UNIVERSITY OF CALIFORNIA
COLLEGE OF ENGINEERING

E77: INTRODUCTION TO COMPUTER PROGRAMMING FOR SCIENTISTS AND ENGINEERS

Spring 2006
First Midterm Exam—February 22, 2006

[45 points = 45 minutes]

Question	Points	Grade
A	20	
B	7	
C	10	
D	8	
TOTAL	**45**	

Notes:

1. Write your name below and on the top right corner of every page.
2. Please give all your answers only in the spaces provided.
3. You may NOT ask any questions during the exam.
4. You may NOT leave the exam room before the exam ends.

Your **PRINTED NAME + signature**: ____

Your **E77** LECTURE SECTION **1** or **2** (Circle your section #)

Circle your Lab Section (where the graded midterms will be returned).

#11: MW 8-10 (Etch)	#12: MW 10-12 (Etch)	#13: MW 2-4 (Etch)	#14: MW 4-6 (Etch)
#15: TuTh 8-10 (Etch)	#16: TuTh 10-12 (Etch)	#17: TuTh 12-2 (Etch)	#18: TuTh 2-4 (Etch)
#19: TuTh 4-6 (Etch)	#20: MW 8-10 (Latimer)	#21: TuTh 8-10 (Latimer)	

A. <u>20 points</u> (10 questions × 2 points each)

a. We wish to evaluate the formula $\left[\frac{w_1 + w_2 + \ldots w_m}{m}\right]^{-2}$ with `w = [w1 w2 w3 ... wm]` in a MATLAB statement. Which one of the MATLAB statements gives the correct result? Circle your answer.

(a) `1./sum(1/w).^2` (b) `(sum(w)/length(w))^(-2)` (c) `m/sum(w)^2`

(d) `m/sum(w)^2`

b. Consider the following MATLAB statement.

```
>> cars = { 'volvo'     'blue'     22000; ...
            'toyota'    'red'      17500; ...
            'ford'      'green'    20000   };
```

(i) In the MATLAB context, what does the variable `cars` correspond to? Circle your answer.

(a) 3×3 matrix
(b) structure array
(c) string array
(d) cell array

(ii) What will be the output generated by the following MATLAB statement? Circle your answer.

```
>> cars{3,2}
```

(a) `green`
(b) `17500`
(c) `ford`
(d) `'green'` — if you got this you only loose 0.5pts

c. Use the information given in Part b for `cars` and create the 1-D array of structures `newcars`. Each structure has the same fields: `make`, `color`, and `price`. Write the code that would create the array `newcars` in the space below.

newcars = [struct('make', 'volvo', 'color', 'blue', 'price', 22000),
struct('make', 'toyota', 'color', 'red', 'price', 17500),
struct('make', 'ford', 'color', 'green', 'price', 20000)];

or any other form that produces the same result in MATLAB.

d. For the structure array created in Part c, what will be the output of the following MATLAB statements?

(a) `>> newcars(2)`

make: 'toyota'
color: 'red'
price: 17500

(b) `>> newcars(1).color`

blue

e. The following is an incomplete function, saved as file named `myfun.m`. This function accepts as input an array, `x`, and returns two arrays, one of exponent values (e^x) and the other of square root ($\sqrt{x}$) values of `x`. Complete the blanks.

```
function [expx, sqrx] = myfun(x)

% function to compute exponent and square root of array x
expx = exp(x);
sqrx = sqrt(x);
```

f. When the following sequence of MATLAB statements is executed

```
a = [4 8 5; -9 3 7; 2 8 -3];
b = min(max(a'))
```

what will the value of `b` be? Circle your answer.

(a) -9 (b) 3 (c) 7 (d) 8

g. Complete the following MATLAB statements that perform the stated tasks.

(i) Given array $w=[w_1,w_2,\ldots,w_m]$, calculate the arithmetic average defined as $\dfrac{\sum_{i=1}^{m} w_i}{m}$.

`average = sum(w) /` length(w)

(ii) Write a single MATLAB statement to plot w_i versus i , for i ranging from 1 to m.

```
>> plot(1:length(w),w);
```

h. Given the following code for a MATLAB function `inc`

```
function y = inc(z)
z = z+2;
y = 2*z;
```

and that the MATLAB statements given below are executed

```
>> z = 1;
>> a = inc(z);
>> q = a+z
```

what would be the resulting value for `q`? Circle your answer.

(a) 5 (b) 6 (c) 7 (d) 8

i. Show, in the spaces provided, what is displayed after each one of the following statements is executed sequentially in the MATLAB command window.

```
>> x = [1 2; 2 1]
```

1 2
2 1

```
>> x = x.*x
```

1 4
4 1

```
>> x = x*x
```

17 8
8 17

j. We are given an array A. Write a single MATLAB statement to find the indices of those elements of A that are more than zero and less than one.

```
>> find(A>0 & A<1)
```

B. **<u>7 points</u> (7 questions × 1 point each)**

You are given a matrix, `>> G = [1 2 3; 4 5 6].` What are the results of the following MATLAB statements:

(a) `>> G(2,:)`

4 5 6

(b) `>> [ 7 8; G(:,2)' ]`

7 8
2 5

(c) `>> size(G*G')`

2 2

(d) `>> G(1,:) + [1 2 3]`

2 4 6

(e) `>> H = [3: 2 : 9, G(2,:)]`

3 5 7 9 4 5 6

(f) `>> G(2,:)./G(1,:)`

4 2.5 2

(g) `>> G(:,1)=[]`

2 3
5 6

C. <u>10 points</u> (3 + 2 + 2 +3)

a. When the following MATLAB program is executed what would be the output from the last statement?

```
p=0; q=0; r=0;
for i = 1 : 2 : 3
     p = p + 1;
     for j = 1 : i
        q = q + 1;
     end
end
disp([p,q])
```

2 4

b. Given that `wt = [2, 5, 6, 8, 3];` what will be the value of `ii` after MATLAB executes the following set of command lines?

```
num=0; ii=1;
while(and(wt(ii)<=5, ii<=length(wt)))
          ii=ii+1;
end
disp(ii)
```

3

c. Write a <u>one-line</u> MATLAB statement to accomplish exactly the same as the code in the above problem.

» find (wt>5, 1)

d. Given x=[1;1] and y=[1;0] evaluate the following MATLAB expression:

(a) `L=[x, y, not(x),or(x,y), and(x, y)]` hint: or is | , and is &, not is ~

____

1 1 0 1 1
1 0 0 1 0

D. <u>8 points</u> (1 + 4 + 3)

The sum of arithmetic series that starts at `x1` and has step `a` can be written as: `S(n) = x1+(x1+a)+(x1+2a) +...+x1+(n-1)*a`. Write this sum in a form that leads to a recursive algorithm

(a) $S(n) = S($n-1$) +$ x1 + (n-1)*a

(b) Write a recursive function that calculates the sum

```
function s = arith_rec_sum(x,a,n)
if n==1
    s=x;
else s= arith_rec_sum (x,a,n-1)+ x+ (n-1)*a;
end
```

(c) Write an iterative function that does the same job

```
function s = arith_iter_sum(x,a,n)
s=0;
for k=1:n
    s= s+(k-1)*a +x;
end
```