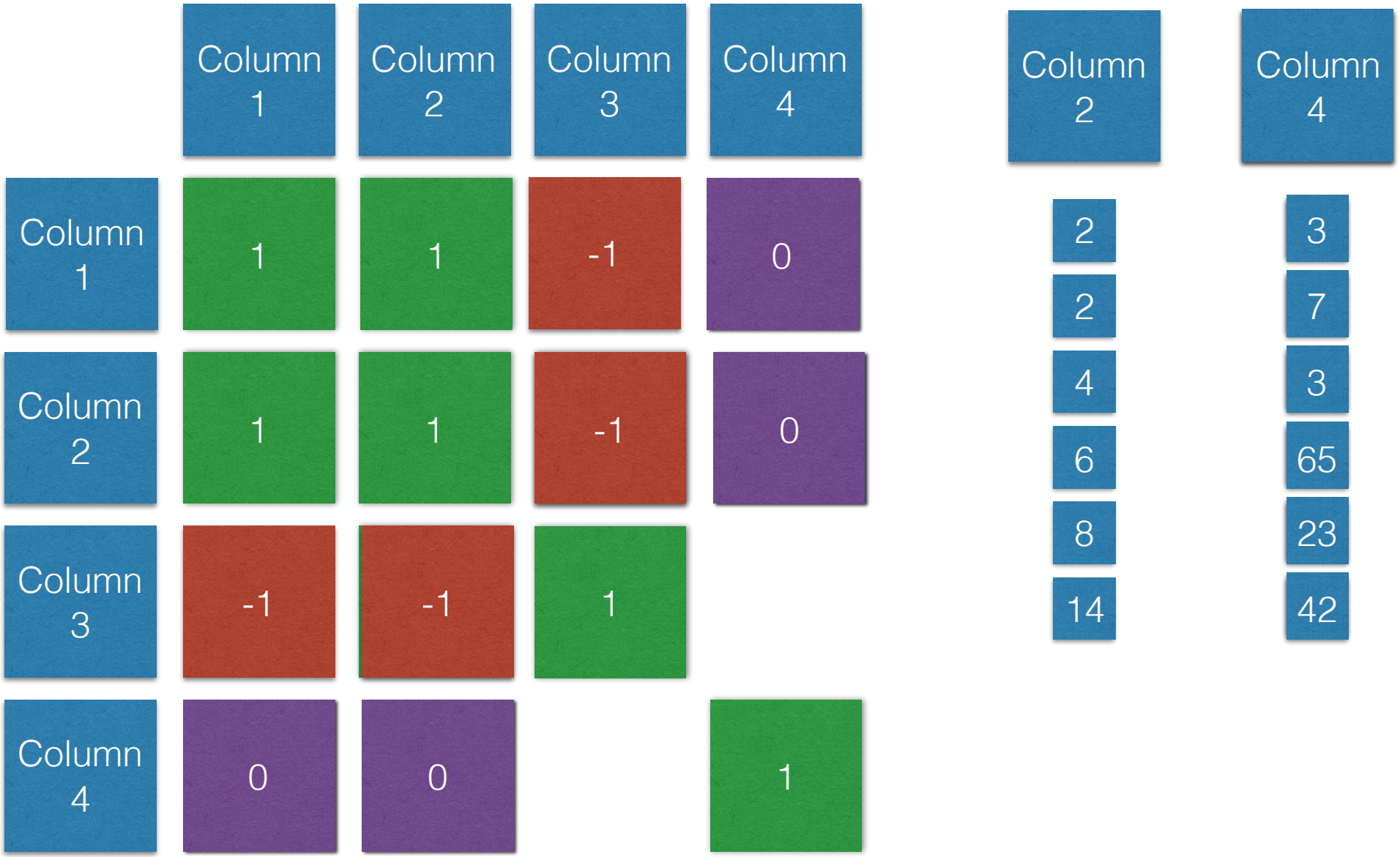

Column 1
Column 2
Column 3
Column 4
Column 1
Column 4
Column 1
1
1
-1
Column 2
1
1
Column 3
-1
1
Column 4
1
1
1
2
3
4
7
3
7
3
65
23
42

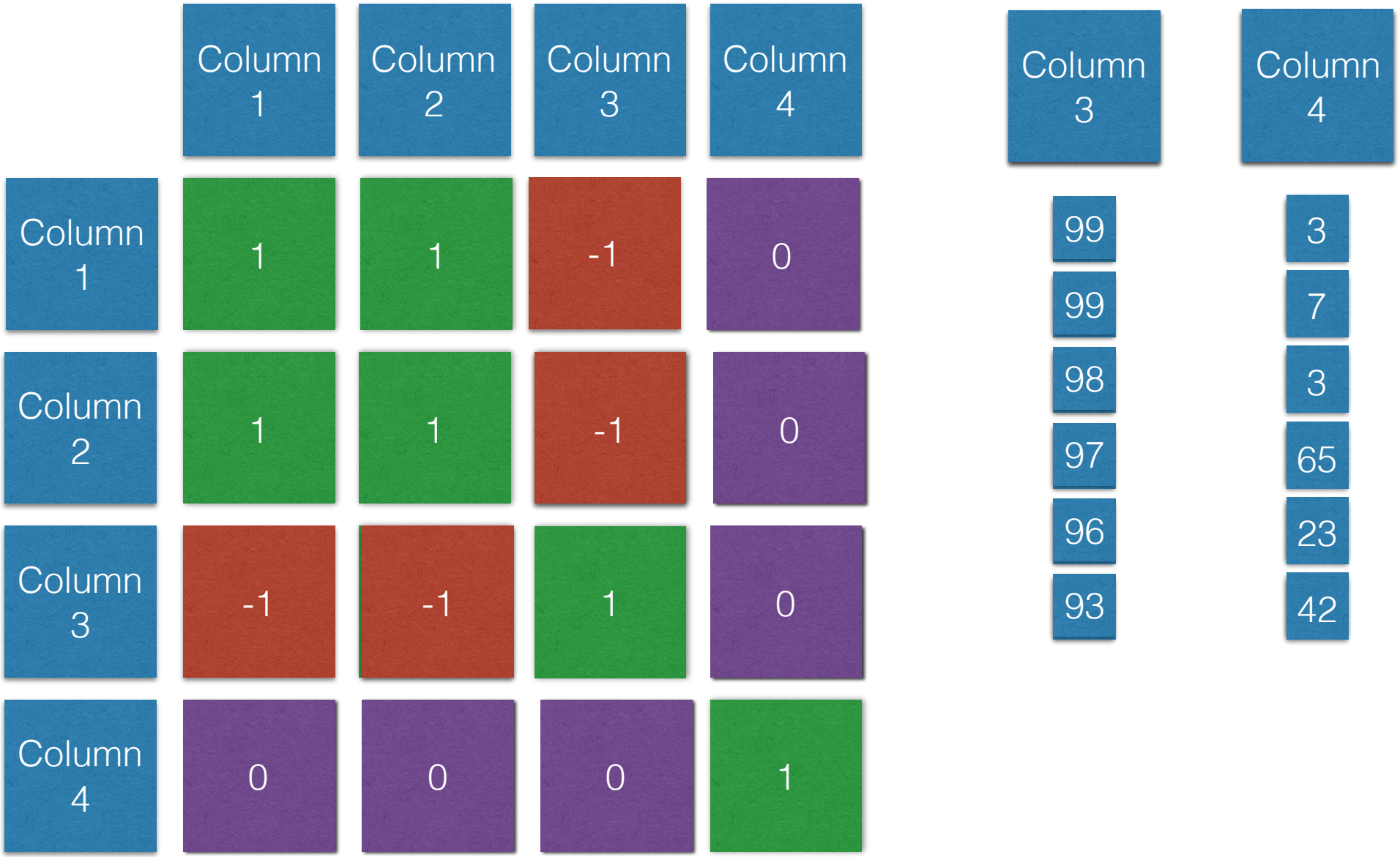

Column 1
Column 2
Column 3
Column 4
Column 1
1
1
-1
0
Column 2
1
1
Column 3
-1
1
Column 4
1
Column 1
1
1
2
3
4
7
Column 4
3
7
3
65
23
42

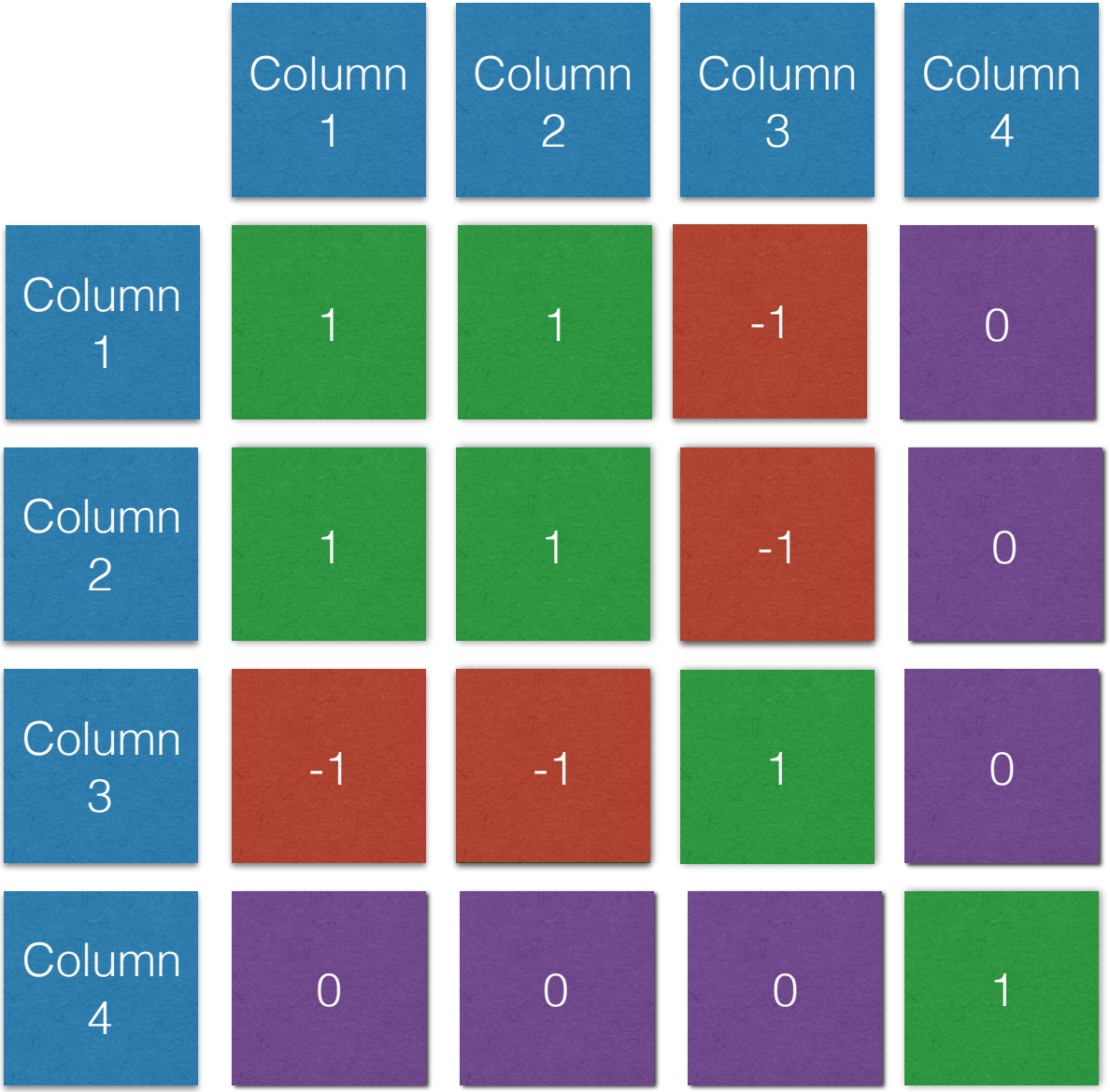

Column 1
Column 2
Column 3
Column 4
Column 1
1
1
-1
0
Column 2
1
1
Column 3
-1
1
Column 4
0
1
Column 1
1
1
2
3
4
7
Column 4
3
7
3
65
23
42

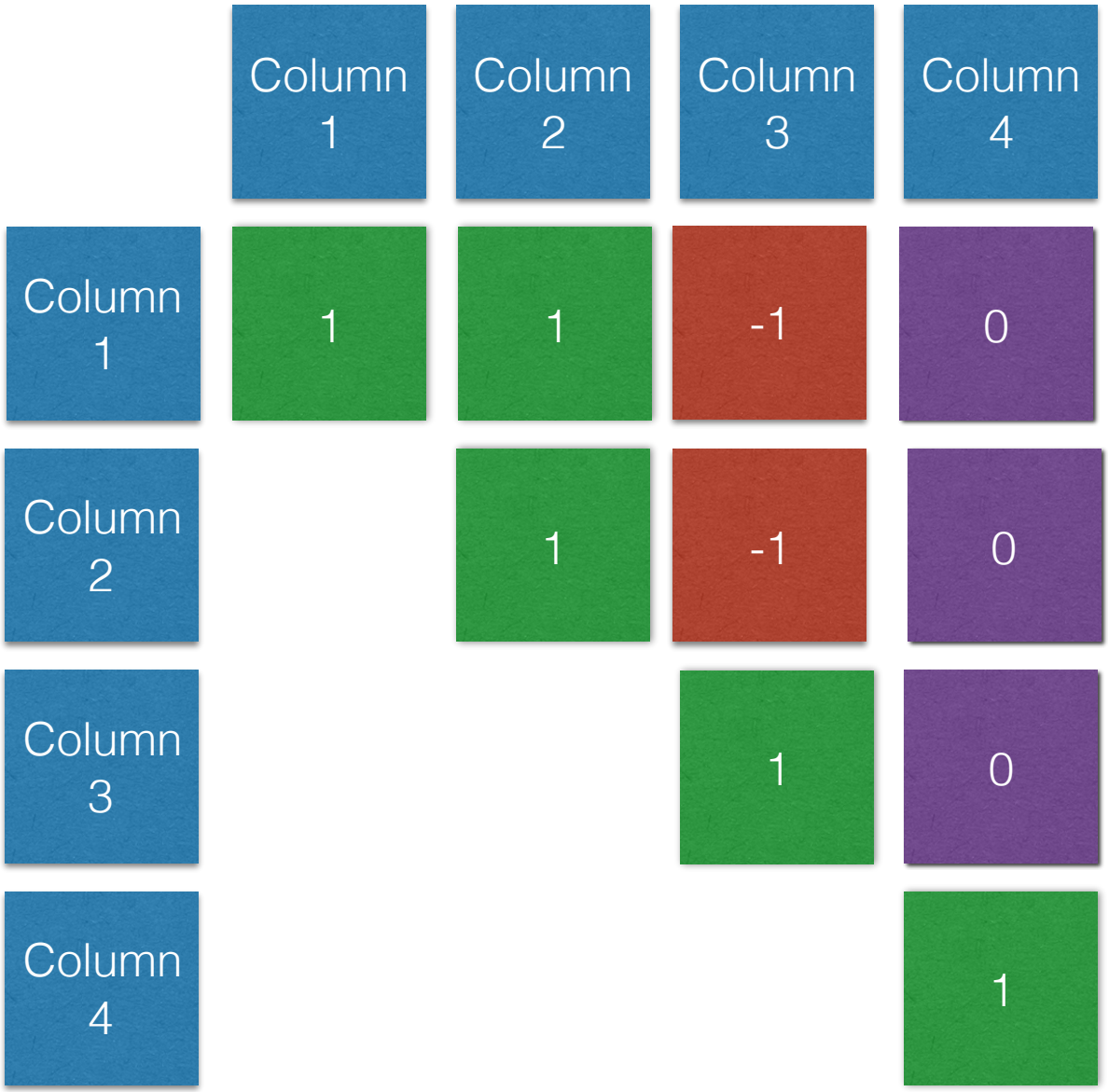

Column 1
Column 2
Column 3
Column 4
Column 1
1
1
-1
0
Column 2
1
1
Column 3
-1
1
Column 4
0
1
Column 2
2
2
4
6
8
14
Column 3
99
99
98
97
96
93

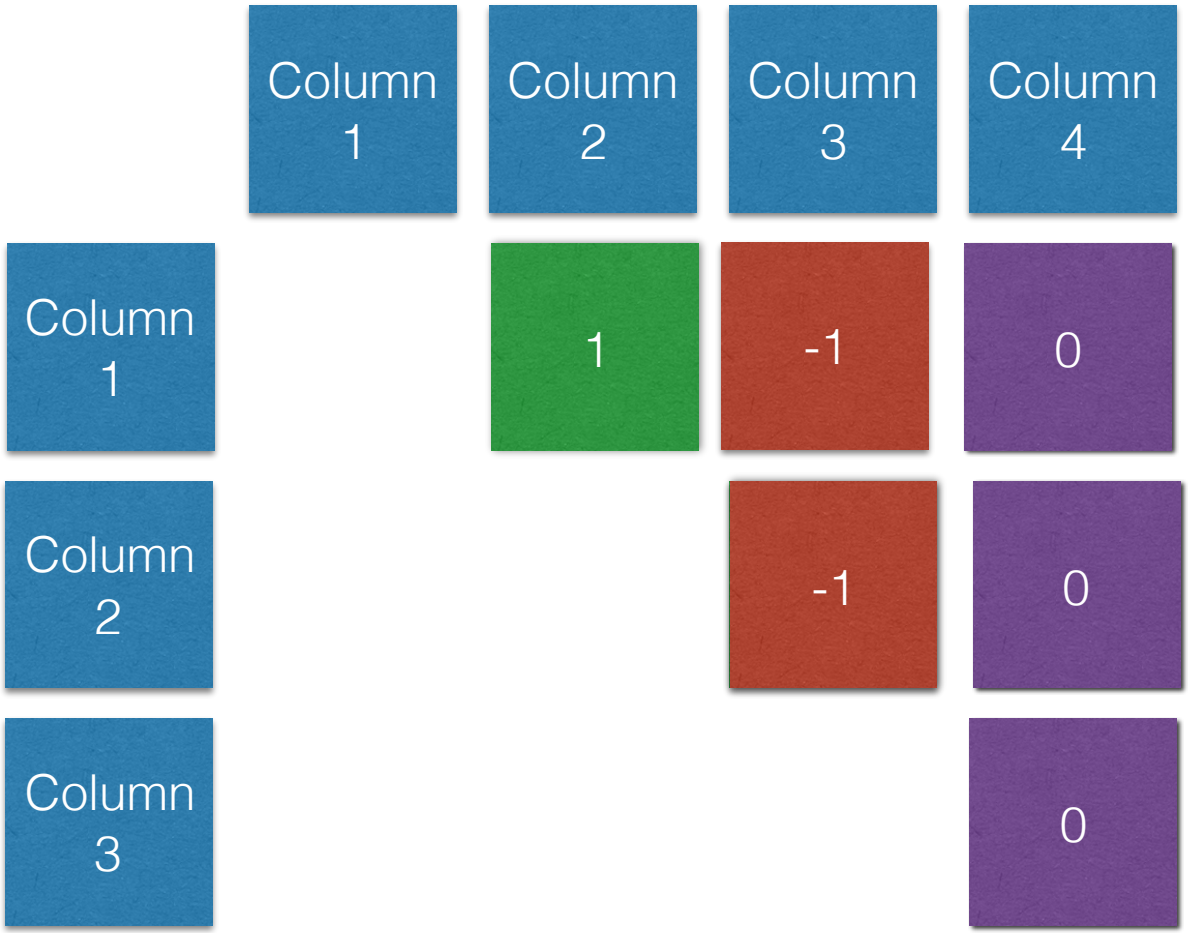

Column 1
Column 2
Column 3
Column 4
Column 1
1
1
-1
0
Column 2
1
1
-1
Column 3
-1
-1
1
Column 4
0
1
Column 2
2
2
4
6
8
14
Column 3
99
99
98
97
96
93


Column 1
Column 2
Column 3
Column 4
Column 1
1
1
-1
0
Column 2
1
1
-1
0
Column 3
-1
-1
1
Column 4
0
0
1
Column 2
2
2
4
6
8
14
Column 4
3
7
3
65
23
42


Column 1
Column 2
Column 3
Column 4
Column 1
1
1
-1
0
Column 2
1
1
-1
0
Column 3
-1
-1
1
0
Column 4
0
0
0
1
Column 3
99
99
98
97
96
93
Column 4
3
7
3
65
23
42


Column 1
Column 2
Column 3
Column 4
Column 1
1
1
-1
0
Column 2
1
1
-1
0
Column 3
-1
-1
1
0
Column 4
0
0
0
1


Column 1
Column 2
Column 3
Column 4
Column 1
1
1
-1
0
Column 2
1
-1
0
Column 3
1
0
Column 4
1


Column 1
Column 2
Column 3
Column 4
Column 1
1
-1
0
Column 2
-1
0
Column 3
0

Summary

- covariance explains interactions between columns
- covariance and correlation basically is the same
- covariance matrix shows all column interactions

The next video covers…

Multidimensional Vector Spaces