UNIVERSITY OF CALIFORNIA, BERKELEY
Department of Civil and Environmental Engineering

Practice Midterm 01

50 minutes – 50 pts

Question	**Points**	**Grade**
1	**4**	
2	**5**	
3	**6**	
4	**16**	
5	**7**	
6	**12**	
Total	**50**	

Notes

(a) Write your name and your SID on the top right corner of EVERY page (including the first page)
(b) Full credit will be awarded only if the correct answer is given in the box provided. Partial credit may be awarded with respect to the work you show outside the boxes
(c) You may not leave the exam room before the exam ends
(d) No calculator / computer is allowed
(e) You may have one sheet of notes written on both sides

Your PRINTED FULL NAME + signature

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Please circle your LAB Section:

11 M-W 6-8 Etcheverry	12 M-W 10-12 Etcheverry	13 M-W 2-4 Etcheverry	14 M-W 4-6 Etcheverry	15 Tu-Th 8-10 Etcheverry	16 Tu-Th 10-12 Etcheverry	17 Tu-Th 12-2 Etcheverry
18 Tu-Th 2-4 Etcheverry	19 Tu-Th 4-6 Etcheverry	20 M-W 8-10 Etcheverry	21 M-W 10-12 Wheeler	22 Tu-Th 6-8 Etcheverry	23 Tu-Th 6-8 Wheeler	24 M-W 6-8 Wheeler

Question 1

Consider the following equation:

$$F = G\frac{m_1 m_2}{r^2}$$

Where `G` is a constant equal to `6.673x10`$^{-11}$, and `m1`, `m2`, and `r` are all arrays of size n by 1. Circle the answer to the following questions about writing this equation in MatLab.

(a) What is the correct way to calculate the array F?

A) `F = G*m1*m2/r^2`
B) `F = G*m1.*m2/r*r`
C) `F = G*m1.*m2./r^2`
D) `F = G*m1.*m2./r.^2`
E) `F = G*(m1.*m2)./r.*r`

(b) Now assume that F is calculated in the command window. What is true about the dimensions (size) of F?

A) F will be a column vector
B) F will be a row array
C) F will be a scalar value
D) F will be a square matrix
E) Not enough information to tell

(c) Assuming that `G`, `m1`, `m2`, and `r` are scalar numbers, then class of `F` is:

A) char B) string **C) double** D) struct E) cell

(d) If `G`, `m1`, `m2`, and `r` are now only scalar numbers, then the following code will correctly calculate the value of F:

```
>> F = G*m1*m2/r^2
```

TRUE FALSE

Question 2

For the following multiple choice or TRUE / FALSE Questions, please clearly circle or underline your answer to each question. If you are uncertain or unable to circle only 1 answer, please justify yourself in words beneath the question in a blank space.

(a) A function's workspace shares the same workspace as the command window

TRUE **FALSE**

(b) Which of the following statements on mfiles and MatLab functions are true?

I. mfiles have no input or output variables
II. functions must have input or output variables
III. functions can be called within another function, whereas mfiles cannot
IV. mfiles use the command window's workspace

a) I only b) II and III c) I, II, IV **d) I, IV** e) IV only

(c) Given an m x n array of numbers, it is possible to access any set of sub-matrices, horizontal, or vertical arrays using a single line of matlab.

TRUE FALSE

(d) Given a random real number X, the absolute value of the difference between `floor(X)` and `ceil(X)` must be 1

TRUE **FALSE**

(e) It is possible for a function to call itself within the body of its code

TRUE FALSE

Question 3

The following MATLAB commands are saved in a script file called `examQuestion3a.m` and `examQuestion3b.m` What is the value of `x` when the script file `examQuestion3a.m` is executed? What is the value of `n` and `counter` when `examQuestion3b.m` is executed? Do not worry about the exact format of the output.

Script file `examQuestion3a.m`

```
x = 0;
for i = 1:1000
   for j = 1:2000
      if i == j
      x = x + 1;
      end
   end
end
```

```
x = 1000
```

Script file `examQuestion3b.m`

```
n = 256;
counter = 1;

while n ~= 1
   if rem(counter,2) == 0
         n = n/2;
   else
         n = n/4;
   end

   counter = counter + 1
end
```

```
n = 1
```

```
counter = 6
```

Question 4

Consider the following 5 lines of MatLab code entered in the MATLAB command window:

```
>> X = [7 7 7 7];
>> Y = 6:9;
>> W = 3;
>> Z = 2;
>> V = 8;
```

What is the output when the following commands are typed in sequence from the MATLAB command window? Do not worry about the exact format of the output.

```
>> V ~= X
```

```
ans = 1  1  1  1
```

```
>> V == Y
```

```
ans = 0  0  1  0
```

```
>> X+Y/2
```

```
ans = 10.0000   10.5000   11.0000   11.5000
```

```
>> V/Z*W
```

```
ans = 12
```

```
>> 4*W/Z^2+2
```

```
ans = 5
```

```
>> Z*[1:2:6]
```

```
ans = 2     6    10
```

```
>> a = [W,Z,V,Z]
>> [a',X']
```

```
ans = 3      7
      2      7
      8      7
      2      7
```

```
>>  (X>=Y) ~= (W*2 == Y)
```

```
ans =  0      1      0      0
```

Question 5

1. Consider the following parametric functions:

$$x = \sin(t)\left(e^{\cos(t)} - 2\cos(4t) - \sin^5\left(\frac{t}{12}\right)\right)$$

$$y = \cos(t)\left(e^{\cos(t)} - 2\cos(4t) - \sin^5\left(\frac{t}{12}\right)\right)$$

Create a function in MatLab called myButterfly which accepts an array of numbers (t) as input. The corresponding array of X and Y coordinates should be the output, as described by the equations above. The declaration line of the function should look like:

```
function [X,Y] = myButterfly(t)
```

Write the remainder of the myButterfly.m here:

```
function [X,Y] = myButterfly(t)

X = sin(t)*.(exp(cos(t)) – 2*cos(4*t) – sin(7/12).^5);

Y = cos(t)*.(exp(cos(t)) – 2*cos(4*t) – sin(7/12).^5);
```

Plot your function for t = 0 to 12π with an increment of 0.01π. No additional plotting parameters are needed (e.g. axis, grid, line style, plot color). This plot should go in the bottom right corner of a [2 x 2] subplot. You may use up to 3 lines of code.

```
>> [X,Y] = myButterfly(t);

>> subplot(2,2,4), plot(X,Y)

>>
```

Question 6

Consider the following arrays defined in MatLab's workspace:

$$W = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 2 & 3 & 0 & 0 \\ 4 & 5 & 6 & 0 \\ 7 & 8 & 9 & 1 \end{bmatrix} \qquad Z = \begin{bmatrix} 2 & 9 & 0 \\ 7 & 5 & 6 \end{bmatrix}$$

Retrieve the following sub-matrices from W and Z in a single line of MATLAB code:

Retrieve or create from W the following sub-arrays:

$\begin{bmatrix} 2 & 0 \\ 7 & 9 \end{bmatrix}$

```
>> W([2,4],[1,3])
```

$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$

```
>> W([5,9:10,13:15])
```

$\begin{bmatrix} 1 & 1 \end{bmatrix}$

```
>> W([1,end])
```

Retrieve or create from Z the following sub-arrays:

$\begin{bmatrix} 6 & 0 & 5 & 9 & 7 & 2 \end{bmatrix}$

```
>> Z(6:1)
```

$\begin{bmatrix} 6 & 5 & 7 \\ 2 & 9 & 0 \end{bmatrix}$

```
>> [Z(2,3:-1:1);Z(1,:)]
```

Retrieve or create from W and Z the following sub-arrays:

$\begin{bmatrix} 9 & 0 & 2 & 3 \\ 5 & 6 & 4 & 5 \end{bmatrix}$

```
>> [Z(:,1:2), W(2:3,2:3)]
```