CS 105

Introduction to Scientific Computing

Lecture #5 – Built-In Functions

Matt Burlick
Stevens Institute of Technology

MOTIVATION

- What if we want to add up all the values in a Vector?
  - We’ll see how to do by this ourselves later
  - But wouldn’t it be nice to write the list of commands once and then be able to use them often?
- How do we read an image so that we can manipulate it and write it back out?
  - Not trivial
  - Matlab makes it easy for us by having built-in stuff

TOPICS

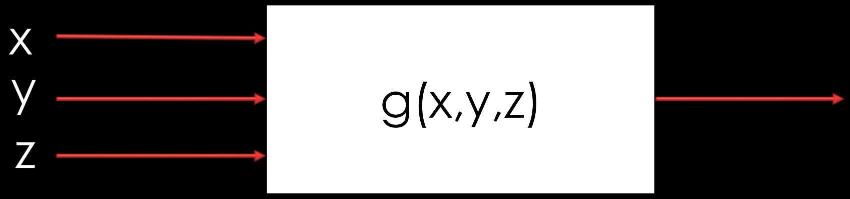
1. What are Functions
2. Using Functions
3. Common Built-In Functions

READING

- Section 2.6.2 – The display function
- Section 2.10 – Built-in MATLAB Functions

WHAT ARE FUNCTIONS?

- Remember what functions are from math?
  - $f(x) = x^2$
  - For an input, we get an output
    - f(20)
- They can be thought of as “black boxes” where there are inputs (maybe) and outputs (maybe)



WHAT ARE FUNCTIONS?

- We call the inputs *arguments*
- We call the outputs *return values*

- Matlab has A LOT of built-in functions
  - We can also make our own (we’ll see this later)
- To see what the arguments and return values are we can use MATLAB *help*
  - Also shows example usage.
- EX:
    - plot
    - num2str
    - zeros

USING FUNCTIONS

- Once a function is created (either by us or by MATLAB) we use it by *calling* it
  - Provide inputs (optionally) and get back the output (optionally)
- y=f(x)

MATRIX CREATION FUNCTIONS

- zeros(rows, cols)
- ones(rows, cols)
- rand(rows, cols)

MATRIX TESTING FUNCTIONS

- length(X)
- size(X)
- size(x,1)
- size(x,2)
- isempty(X)

STATISTICS FUNCTIONS

- min(X)
- max(x)
- mean(x)
- std(x)

DISPLAY FUNCTIONS

- The easiest way to output *strings* in MATLAB is with the ***disp*** function
- Early versions of disp only displays strings, so you'll need to convert numerical types before displaying
  - num2str function
- We can *concatenate* vectors by putting them inside brackets

  -
    ```
    X=[3 2 4]
    Y=[1 2]
    Z = [X Y]
    ```

  -
    ```
    X='Hello'
    Y = num2str(4);
    Z = [X Y]
    ```

FUNCTIONS FOR ASSIGNMENT 3

- To manipulate our data we first need to convert it to *double* data type
  - Y = double(X)
- To display it, we need to convert it to uint8 type
  - Z = uint8(Y);
- To read in images we can use
  - X = imread(filename);
- To display images, we can use
  - imshow(Z)
- To generate random data we can use
  - rand(100,200) %creates 100 rows, 200 cols of rand data

FUNCTIONS FOR ASSIGNMENT 3

- audioread(filename)
- sound(X,fs)