**Short Answer: Answer the following questions.**

1. Briefly explain the difference between the Command Window and the Workspace.

The Command Window is typically used for testing functions and scripts, while the Workspace is used for actually creating functions and scripts.

1. Which of the following function headers is NOT correct?

a) function [out1 out2] = myFunc(in1, in2)

b) function [out1, out2] = myFunc(in1, in2)

c) function myFunc

d) function [out1 out2] = myFunc(in1 in2)

e) function in = myFunc(in)

1. Write a function header for a function called "volCyl" that outputs the volume of a

cylinder, given inputs of the cylinder's height and radius.

function volume = volCyl(height, radius)

**Short Tracing**: **For each of the following questions, provide the output for the given variable as MATLAB would store it in the Workspace: vectors and arrays in square brackets, strings in single quotes, and logical values written as trues and falses.**

1. What is the value of out1 after the following code is run?

a = 'this is true';

b = (a=='z')+1;

c = class(b);

d = round(('z'+'a')/2);

c(c>=d) = [];

out1 = c

1. What is the value of out2 after the following code is run?

a = 'potatoes';

b = 'c'-'a';

c = [a b];

c(3) = false;

out2 = class(c)

1. What is the value of out3 after the following code is run?

a = 'a'+0;

b = 'b';

c = [a b];

d = [b a];

out3 = c == d

1. What is the value of out4 after the following code is run?

a = [false 1];

b = [0 true];

c = class(a);

d = length(c == class(b));

out4 = c(d)

1. What is the value of out5 after the following code is run?

a = [1 4 3];

b = 1:2:11

c = 'this is a line';

d = b(a);

e = c(d);

f = 'b'-'a';

**Short Coding**

**Write 1-6 lines of code to do the following tasks. Do not write function headers; simply write a code block which would perform the given task.**

1. Given a string called str with words separated by spaces, swap the first and second words. Store the resulting string in a variable called out.
2. Generate one random integer between 5 and 14 and store it in a variable called num.
3. Given an array called arr, determine if the array has an element equal to its own overall average. Your answer should be a logical stored in a variable called log.

**Long Tracing and Error Correction: Answer the following questions.**

1. Consider the following code, which was written for a function called taylorSeries. The intent of the function was to calculate the range of x values for which a Taylor series (a polynomial) was a good estimate for a non-polynomial function. Specifically, the function compares the function

f(x) = exp(-x)

with its polynomial Taylor series counterpart,

g(x) = 1 - x + x^2/2 - x^3/6 + x^4/24

The function outputs the minimum and maximum values for which the difference between the exponential function and the polynomial is less than 0.1, over a defined input interval of x coordinates. For instance, if the inputs were -5 and 5, then the function calculates the minimum and maximum x values between -5 and 5 for which the difference between f and g is less than 0.1.

Please note that intentional errors have been placed in this code.

1 function [minX maxX] = taylorSeries (x1, x2)

2 xs = linspace(x1,x2);

3 realys = exp(-xs);

4 approxys = 1 - xs + (xs^2)/2 – (xs^3)/6 + (xs^4)/24;

5 difference = abs(realys-approxys);

6 goodApprox = difference<=0.1;

7 interval = xs(goodApprox);

8 minX = interval(1);

9 maxX = interval(end);

10 end

You call the function in the Command Window:

[minX maxX]= taylorSeries(-5,5);

a) An error occurs on line 4:

Error using ^

Inputs must be a scalar and a square matrix.

Explain why the error occurred, and fix the line below so that it functions as intended.

b) Immediately after line 6 is run, what is the data type of the variable goodApprox? What is its length?

c) Now that the code works, your function outputs that minX is -1.4646 and maxX is 1.6667. However, it turns out that the real answer is minX should be -1.5527 and maxX should be 1.7320. Explain why your answer is still differing from the correct output.

d) Imagine that you input the interval backwards, and called the function as:

[minX maxX] = taylorSeries(5,-5)

Would you still get the same output? If not, what would the output look like?

e) Now imagine that you called the function with new inputs:

[minX maxX] = taylorSeries(5,6)

An error now occurs on line 8. Explain why.

**Long Coding**

1. Write the following function.

Function Name: matlock

Inputs (3): -(char) A random string of characters

-(logical) An MXN logical array

-(double) A 1x2 vector

Outputs (1): -(logical) A logical value depicting whether a suspect is declared innocent

Function Description:

You are determining the guilt of a suspect on trial, and in order to do so, you must write MATLAB code to perform a function. You have available a random string of characters, an MXN logical array, and a 1x2 vector. Finally, you know the following algorithm to determine the suspect's guilt.

Find the number of lowercase letters in the string of random characters, as well as uppercase letters, numerical characters ('0' - '9'), and the number of other characters that do not fall within the three aforementioned categories. The 1x2 vector given is a pair of coordinates for the logical array, where the first input is the row index and the second input is the column index. This is the start location. Using the number of lowercase, uppercase, numerical, and other characters, a final index location will be obtained through the following process:

- For every lowercase letter in the random string, the index will be moved to the left by one step.

- For every uppercase letter in the string, the index will be moved to the right by one step.

- For every numerical character in the string, the index will be moved up by one step.

- For every other type of character in the string, the index will move down by one step.

Once the final coordinate has been obtained from this algorithm, index the logical array with this location and output the logical value found. This logical value will declare whether the suspect is innocent (true) or guilty (false).

Note:

- The numerical character values in the ASCII table begin with '0' and increase to '9'.

- You do not need to account for a case where you would end up indexing out of bounds.

Test Cases:

arr = [true, false, true, true, true, true;

false, true, true, false, true, false;

false, false, false, true, false, false;

true, true, true, false, true, false;

true, true, false, true, false, true];

[out1] = matlock('Kb!!!!O9Da?SeX5&ED', arr, [1,1]);

=> out1 = false

[out2] = matlock('2N#x^\*DPL111aS&M76', arr, [3,2]);

=> out2 = true