Topics: Iteration using while, intro to 1-dimensional array

Reading (ML): Sec 4.1, revisit Sec 2.1-2.4, 2.8 for discussion on 1-d array (exclude matrix and matrix operations)

Iteration

Important features:

- Task can be accomplished if some step is repeated a number of times
- Must be able to quantify success
- Must have a starting point
- Must keep track of progress

Syntax of the while Loop

```plaintext
while expression
  statements to execute if expression evaluates to true
end
```

Example 1: Average

Write a program that prompts the user for 10 numbers and then print the average. Use only scalar variables.

```
Pattern for doing something n times

i = 1;
while i<=n
  % do something
  % ...
  i = i + 1;
end
```

Example 2: Running average

Can you modify the program in Example 1 to print the running averages? A running average is the average of all previously entered numbers. The user enters 10 numbers in total. Again use only scalar variables.
Example 3: Indefinite iteration

What if the total number of entries is not known in advance? Write another program for calculating running averages. The user enters -9999 to indicate the end of data entry.

Brute-force algorithm to find minimum function value

- Start at $x = L$
- Set a current minimum function value—“minimum found so far”
- Until the end point ($x = R$) is reached, repeat the following:
  - Calculate $f(x)$
  - Compare $f(x)$ with the minimum found so far and update if necessary
  - Increment value of $x$

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 identifies the position of a value in the vector.

Suppose vector $\mathbf{v}$ is a collection of 4 values, i.e., vector $\mathbf{v}$ has 4 cells.

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

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

Copy the value in the 4th cell to the 2nd cell of vector $\mathbf{v}$: $\mathbf{v}(2) = \mathbf{v}(4)$.

Copy the value in the current cell to the next cell of vector $\mathbf{v}$: $\mathbf{v}(i+1) = \mathbf{v}(i)$.
The while loop

while expression

\textit{statements to execute if expression evaluates to true}

end
Pattern for doing something \( n \) times

\[
i = 1;
\]

\textbf{while} \( i \leq n \)

\%
% do something

\%
% ...

\%
% ...

\% 
\[
i = i + 1;
\]

\textbf{end}
Pattern for doing something
an indefinite number of times

% initialization

% ...

while not stopping signal

% do something

% ...

% update status (variables)

% ...

end