



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) $\frac{1}{2}+5^2$ 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) $\frac{3+\ln(4)}{7*(3+|\tan(3)-2|)}$

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:
- Set variable "theta" (an angle) to a value of 30 (degrees).
 - Calculate the following rotation matrix, $R1$, that is a function of theta (i.e., θ). Note that you may embed the `cos()` and `sin()` calculations in the one-line command that creates the matrix $R1$. (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:

$$xvec2 = R1 \cdot xvec$$

- 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.

- $A = \text{magic}(4)'$
- $A(2,:) = []$
- $B = A + [\text{eye}(3), [0; 1; 0]]$
- $C = B(A(4:6))$

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:
- 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).
 - Calculate the min, mean, and max of each exam and store these 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 the code you need by following these steps:
- Normalize the power (and energy) in the `snippet` by dividing the `snippet` by the square root of the average (or mean) value of the squares of all the values in `snippet`. Call the result `normsnip`.

$$\text{normsnip} = \frac{\text{snippet}}{\sqrt{\frac{1}{\text{length}(\text{snippet})} \sum_{i=1}^{\text{length}(\text{snippet})} \text{snippet}_i^2}}$$

- Create a matrix S whose five rows are all copies of `normsnip`.
 - 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`. (Note that we assume the power of each row of W is normalized ahead of time.)
8. Which of the following are valid variable names?
- aA3
 - _a2
 - a_6
 - 4_a
 - A3@B
 - zzz_4_
9. If $B = \text{magic}(4)$, find the value of each of the following:
- $A = B(\text{end}, :)$
 - $A = B([1;3],1)$
 - $A = B(2:2:4,[1,1,3])$
10. If $B = \text{magic}(4)$, 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.

Selected answers:

1.b) $\pi + 4 \cdot (8+2)$

2.b) $\exp(-\cos(3 \cdot \pi))$

3. $M = [\text{eye}(2), \text{ones}(2,1); 2 \cdot \text{ones}(1,3)]$

4.b) $R1 = [\text{cosd}(\theta), \dots]$ % This is just the first part of the answer

5.b)

b)
A =
16 5 9 4
3 10 6 15
13 8 12 1

6.a) $\text{scores} = [70, 42; 100, 5; 45, 46; 78, 90; 83, 76];$

7. a) $\text{normsnip} = \text{snippet} / \sqrt{\text{sum}(\text{snippet}.^2) / \text{length}(\text{snippet})}$

8.c) valid, d) invalid

9.c)

c)
B =
5 5 10
4 4 15

10. First of four rows of answer:

ans =

1 5 9 13