Homework M2:
Matlab Primer [1]
Pages 1-24 to 1-25, 1-27 to 2-13, and 2-15 to 2-25

1. List the exact code you would enter at the command prompt in Matlab to compute the following quantities:

   a) $2+2$ b) $\pi + 4(8+2)$ c) $\dfrac{1}{2} + 5^2$ d) -7(8)-(-3)3

2. List the exact code you would enter at the command prompt in Matlab to compute the following quantities:

   a) $\sqrt{5}$ b) $e^{-\cos(3\pi)}$ c) $\dfrac{3 + \ln(4)}{7*(3+ |\tan(3)-2|)}$

   where $\ln = \log_e$ and $|x|$ is absolute value

3. Write down a one-line command using the eye( ) and ones( ) functions to create the following matrix:

$$M = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 2 & 2 & 2 \end{bmatrix}$$

4. This problem involves (somewhat simplified) rotation matrices used in robotics. Write a script file that does the following:
   a) Set variable "theta" (an angle) to a value of 30 (degrees).
   b) Calculate the following rotation matrix, *R1*, that is a function of theta (i.e., θ), (remember to convert from radians to degrees in your program):

$$R1 = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$$

   c) Create a vector, xvec, representing the initial location of the end of a robotic arm:

$$xvec = \begin{bmatrix} 3 \\ 4 \end{bmatrix}$$

   d) Create a vector, xvec2, representing the location of the end of the robotic arm after a rotation of 30 degrees:
      xvec2 = *R1*•xvec
   e) Calculate a vector, xvec3, representing the location of the end of the robotic arm after a second rotation by an angle of your choice.

5. Write down the output created by the following sequence of commands.
   a) A = magic(4)'
   b) A(2,:) = [ ]
   c) B = A + [eye(3),[0; 1; 0]]
   d) C = B(A(4:6))

6. You are given the data below representing the scores of students in ECE 1250 on an exam. Write a script file to do the following:
   a) Create an array called "scores" containing all the exam scores, (col 1 will be Exam 1 scores, col 2 will be Exam 2 scores, and there are no names stored in the array).
   b) Calculate the min, mean, and max of each exam and store the values in three rows in an array called "score_stats".

Student	Exam 1	Exam 2
Abe	70	42
Ben	100	5
Cal	45	46
Deb	78	90
Eve	83	76

7. Suppose the five rows of a matrix W each contain a sound waveform. You wish to determine which of the waveforms in W is most similar to a sound waveform stored as a single row in an array called snippet. Write down the code you would need to do this by the following steps:
   a) Normalize the energy in snippet by dividing snippet by the square root of the average (or mean) value of the squares of all the values in snippet. Call the result normsnip.

$$normsnip = \frac{snippet}{\sqrt{\sum\limits_{i=1}^{length(snippet)} snippet_i^2}}$$

   b) Create a matrix S whose five rows are all copies of normsnip.
   c) Calculate the difference S – W, square each entry in S – W, sum the rows of the squared values, and determine which row has the smallest sum. Store the number of that row in a variable called best_fit.

8. Which of the following are valid variable names?
   a) aA3   b) _a2   c) a_6   d) 4_a   e) A3@B   f) zzz_4_

9. If B = magic(4), find the value of each of the following:
   a) A = B(end, :)   b)   A = B([1;3],1)   c)   A = B(2:2:4,[1,1,3])

10. If B = magic(4), find the value of B(B). (See the Advanced Indexing handout on the course website.)

REF: [1]   The Mathworks, Inc, *Matlab® Primer,* Natick, MA: The Mathworks, Inc, 2012.