CS 1173: MATLAB Array Basics

Suppose \( x = [1, 2, 3, 4; 5, 6, 7, 8] \) is an array. The values in the array are called elements of the array. The positions in the array are called indices.

1) \( x \) has 2 rows and 4 columns. The semicolon says start a new row, and the commas separate items within the row.

\[
x = \begin{bmatrix}
1 & 2 & 3 & 4 \\
5 & 6 & 7 & 8
\end{bmatrix}
\]

2) \( y = x' \) is the transpose of \( x \). The array \( y \) has 4 rows and 2 columns. (The rows become the columns and the columns become the rows.)

\[
y = x' = \begin{bmatrix}
1 & 5 \\
2 & 6 \\
3 & 7 \\
4 & 8
\end{bmatrix}
\]

3) \( y = x(;) \) is the linear representation of \( x \). The columns are put end-to-end to make one column.

\[
y = x(;) = \begin{bmatrix}
1 \\
5 \\
2 \\
6
\end{bmatrix}
\]

4) \( y = \text{reshape}(x, 4, 2) \) is a reshaped version of \( x \). The array has the same linear representation as \( x \). To get \( y \), you first put \( x \) in its linear representation and then count off by columns. \( y \) has 4 rows and 2 columns:

\[
y = \begin{bmatrix}
1 & 3 \\
5 & 7 \\
2 & 4 \\
6 & 8
\end{bmatrix}
\]
5) To **access individual elements of an array** give the row and column numbers in parentheses.

\[ y = x(2, 3); \quad \text{Here } y \text{ has the value 7. This statement takes the value in row 2 and column 3 of } x \text{ and copies it into } y. \]

\[ z = x(1, 2); \quad \text{Here } z \text{ has the value 2. This statement takes the value in row 1 and column 2 of } x \text{ and copies it into } y. \]

6) The **colon** in place of a row or column means take everything in that row or column:

\[ x(:, 3) = \begin{bmatrix} 3 \\ 7 \end{bmatrix} \quad \text{and} \quad x(2,:) = [5 \ 6 \ 7 \ 8] \]

7) The **colon range** specifies the start and end of an interval of positions:

\[ x(2, 3:4) = [7 \ 8] \]

8) The word **end** in a row or column specification means the position of the last element in that row or column: \( x(2, \text{end}) \) is 8, \( x(\text{end}, 3) \) is 7, and \( x(1, 2: \text{end}) \) is \( [2, 3, 4] \);

9) You can **put rows and columns together in different ways**. If you use **comma**, the rows and columns are put side-by-side. If you use **semicolon**, the rows and columns are arranged vertically. Suppose \( a = [1, 2, 3, 4] \) and \( b = [5, 6, 7, 8] \):

i) \( c = [a, b] \) places the rows of \( a \) and \( b \) side-by-side so \( c \) is the \( 1 \times 8 \) array [1, 2, 3, 4, 5, 6, 7, 8].

ii) \( d = [a; b] \) places the rows of \( a \) and \( b \) vertically so \( d \) is the \( 2 \times 4 \) array \[
\begin{bmatrix}
1 & 2 & 3 & 4 \\
5 & 6 & 7 & 8
\end{bmatrix}
\]

iii) \( e = [a', b'] \); places the columns side-by-side so \( e \) is the \( 4 \times 2 \) array
\[
\begin{bmatrix}
1 & 5 \\
2 & 6 \\
3 & 7 \\
4 & 8
\end{bmatrix}
\]

iv) \( f = [a'; b'] \); places the columns vertically so \( f \) is the \( 8 \times 1 \) array
\[
\begin{bmatrix}
1 \\
2 \\
3 \\
4 \\
5 \\
6 \\
7 \\
8
\end{bmatrix}
\]