

Demonstrate some techniques/tricks in matrix manipulation.
Instructor: Nam Sun Wang

Given the following matrix:

$$A := \begin{pmatrix} 1 & 4 & 7 & 10 \\ 2 & 5 & 8 & 11 \\ 3 & 6 & 9 & 12 \end{pmatrix}$$

Extract a column:

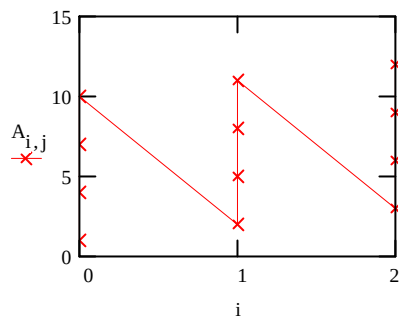
$$A^{<0>} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$$

Further extract an element

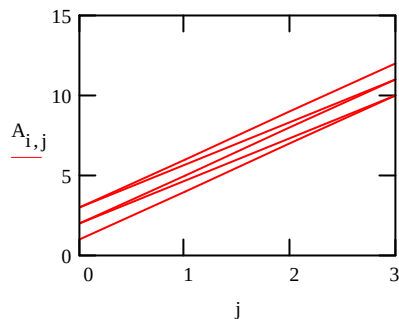
$$(A^{<0>})_2 = 3 \quad \text{which is the same as} \quad A_{2,0} = 3$$

Plot a matrix:

$$i := 0..2 \quad j := 0..3$$

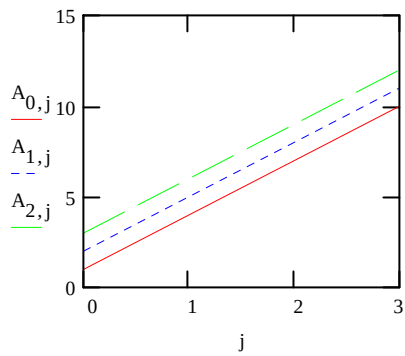


← Note: Index j (column) changes most rapidly:
A₀₀, A₀₁, A₀₂, A₀₃, A₁₀, A₁₁, A₁₂, A₁₃, ...

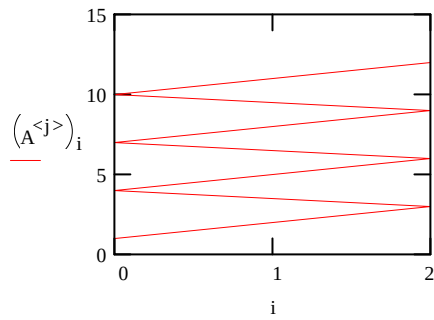


← 3 lines, one for each row, but each row is connected to the next.

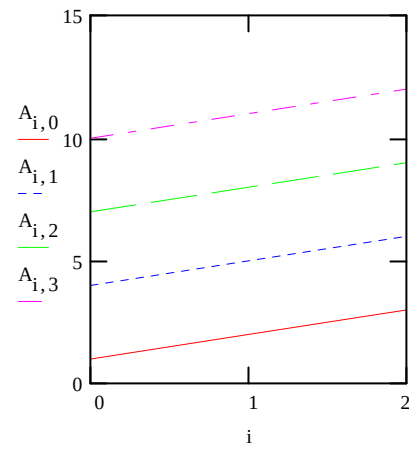
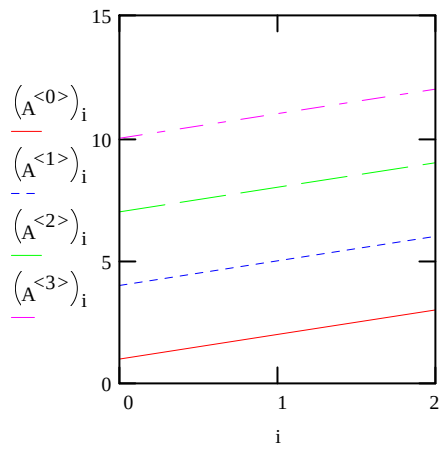
Artificially separate the lines by plotting 3 items (one row per line).



Plot each column.



In the above plot, each column is connected to the next. Thus, we need to separate each column artificially. However, this approach is tedious, because we have to list many variables to plot.

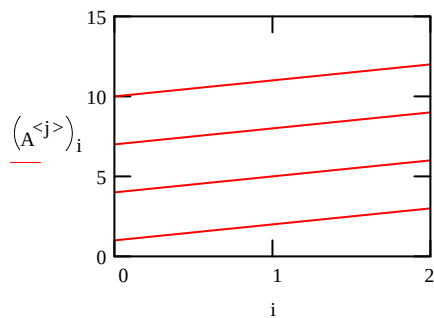


Trick: To disconnect each column, assign an extra row at the end of the matrix but range the abscisa up to only the last significant row. Similarly, to disconnect each row, add an extra column.

$$A := \begin{bmatrix} 1 & 4 & 7 & 10 & 0 \\ 2 & 5 & 8 & 11 & 0 \\ 3 & 6 & 9 & 12 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

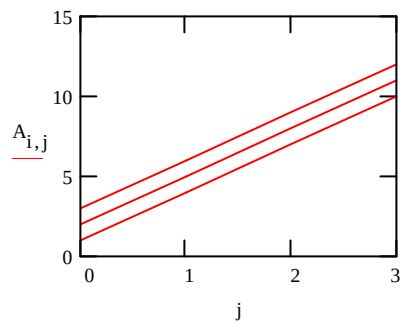
Easy plot of each column /w "draw" trace:

$$i := 0..3 \quad j := 0..3$$



Easy plot of each row /w "draw" trace:

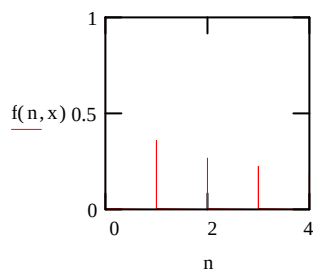
$$i := 0..2 \quad j := 0..4$$



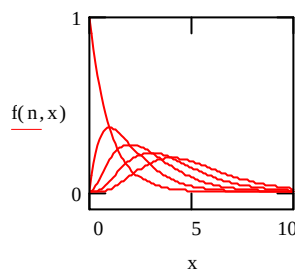
Plot with two ranged variables. $n := 0..4$ $x := 0, 0.1..11$

$$f(n, x) := \frac{1}{n!} \cdot \exp(-x) \cdot x^n$$

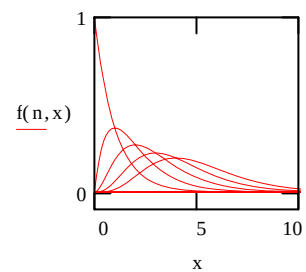
The second variable in the function changes most rapidly. The "draw" trace disconnects points outside the plotting range.



Against 1st variable--"line"



Against 2nd variable--"draw"



Against 2nd variable--"line"