MAE 8 - Spring 2022
Homework 1

Instructions: Follow the homework solution template. Put all answers in a MATLAB script named **hw1.m**. Submit **hw1.m** in CANVAS before 10 PM on 4/8/2022. Use double precision unless otherwise stated.

Problem 1: Using the elementary functions in MATLAB to compute the following expressions:

a) ratio of π to 0, put the answer in **p1a**
b) ratio of 0 to 0, put the answer in **p1b**
c) Square root of -4π, put the answer in **p1c**
d) Cosine of 75°, put the answer in **p1d**
e) Sine of $\pi/3$ radians, put the answer in **p1e**
f) 1234 raised to the 5^{th} power, put the answer in **p1f**
g) Ninth root of 512, put the answer in **p1g**
h) Logarithm of 16,384 using base 2, put the answer in **p1h**
i) Logarithm of 1,000,000 using base 10, put the answer in **p1i**
j) Natural logarithm of Euler's number, put the answer in **p1j**
k) Inverse tangent of 1, put the answer (in degrees) in **p1k**
l) Hyperbolic sine of 6, put the answer in **p1l**
m) Inverse hyperbolic tangent of 1, put the answer in **p1m**

Problem 2: Perform the following exercises:

a) Typecast real number 32π into character type and put the answer in **p2a**.
b) Typecast real number 16 into character type and put the answer in **p2b**.
c) Typecast the answer in part (b) into double-precision type and put the answer in **p2c**.
d) Typecast character Z into 16-bit integer type and put the answer in **p2d**.
e) Typecast character Z into 32-bit integer type and put the answer in **p2e**.
f) Typecast character Y into single-precision real type and put the answer in **p2f**.
g) Typecast character X into double-precision real type and put the answer in **p2g**.
h) Use function **class** to find the data type of variable **p2a** and put the answer in **p2h**.
i) Compute the product of character **Y** and character **Z**. Put the answer in **p2i**.
j) Is **double('Y')** equal to **int64('Y')**? Put the answer in **p2j**.

Problem 3: Use MATLAB to find which of the following statements is true. Your answer should be logical with 0 for false and 1 for true.

a) Character y is equal to character Y. Put the answer in **p3a**.
b) Character y is larger than character X. Put the answer in **p3b**.
c) Character z is smaller than character x. Put the answer in **p3c**.
d) $log_2(1024)$ is equal to 10. Put the answer in **p3d**.
e) $sin(100\pi)$ is not equal to 0. Put the answer in **p3e**.

f) $3\backslash 9+1$ is less than 3. Put the answer in **p3f**.

g) $3/9+1$ is less than 3. Put the answer in **p3g**.

In the following parts, create variables a = 3, b = 4 and c = 5:

h) a is greater than b and a is greater than c. Put the answer in **p3h**.

i) a is less than b and a is greater than c. Put the answer in **p3i**.

j) a is greater than b or a is greater than c. Put the answer in **p3j**.

k) a is greater than b or a less than c. Put the answer in **p3k**.

l) a is exclusively smaller than b or c. Put the answer in **p3l**.

Problem 4: Use **help elfun** or experiment to answer the following questions. Your answers should be logical variables with 1 for true if the expressions are the same and 0 for false if the expressions are not the same:

a) Is fix(2.5) the same as floor(2.5)? Put the answer in **p4a**.

b) Is fix(2.4) the same as fix(-2.4)? Put the answer in **p4b**.

c) Is fix(2.2) the same as floor(2.2)? Put the answer in **p4c**.

d) Is fix(-2.2) the same as floor(-2.2)? Put the answer in **p4d**.

e) Is fix(-2.2) the same as ceil(-2.2)? Put the answer in **p4e**.

f) Is rem(5,3) the same as mod(5,3)? Put the answer in **p4f**.

g) Is rem(5,-3) the same as mod(5,-3)? Put the answer in **p4g**.

Problem 5: Explore the **format** command in more detail. Use **help format** to find options. Your answers should be reported as strings (i.e. if the correct format for part a was short your answer would be reported as p5a='short')

a) What format will display 123.45 as +? Put the answer in **p5a**.

b) What format will display π as 355/113? Put the answer in **p5b**.

c) Which format will display 63.43567 as 63.44? Put the answer in **p5c**.

d) What format will display 6666.333333 as 6666.3? Put the answer in **p5d**.

Problem 6:

In the ASCII character encoding, the letters of the alphabet are in order: 'a' comes before 'b' and also 'A' comes before 'B'.

a) Which comes first - lower-case or upper-case letters? Use the strings 'lower' or 'upper' for your response. Put the answer in **p6a**.

b) What is the absolute integer offset value between lower-case and upper-case letters? Put the answer in **p6b**.

c) Is the answer from part (b) the same throughout the letter alphabet? The answer should be a logical statement, and put it in **p6c**.

Problem 7: It is important for engineers and scientists to be able to work with colleagues in different parts of the world. Correct conversion of data from one system of units to another is critically important (for example, from the metric system to the American system or vice versa). Perform the following exercises:

a) Create a variable $pounds = 1,000$ to store a weight in pounds. Write an expression for a variable *kilos* to convert the weight into kilograms. The conversion factor is $1\,kilogram = 2.2\,pounds$. What is the value of *kilos*? Put the answer in **p7a**.

b) Create a variable $fn = 5.6$ to store measurement of force in Newtons. Write an expression for the variable *dynes* to convert the force in Newtons into dynes. The conversion factor is $1\,Newton = 10^5\,dynes$. What is the value of *dynes*? Put the answer in **p7b**.

c) Create a variable $ftemp = 212$ to store a temperature in degrees Fahrenheit. Write an expression for a variable *ctemp* to convert the temperature into degrees Celsius (C). The conversion factor is $C = (F - 32) * 5/9$. What is the value of *ctemp*? Put the answer in **p7c**.

d) Create a variable $mph = 65$ to store a speed in miles per hour. Write an expression for a variable *kmph* to convert the speed into kilometers per hour. The conversion factor is $1\,mile = 1.6093\,kilometers$. What is the value of *kmph*? Put the answer in **p7d**.

Problem 8:

a) Using function **linspace**, create a row vector **p8a** containing even integer numbers starting from 2 and ending at 998.

b) Using colon operator, create a row vector **p8b** containing odd integer numbers starting from 1 and ending at 999.

c) Combine the vectors created in parts (b) and (a) into to a longer vector **p8c**. Put part (b) first, then part (a).

d) What is the length of the vector in part (c) ? Put the answer to **p8d**.

e) Which element of the vector in part (c) is the number 500? Use function **find**. Put the answer to **p8e**.

f) Add the number 0 at the beginning of the vector in part (c) to create vector **p8f**.

g) Write an expression to extract the second quarter of the vector in part (f) into vector **p8g**.

h) Write an expression to extract the fourth quarter of the vector in part (f) into vector **p8h**.

i) Create a column vector **p8i** to list all odd numbers from -1 to -1999. The vector should be listed in decreasing order.

j) Square all of the elements of the vector in part (i) and put the answer in **p8j**.

k) Sum all elements of the vector in part (i) and put the answer in **p8k**.

l) Find the product of the last five elements of the vector in part (i) and put the answer in **p8l**.

m) Find the cumulative sum of the vector in part (i). Put the answer in **p8m**.

Problem 9:

(a) Create the following matrix and put the answer in **p9a**. Do not input element by

element.

$$\begin{bmatrix} 1 & 2 & 0 & 0 & 5 & 5 & 0 & 0 & 2 & 1 \\ 3 & 4 & 0 & 0 & 5 & 5 & 0 & 0 & 4 & 3 \\ 0 & 0 & 1 & 2 & 5 & 5 & 2 & 1 & 0 & 0 \\ 0 & 0 & 3 & 4 & 5 & 5 & 4 & 3 & 0 & 0 \\ 5 & 5 & 5 & 5 & 1 & 2 & 5 & 5 & 5 & 5 \\ 5 & 5 & 5 & 5 & 3 & 4 & 5 & 5 & 5 & 5 \\ 0 & 0 & 2 & 1 & 5 & 5 & 1 & 2 & 0 & 0 \\ 0 & 0 & 4 & 3 & 5 & 5 & 3 & 4 & 0 & 0 \\ 2 & 1 & 0 & 0 & 5 & 5 & 0 & 0 & 1 & 2 \\ 4 & 3 & 0 & 0 & 5 & 5 & 0 & 0 & 3 & 4 \end{bmatrix} \tag{1}$$

(b) Sum all elements on the fifth column of the matrix in part (a) and put the answer in **p9b**.

(c) Sum all elements on the two diagonals of the matrix in part (a) and put the answer in **p9c**.

(d) Sum all elements of the matrix in part (a) and put the answer in **p9d**.

(e) How many elements of the matrix in part (a) are greater than 2? Put the answer in **p9e**.