

You have 2 hours to complete this test.

There are 4 multi-part questions in this test. Create a script named `test2.m` to answer the questions 2–4. For each part of each question, create a new cell (section) in your script. You do not need to publish a report from your script.

You have access to the internet during this test. Please do not use any communication software such as email, text chat, social media services, etc.

When you are finished your test, submit your functions and script using the online submit service <https://webapp.eecs.yorku.ca/submit/>

1. (10 points) A point  $(x, y)$  is inside, on, or outside of the unit circle under the following conditions:

inside  $x^2 + y^2 < 1$   
on  $x^2 + y^2 = 1$   
outside  $x^2 + y^2 > 1$

- (a) (6 points) Create and complete the following MATLAB function (you can cut and paste the code into a new function):

```
function inout = classify(x, y, tol)
%CLASSIFY In, on, or outside of a circle.
% INOUT = CLASSIFY(X, Y, TOL) classifies a scalar point (X, Y)
% as being inside, on, or outside of the unit circle.
% INOUT is -1 if the point is inside the circle,
% 0 if the point is on the circle, and 1 if the point is outside
% the circle.
%
% A point is considered on the circle if (X^2 + Y^2) is inside the
% range (1 + TOL) to (1 - TOL).
```

- (b) (4 points) Create a new function `vclassify` that is similar to the function in part (a) except that `x` and `y` are now vectors of x-coordinates and y-coordinates, respectively. For example,

```
>> vclassify([0, 1, 3], [0, 0, 5], 1e-6)
ans =
    -1     0     1
```

This can be done without a loop, although you may use loops if you want. You should include suitable help comments.

2. (14 points) Create a script named `test2.m` to answer questions 2–4.

(a) Consider the following MATLAB code:

```
result = zeros(1, length(vec));
for idx = 1:length(vec)
    if vec(idx) > 5
        result(idx) = 1;
    end
end
```

- i. (2 points) In a comment, explain using 1–2 sentences what the code is trying to accomplish.
- ii. (2 points) Rewrite the code using a single MATLAB statement.

(b) Consider the following MATLAB code:

```
result = 0;
[r, c] = size(A);
for row = 1:r
    for col = 1:c
        result = result + A(row, col);
    end
end
```

- i. (2 points) In a comment, explain using 1–2 sentences what the code is trying to accomplish.
- ii. (2 points) Rewrite the code using a single MATLAB statement.

(c) (6 points) Using nested loops (like in part (b)) write a script that computes the transpose of a matrix `A`. You should not assume anything about the size of `A` except that the number of rows and the number of columns are both greater than zero. You should not use any MATLAB functions or the transpose operator.

3. (14 points) Congratulations! You've gotten a summer job working as a research assistant in a professor's lab. Your first task is to analyze some data collected by a graduate student in the lab. The data is stored in a file as a table having two columns; an example of a good data file is shown below:

measurement of X	measurement of Y
10.23	126.3
9.833	138.43
10.7514	120.531
(and so on)	

Unfortunately, the graduate student made some errors recording the results and some (much less than half) of the measurements have been recorded in the wrong columns (i.e., in some of the rows, the X and Y measurements have been swapped). Your job is to find the incorrect measurements, fix the incorrect measurements, and then perform a simple analysis of the data.

To answer this question, create a script named `test2.m` and complete the following parts:

- (4 points) Save a copy of the file <http://www.eecs.yorku.ca/course/1541/test2/data.txt>. Read the contents of the file using `textread`
- (2 points) Create a histogram of all of the measurements; you do not need to label the plot. Based on the histogram results, what is a value that correctly separates the X and Y measurements? Record your answer in your script.
- (4 points) Based on your answer to part (b), find and correct the swapped X and Y measurements. Record the steps in your script so that I can repeat your answer in MATLAB.
- (2 points) Create a boxplot of the corrected measurements. Label the x axis using the labels 'X' and 'Y' for the two groups of measurements. You do not need a label on the y axis or a title. If you are having difficulty with part (b) then create a boxplot of the original measurements.
- (2 points) Compute the mean and standard deviation of the corrected measurements.

4. (12 points)

- (a) (3 points) Consider the following logical statement for a scalar  $x$ :  $\sim(x > 0 \ \& \ x < 10)$   
Rewrite the statement using an OR statement (hint: consider the mathematical interpretation of the statement).
- (b) (3 points) There are two types of loops in MATLAB: **while** loops and **for** loops. What is the rule for choosing which type of loop you should use?
- (c) (3 points) You should know that a boxplot has a default maximum whisker length; can a boxplot have a whisker length of zero if you don't modify the **'whisker'** property of the boxplot? Describe what your data must look like for this to occur.
- (d) (3 points) Consider the following user-defined function:

```
function [x, y, z] = myfunction(a, b, c, d)

x = a * b + c;
y = d - x;

end
```

How many inputs and outputs does **myfunction** have? Ignoring the poor style and lack of help comments, what has the programmer forgotten to do in **myfunction**?