MATLAB III

To multiply two matrices in MATLAB, use the operator *, just as for multiplying a matrix and a vector.

\[
>> A=[1 \ 2; \ 3 \ 4], \ B=[4 \ 5; \ 6 \ 7]
\]

\[
A =
\begin{pmatrix}
1 & 2 \\
3 & 4
\end{pmatrix}
\]

\[
B =
\begin{pmatrix}
4 & 5 \\
6 & 7
\end{pmatrix}
\]

\[
>> A*B
\]

\[
an =
\begin{pmatrix}
16 & 19 \\
36 & 43
\end{pmatrix}
\]

The \( n \times n \) identity matrix is formed with the command \text{eye}(n).

\[
>> \text{eye}(2)
\]

\[
an =
\begin{pmatrix}
1 & 0 \\
0 & 1
\end{pmatrix}
\]

\[
>> \text{eye}(3)
\]

\[
an =
\begin{pmatrix}
1 & 0 & 0 \\
0 & 1 & 0 \\
0 & 0 & 1
\end{pmatrix}
\]

If a matrix is invertible, we can compute its inverse with \text{inv}.

\[
>> A=[2 \ 4 \ 6; \ 1 \ 3 \ 5; \ 0 \ 1 \ 1];
\]

\[
>> A_{inv} = \text{inv}(A)
\]
\[ A_{\text{inv}} = \]
\[
\begin{array}{ccc}
1.0000 & -1.0000 & -1.0000 \\
0.5000 & -1.0000 & 2.0000 \\
-0.5000 & 1.0000 & -1.0000 \\
\end{array}
\]

\[
>> A* A_{\text{inv}}
\]

\[
\text{ans} =
\]
\[
\begin{array}{ccc}
1 & 0 & 0 \\
0 & 1 & 0 \\
0 & 0 & 1 \\
\end{array}
\]

Recall that a matrix is invertible if and only if it is square, say \( n \times n \), and has full rank, that is rank \( n \). Thus, we can use the MATLAB command \texttt{rank} to determine whether a square matrix is invertible. In the following example, \( M \) is invertible but \( N \) is not.

\[
>> M=[-1 3 4 -2; -2 -1 4 -5; 2 3 0 3; 1 5 4 5];
\]

\[
>> \text{rank}(M)
\]

\[
\text{ans} =
\]
\[
4
\]

\[
>> N=[12 0 1 0 3; 2 2 1 1 1; 0 2 4 -1 -1; 0 0 1 0 1; -2 -1 -1 0 0];
\]

\[
>> \text{rank}(N)
\]

\[
\text{ans} =
\]
\[
4
\]

In this situation, we can also take advantage of MATLAB’s logical operation \( == \). This means roughly, “are they equal.” MATLAB answers with 1 for YES or 0 for NO.

\[
>> \text{rank}(M)==4
\]

\[
\text{ans} =
\]
\[
1
\]

\[
>> \text{rank}(N)==5
\]
ans =

0

We can ask MATLAB for its reasoning using the command why. Unfortunately, MATLAB usually takes an attitude and gives a random response.

>> why
The computer did it.
>> why
Some not very bald very rich system manager wanted it.
>> why
You told the rich system manager.
>> why
Some not excessively rich young and smart hamster obeyed some rich and not very good and good and bald kid.

When good computers go silly...