Department of Mechanical Engineering
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E7 Midterm Examination 1

October 12, 2012

NAME :

SID : ________________________________

SECTION : **1** or **2** (please circle your discussion section)

LAB :

#11: TuTh 8-10	#12: TuTh 10-12	#13: TuTh 12-2	#14: TuTh 2-4
#15: TuTh 4-6	#16: MW 8-10	#17: MW 10-12	#18: MW 2-4
#19: MW 4-6	#20: TuTh 10-12*	#21: MW 3-5 *	#22: TuTh 4-6*

(please circle your lab section) * in Wheeler

Part	Points	Grade
A	10	
B	8	
C	10	
D	5	
E	12	
F	15	
TOTAL	**60**	

Carefully read and follow these instructions:

1. Write your name on the top right corner of each page.
2. Record your answers only in the spaces provided.
3. You may not ask questions during the exam.
4. You may not leave the exam room before the exam ends.
5. You may not use any electronic devices.
6. You may use a 1-page 8.5×11 of handwritten notes.
7. Count the number of pages before the start of the exam.
   There should be **8 pages**.

Part A (10 points)

Let two MATLAB arrays `A` and `B` be defined as

```
>> A = 1:5
>> B = [1 2 3 2 1]
```

Record the output of the following MATLAB commands:

A.1 (1 point)

```
>> A

    ans =
```

A.2 (1 point)

```
>> A+B

    ans =
```

A.3 (1 point)

```
>> [A B]

    ans =
```

A.4 (1 point)

```
>> B./B

    ans =
```

A.5 (1 point)

```
>> A+4

    ans =
```

A.6 (1 point)

```
>> 1./B

    ans =
    ans =
```

A.7 (1 point)

```
>> B.^2

    ans =
```

A.8 (1 point)

```
>> [A' B]

    ans =
```

A.9 (1 point)

```
>> size([A;B])

    ans =
```

A.10 (1 point)

```
>> A.*B

    ans =
```

Part B (8 points) Suppose that the following code is executed.

```
clear
A = cell(2,2);
A{1,1} = linspace(0,5,100);
A(1,2) = {{'Hello' 'World'}};
A{2,1} = A(1,1);
A{2,2} = {@cos, @(v) 10-2*v};
```

B.1 (1 point) Write a 1-line command that returns the contents of cell (1,2) of `A`.

```
>>
```

B.2 (1 point) Write a 1-line command that changes the second word in the contents of cell (1,2) of `A` to `'Earth'`.

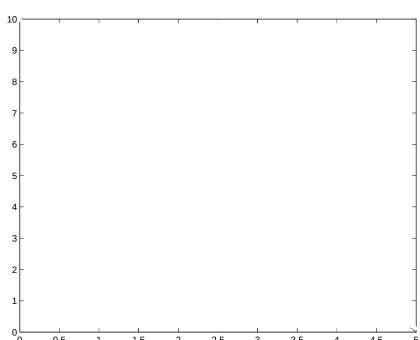
```
>>
```

B.3 (1 point) What does `class(A{2,1})` return?

B.4 (1 point) What does `size(A{2,1})` return?

B.5 (4 points) In the space provided below, sketch the graph produced by executing the MATLAB statement below. Write ERROR if the code produces an error.[1]

```
plot(A{1,1},A{2,2}{2}(A{1,1}))
```



[1] `plot(X,Y)` plots the elements of vector `Y` (vertical axis) versus elements of vector `X` (horizontal axis).

Part C (5+5 points)

Write the outputs of the following MATLAB commands:

```
>> A = [5 ; 6];
>> B = [3 ; 4];
>> C = 3;
>> B(2) = 2;
>> B = B - C
```

```
>> t = sum([A, -a] .* B);
>> t = [t ; B(2,:)]
>> [i,j] = find(t>0);
>> i
```

<u>Part D</u> (5 points)

Let the function M-file **myfun.m** be given by

```
function r = myfun(x)
% Calculate twice of reciprocal function evaluation
reciprocal = 1/x;
r = 2*reciprocal;
```

Suppose that `myfun` is visible to MATLAB and the workspace is clear. Write the output of the MATLAB statements below. Write `ERROR` if the statement produces a MATLAB error.

D.1 (1 point)

```
>> myfun(4)

    ans =
```

D.2 (1 point)

```
>> myfun(0)

    ans =
```

D.3 (1 point)

```
>> reciprocal

    ans =
```

D.4 (1 point)

```
>> myfun(myfun(1)+1)

    ans =
```

D.5 (1 point)

```
>> a = 2;
>> a = myfun(a)
```

Part E (12 points)

The function `func` takes two input arguments: array `A` and scalar `n`. The function returns array `B` of the same size as `A`. The elements of `B` are specified as follows:

- If `A(i,j)` ≥ 0, then `B(i,j) = 2 * A(i,j)`.
- If `A(i,j)` < 0, then `B(i,j) = n`.

The file `func.m` also contains subfunction `subf`.

Complete the 3 incomplete lines of the code given below.

```
function B=func1(A,n)

B = 2*subf(A,n) ;

function C = subf(C,n)

C(C<0) = n/2;

*************************************
function B=func2(A,n)

B = 2*subf(A,n);

function C = subf(C,n)

C(find(C<0)) = n/2;
*************************************
function B=func3(A,n)

B = 2*subf(A,n);

function C = subf(A,n)

C = (A<0)*n/2 + A.*(A>=0);
```

Part F (15 points)

F.1 (10 points)

The function `min_dist` shown below determines the minimum value of

$$D(x) = \sqrt{f^2(x) + x^2} \quad \text{for } a \leq x \leq b$$

$f(x)$ is a user-defined function. `min_dist` utilizes the matlab-defined function `fminbnd` (see syntax below) [2]

Complete the missing line of code (only 1 line).

```
function D = min_dist(fh,a,b)

Dh = @(x) sqrt( fh(x) .^ 2 + x .^ 2);

[xmin, D]  = fminbnd(Dh,a,b);
```

F.2 (5 points)

Write a 1-line command that uses the function `min_dist` to compute the minimum value of $D(x)$ defined above in the range $-6 \leq x \leq 6$, when the function $f(x)$ is defined by the M-file `MyFun`.

```
>>
```

[2] `[xmin,fmin] = fminbnd(fun,a,b)`
`xmin` is a minimizer of a singled-valued vectorized function with handle `fun` in the interval `a` $\leq$ `x` $\leq$ `b`. `fmin = fun(xmin)`. `fun` is a function handle.