EXAM 2 – WRITTEN PORTION

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Written Portion	/ 50
Computer Portion	/ 50
Total	/ 100

USE MATLAB SYNTAX FOR ALL PROGRAMS AND COMMANDS YOU WRITE

Problem 1: (4 points) If we run the code snippet

```
A(2:3,2) = 1
```

in the Command Window, what do we get for `A`?

a. $\begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}$

b. 1

c. $\begin{bmatrix} 0 & 1 \\ 0 & 1 \end{bmatrix}$

d. $[0 \quad 1 \quad 1]$

e. $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$

f. $\begin{bmatrix} 0 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$

g. $\begin{bmatrix} 0 & 0 \\ 1 & 1 \\ 1 & 1 \end{bmatrix}$

h. $\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$

i. $\begin{bmatrix} 0 & 0 \\ 0 & 1 \\ 0 & 1 \end{bmatrix}$

j. $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 1 \end{bmatrix}$

k. Nothing, because MATLAB crashes.

l. Other (explain): _____

Problem 2: (4 points) What is `c` after this code finishes running?

```
a = [1 4 16];
b = [2 1 -1];
c = sqrt(a).*(b.^2);
```

a. $[4 \quad 2 \quad -4]$

b. $[4 \quad 4 \quad 16]$

c. $[2 \quad 2 \quad 4]$

d. $[4 \quad 2 \quad 4]$

e. $[2 \quad 4 \quad -16]$

f. $[2 \quad 2 \quad -4]$

g. $[4 \quad 4 \quad -16]$

h. The program crashes.

i. Other (explain): _____

Problem 3: (4 points) Below is a main code followed by code for a function:

```
% Main code:
a = 3;
b = 1;
[c] = myFunction(a,b);

% Function code:
function [z] = myFunction(x,y)
z = x^2 + 3*y;
```

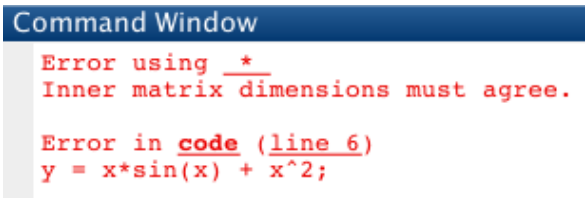
What is `z` in the main workspace after we run the main code?

a. 9
b. 10
c. 11
d. 12
e. `z` is undefined in the main workspace.
f. The program crashes before `z` is computed.
g. Other (explain): _____

Problem 4: (4 points) Suppose we run the code snippet shown below from the MATLAB editor:

```
x = [0:0.1:3];
y = x*sin(x) + x^2;
```

The code is supposed to create a vector of y values computed from the formula $y(x) = x\sin(x) + x^2$ for x values ranging from 0 to 3 in steps of 0.1. However, MATLAB instead returns the error shown. Fix the code so that, given the vector `x`, the vector `y` is generated in a single line of code (i.e., do **not** use a loop).



Problem 5: (4 points) Below is a main code followed by code for a function:

```
% Main code:
a = 2;
b = 4;
c = 6;
[d] = myFunction(a,b,c);

% Function code:
function [z] = myFunction(w,x,y)
if (w > 2) || (x < 3)
   z = 3*w - x + 2*y;
else
   z = w + 2*x + y;
end
```

What is `d` after we run the main code?

Problem 6: (4 points) Consider the main code shown below that is followed by code for a function:

```
% Main code:
a = 1;
b = 2;
c = 3;
[x] = myFunction(a,b,c);
[y] = myFunction(a,b,c);

% Function code:
function [X,Y] = myFunction(A,B,C)
X = 3*A + C;
Y = 4*B - 2*C;
```

We are supposed to get `x = 6` and `y = 2` when we run the main code, but we instead get `x = 6` and `y = 6`. We know that the function `myFunction` itself behaves properly. Fix the code so it works as expected without modifying or duplicating `myFunction` in any way.

Problem 7: (4 points) You are given a matrix

$$M = \begin{bmatrix} 1 & 4 & 6 \\ 2 & 7 & 8 \\ 3 & 9 & 5 \end{bmatrix}$$

If we run the code snippet

```
A = M(1,:)./(M(:,1)')
```

in the Command Window, what is `A`?

a. $\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$

b. $[1 \quad 1 \quad 1]$

c. $[1 \quad 2 \quad 2]$

d. $\begin{bmatrix} 1 \\ 2 \\ 2 \end{bmatrix}$

e. $[1 \quad 2 \quad 3]$

f. $\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$

g. MATLAB crashes, so `A` is not generated.

h. Other (explain): _____

Problem 8: (4 points) Consider the code shown below:

```
counter = 1;
y = [3:-1:-2];
while y > 0
      fprintf('%1.0f > 0 \n', y(counter));
      counter = counter + 1;
end
```

When we run the code, it is supposed to print to the Command Window the text shown on the right.

However, nothing prints. Fix the code so it behaves as expected.

Command Window

```
3 > 0
2 > 0
1 > 0
```

Problem 9: (4 points) What is `c` after this code runs?

```
a = 10;
b = 1;
c = 2;
while (a > 0) && (b == 1)
    if a > 5
       c = a - 4*b + c;
    else
       b = 0;
    end
    a = a - 3;
end
```

a. The program crashes.
b. 2
c. 5
d. 8
e. 11
f. 13
g. Other (explain): _____

Problem 10: (4 points) Below is a main code followed by code for a function:

```
% Main code:
a = 1;
b = 4;
c = 3;
[d] = myFunction(b,c,a);

% Function code:
function [d] = myFunction(a,b,c)
d = 2*a + b - 3*c;
```

What is `d` after running the main code?

a. The program crashes.
b. −7
c. −5
d. −3
e. 0
f. 7
g. 8
h. 10
i. Other (explain): _____

Problem 11: (4 points) What is `y` after running the code snippet below?

```
y = [-4:3:3]
```

Problem 12: (6 points) Suppose you are provided with a function called `myFunction` whose function declaration (i.e., the first line of the function file) has the following form:

```
function [y] = myFunction(x)
```

The function input `x` is a vector or a scalar, whichever you prefer. The function output `y` has the same dimensions as `x`. For example, if `x` is a scalar, then `y` is also a scalar.

Write a short program to produce a vector of `y` values for `x` values, in steps of 0.2, starting at 6 and ending at -1.

Remember to use proper MATLAB syntax.

EXAM 2 – COMPUTER PORTION

For this exam, you will create **TWO** m-files: a main program called `lastname_firstname_exam_2.m` (all lower case) and a function called `lastname_function.m` (all lower case).

The header section of your code should include your name, section number, and CM number; you do not need to do any other commenting. **There should be no output other than what is requested.**

Problem 1 (15 pts)

Price history data for Apple Inc. stock between October 2006 and October 2016 are provided in an Excel file named `AAPL.xls`. Stock price (in dollars) at market closing is stored in the second column, and the corresponding trading day number (1, 2, 3, etc.) is listed in the first column.

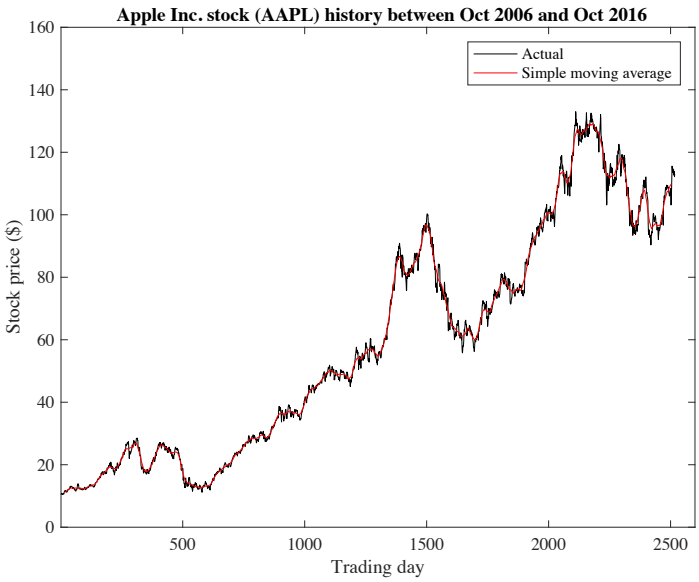
a) (5 points) Download the Excel file from the course website. Load the contents of the file into MATLAB. **Do not** hard-code the dimensions of the loaded array. Create vectors of the trading day and stock price data.

b) (10 points) Download the function file `exam_2_function_1.m` from the course website. This function computes a *simple moving average* curve that smoothly displays the trend of the stock price history data. The first line of the function is as follows:

```
function [SMA, daysSMA] = exam_2_function_1(price, ndaysSMA)
```

where `SMA` is a vector of the simple moving average values; `daysSMA` is the corresponding vector of trading days for which the average values were computed; `price` is the vector of stock price data you created in a); and `ndaysSMA` is the number of trading days used for averaging. You are welcome to inspect the function file, but **do not modify the function in any way.**

Using this function, compute the simple moving average curve for the Apple Inc. stock price history using 29 trading days for averaging. Plot the price data as a **solid black line** and the simple moving average curve as a **solid red line** on the same axes, with trading days on the horizontal axis. Set the axes so that the plot displays days from 1 to 2600 and stock price ranging from \$0 to \$160. Make sure you include good axis labels, a title, and a legend. When finished, your figure should look like the one shown on the right. (The simple moving average curve is a bit difficult to see, but it *is* plotted.)



(over)

Complete the next two problems in your main program file, `lastname_firstname_exam_2.m`, *started for Problem 1.* ***Do not create a new file.***

Problem 2 (15 pts)

Download the function file `exam_2_function_2.m` from the course website. This function calculates the output y value for a particular formula with input value x. The first line of the function is as follows:

```
function [y] = exam_2_function_2(x)
```

where `y` and `x` correspond to the y and x values, respectively. Inspect the function file to determine if `y` and `x` are scalars or vectors. **Do not modify the function in any way.** Using this function, have your program generate vectors of x and y values, with x values starting at 0 and increasing in steps of 0.005, so long as the value of y is greater than -2. **Do not generate any further values.** Create a **new** figure (i.e., **do not** overwrite your graph from Problem 1) in which you plot the y values on the vertical axis against the x values on the horizontal axis. Plot the resulting curve as a **solid black line**. Label the horizontal axis "x value" and the vertical axis "y value". You do not need to include a title.

Problem 3 (20 pts)

a) (10 points) Write a function with 2 inputs and 2 outputs. The 2 inputs are a parameter b and an angle θ (in radians, rad); the 2 outputs are the x-y values of a curve. The first line of the function must have the form

```
function [x, y] = lastname_function(b, theta)
```

where `x`, `y`, `b`, and `theta` are x, y, b, and θ, respectively. The curve's x-y values are calculated according to the following equations:

$$r = e^{\cos\theta} - b\cos(2b\theta) + \left(\sin\left(\frac{\theta}{6b}\right)\right)^5$$

$$x = r\sin\theta$$

$$y = r\cos\theta$$

The function input θ and the outputs x and y may be scalars or vectors, whichever you prefer.

b) (10 points) Using your function created in a), generate vectors of the curve's x-y values for $b = 2$ and θ values ranging from 0 rad to 27 rad in steps of 0.01 rad. In a **new** figure, plot the curve as a **solid blue line**. Label the horizontal axis "x value" and the vertical axis "y value". Give your figure the title "Spread your wings and fly". Also include the `axis equal` command.

When you are finished, put your main program (`lastname_firstname_exam_2.m`) and your function (`lastname_function.m`) in the Moodle assignment dropbox.

NOTE: All programming must stop 5 minutes before the end of the period. You will have 5 minutes after that to upload your files to Moodle if you need that time.