

## CS 1173: MATLAB Array Basics

Suppose  $x = [1, 2, 3, 4; 5, 6, 7, 8]$ ; 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.

$$y = x(:) = \begin{bmatrix} 1 \\ 5 \\ 2 \\ 6 \\ 3 \\ 7 \\ 4 \\ 8 \end{bmatrix}$$

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.

$y = x(2, 3);$  Here  $y$  has the value 7. This statement takes the value in row 2 and column 3 of  $x$  and copies it into  $y$ .

$z = x(1, 2);$  Here  $z$  has the value 2. This statement takes the value in row 1 and column 2 of  $x$  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

$$a = [1, 2, 3, 4] \text{ and } b = [5, 6, 7, 8]:$$

i)  $c = [a, b]$  places the rows of  $a$  and  $b$  side-by-side so  $c$  is the 1 x 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 x 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 x 2 array  $e = \begin{bmatrix} 1 & 5 \\ 2 & 6 \\ 3 & 7 \\ 4 & 8 \end{bmatrix}$

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