Visual shortcut for matrix multiplication

While looking up some math information on the Web, I came across the following visual shortcut for doing matrix multiplication:

If you are multiplying a matrix *A* of size *m*×*q* by a matrix *B* of size *q*×*n*, the result will be a matrix *C* of size *m*×*n*. For example:

If *A* = (size 2×3) and *B* =  (size 3×4),  
then *C* = *A* × *B* =  =  (size 2×4)

The elements of *C* (shown with question marks above) are calculated by multiplying the rows of matrix *A* by the columns of matrix *B* and adding up the results. But how can you keep track of what to multiply and where the result will go?

Instead of writing the calculation with the usual left-to-right notation (as shown above), write the matrices in a triangle, as shown below:

*B*

*AC*

The elements of *C* are calculated using the row to the left from *A* and the column above from *B*:



As shown by the boxes in the diagram, the element of *C* in row 1 and column 1 is found by multiplying row 1 from *A* and column 1 from *B* and adding up the results:

*C*11 = 1(0) + 3(1) + 2(1) = 0 + 3 + 2 = 5

Note that if multiplication is possible, the number of columns in *A* must match the number of rows in *B*, so the values will form pairs for multiplication.

 

This process can be continued to calculate each of the elements of *C* – e.g.:



  *C*23 = 0(2) + 2(0) + 1(2) = 0 + 0 + 2 = 2

Try to complete the remaining calculations for yourself. Then use your Matrix class to do the multiplication using the computer to verify that you (and I!) have reached the correct answers.

# References:

Lemeire, Jan. *Parallel Systems: Session 7*. Parallel Computing Laboratory, Free University of Brussels Department of Mathematics. Retrieved March 21, 2003 from the World Wide Web: <http://parallel.vub.ac.be/education/parsys/Parallel_systems_session4.pdf>