PERI INSTITUTE OF TECHNOLOGY
DEPARTMENT OF ECE

Two days National Workshop On
Communication & Image Processing Using Matlab "CIPM 2017"

MATLAB EXERCISE -3

Basic Syntax and Command-Line Exercises

The following exercises are meant to be answered by a single MATLAB command. The command may be involved (i.e., it may use a number of parentheses or calls to functions) but can, in essence, be solved by the execution of a single command. If the command is too complicated, feel free to break it up over two or more lines.

1. Create a vector of the even whole numbers between 31 and 75.

2. Let x = [2 5 1 6].

   a. Add 16 to each element
   b. Add 3 to just the odd-index elements
   c. Compute the square root of each element
   d. Compute the square of each element

3. Let x = [3 2 6 8]' and y = [4 1 3 5]' (NB. x and y should be column vectors).

   a. Add the sum of the elements in x to y
   b. Raise each element of x to the power specified by the corresponding element in y.
   c. Divide each element of y by the corresponding element in x
   d. Multiply each element in x by the corresponding element in y, calling the result "z".
   e. Add up the elements in z and assign the result to a variable called "w".
   f. Compute x'*y - w and interpret the result

4. Evaluate the following MATLAB expressions by hand and use MATLAB to check the answers

   a. 2 / 2 * 3
   b. 6 - 2 / 5 + 7 ^ 2 - 1
   c. 10 / 2 \ 5 - 3 + 2 * 4
   d. 3 ^ 2 / 4
   e. 3 ^ 2 ^ 2
   f. 2 + round(6 / 9 + 3 * 2) / 2 - 3
   g. 2 + floor(6 / 9 + 3 * 2) / 2 - 3
   h. 2 + ceil(6 / 9 + 3 * 2) / 2 - 3

5. Create a vector x with the elements ...

   a. 2, 4, 6, 8, ...
   b. 10, 8, 6, 4, 2, 0, -2, -4
   c. 1, 1/2, 1/3, 1/4, 1/5, ...
   d. 0, 1/2, 2/3, 3/4, 4/5, ...

6. Create a vector x with the elements,

$$x_n = (-1)^{n+1}/(2n-1)$$

Add up the elements of the version of this vector that has 100 elements.

7. Write down the MATLAB expression(s) that will

a. ... compute the length of the hypotenuse of a right triangle given the lengths of the sides (try to do this for a vector of side-length values).

b. ... compute the length of the third side of a triangle given the lengths of the other two sides, given the cosine rule

$$c^2 = a^2 + b^2 - 2(a)(b)\cos(t)$$

where t is the included angle between the given sides.

8. Given a *vector*, t, of length n, write down the MATLAB expressions that will correctly compute the following:

a. $\ln(2 + t + t^2)$
b. $e^t(1 + \cos(3t))$
c. $\cos^2(t) + \sin^2(t)$
d. $\tan^{-1}(1)$ (this is the *inverse* tangent function)
e. $\cot(t)$
f. $\sec^2(t) + \cot(t) - 1$

Test that your solution works for t = 1:0.2:2

9. Plot the functions x, x^3, e^x and e^{x^2} over the interval $0 < x < 4$ ...

a. on rectangular paper
b. on semilog paper (logarithm on the y-axis)
c. on log-log paper

Be sure to use an appropriate mesh of x values to get a smooth set of curves.

10. Make a good plot (i.e., a non-choppy plot) of the function

$$f(x) = \sin(1/x)$$

for $0.01 < x < 0.1$. How did you create x so that the plot looked good?

11. In polar coordinates (r,t), the equation of an ellipse with one of its foci at the origin is

$$r(t) = a(1 - e^2)/(1 - (e)\cos(t))$$

where a is the size of the semi-major axis (along the x-axis) and e is the eccentricity. Plot ellipses using this formula, ensuring that the curves are smooth by selecting an appropriate number of points in the angular (t) coordinate. Use the command **axis equal** to set the proper axis ratio to see the ellipses.

12. Plot the expression (determined in modelling the growth of the US population)

$$P(t) = 197{,}273{,}000/(1 + e^{-0.0313(t - 1913.25)})$$

where t is the date, in years AD, using t = 1790 to 2000. What population is predicted in the year 2020?