Topics: One-dimensional array—vector

Reading (ML): Sec 2.1–2.4, 2.8 for discussion on 1-d array, make sure you’ve done all the required reading!

1-Dimensional Array: Vector

An array is a named collection of data values organized into rows and/or columns. A 1-d array is a row or a column, also known as a vector. An index is a positive integer that identifies the position of a value in the vector.

Suppose vector \( \mathbf{v} \) is a collection of 5 values, i.e., vector \( \mathbf{v} \) has 5 cells.

The \( i \)-th value can be accessed as \( \mathbf{v}(i) \).

Assign a value of 9 to into the 4-th cell of vector \( \mathbf{v} \): \( \mathbf{v}(4) = 9 \).

Copy the value in the 5-th cell to the 2-n-d cell of vector \( \mathbf{v} \): \( \mathbf{v}(2) = \mathbf{v}(5) \).

Copy the value in the current (i-th) cell to the next cell of vector \( \mathbf{v} \): \( \mathbf{v}(i+1) = \mathbf{v}(i) \).

The length of vector \( \mathbf{v} \): \texttt{length(\mathbf{v})}.

Array Initialization

MATLAB function \texttt{zeros}:
\[
\texttt{vecA} = \texttt{zeros(1,5)}
\]

MATLAB function \texttt{ones}:
\[
\texttt{vecB} = \texttt{ones(5,1)}
\]

MATLAB short-cut expression for consecutive numbers: \texttt{1:6} or \texttt{1:1:6}

“Manual”:
\[
\texttt{vecC(5) = 10, vecD = [2 3.5 6]}
\]

Example 1

Can you write a program for calculating the average of 10 numbers (Example 1 from 2/4 lecture) that stores all the data entered by the user? Below is the original program that doesn’t store all user input.

\[
\texttt{\% Average 10 numbers from user input}
\]

\[
\texttt{n = 10; \% number of data values}
\texttt{total = 0; \% current sum (initialized to zero)}
\texttt{i = 1; \% initialize counter}
\texttt{while (i<=n)}
\texttt{\% read and process input value}
\texttt{\quad num = input('Enter a number: ')};
\texttt{\quad total = total + num;
\texttt{\% update}
\texttt{\quad i = i + 1;}
\texttt{end}
\texttt{ave = total/n \% average of n numbers}
\]

What are some useful MATLAB built-in functions for the above problem?
Example 2

Write a program segment that calculates the \textit{cumulative sums} of a given vector \( \mathbf{v} \). The cumulative sums should be stored in a vector of the same length as \( \mathbf{v} \). E.g., the cumulative sums for the sequence 1,3,5,0 is 1,4,9,9. Do not use MATLAB predefined functions other than \texttt{length}.

Example 3

Write a program segment to evaluate an \( n \)\textsuperscript{th} order polynomial of \( x \):

\[ a_0 + a_1 x + a_2 x^2 + \cdots + a_n x^n \]

A given vector \( \mathbf{p} \) has length \( n+1 \) and contains the coefficients of the polynomial where \( \mathbf{p}(1) \) is the coefficient for the term \( x^0 \). Your program should request a user input value for variable \( x \) and then evaluate the polynomial. Use a \texttt{while} loop. Do not use MATLAB predefined functions other than \texttt{length} and \texttt{input}.