UNIVERSITY OF CALIFORNIA, COLLEGE OF ENGINEERING

E77: INTRODUCTION TO COMPUTER PROGRAMMING FOR SCIENTISTS AND ENGINEERS
Second Midterm Exam – April 7, 2004

Question	Points	Grade
A	10	
B	10	**CONFIDENTIAL**
C	14	
D	11	
TOTAL	**45**	

Notes:
1. Write your name below and on the top left corner of every page.
2. Verify that you have all 6 pages of the test.
3. Please give all your answers only in the spaces provided.
4. You may NOT ask any questions during the exam.
5. Please no cell phones, calculators, or talking during the exam.
6. Please do not leave your seat before the end of the exam.

Your NAME: _____   Your SIGNATURE: _____

Your STUDENT ID: _____   SECTION   **1** or **2**   (circle your Lecture Section #)

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

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

A.1. (5 Points) Determine the values of variables **s** and **t** after execution of the following MATLAB statements:

```
>> A = [1 0 2];
>> B = [3 4];
>> s = 0;   t = 0;
>> for m = 1:2
       s = s + t;
       for n = 1:3
         t = t + A(n)*B(m);
       end
    end

>> s

   s = _____

>> t

   t = _____
```

A.2. (5 Points) Given the following MATLAB code

```
>> i = 1;   j = 1;   z = 1;
>> while i < 5
       i = i + 1;
       while j < 3
          z = [z  i+j]   % Note:  Output from this line is not
                         %           suppressed by a semicolon
          j = j + 1;
       end
    end
```

When this code is run, what is printed to the screen? Record your answer below. **Add more lines as needed.**

```
z = _____
```

B. (10 Points) Given a set of 3 linear algebraic equations with 3 unknowns,

$$-6x_1 + x_2 + 2x_3 - 11 = 0$$
$$x_1 - 5x_2 + 2x_3 = 0$$
$$2x_1 + 2x_2 - 7x_3 = 0$$

(a) Write the above equations in matrix form $\mathbf{Ax = b}$:

(b) Write MATLAB statements to create the necessary arrays:

```
>> A =
```

```
>> b =
```

(c) Write a MATLAB statement that solves the matrix equation that you have developed in part (b):

```
>>x =_____
```

C.1. (4 Points) Two relationships to evaluate the sum of the first n odd integers are:

$S_n = 1 + 3 + 5 + \ldots + (2n - 1)$ and
$S_n = S_{n-1} + (2n-1)$

Using the recursive relationship above, finish the recursive function TOT below so that it calculates the sum of the first n odd integers.

```
function total = TOT(n)

  if _____

     total =_____

  else

     total =_____ _ _

  end
```

C.2. (4 Points) The Tribonacci numbers are defined using the recurrence relation
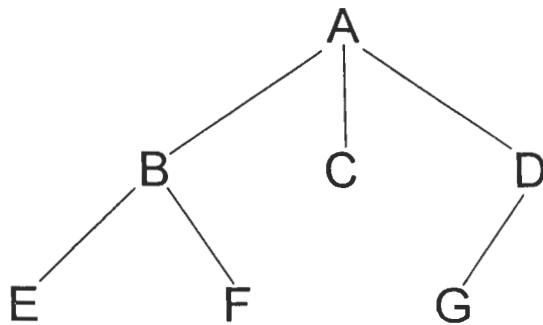
$T_n = T_{n-1} + T_{n-2} + T_{n-3}$

where $T_1 = 1$, $T_2 = 1$, $T_3 = 2$. Use the above relationship to complete the iterative function TRIBO so that it returns an *array* of the first n Tribonacci numbers. The function should work for $n \geq 4$.

```
function t = TRIBO(n)

  t = ._____

  for k=_____


     _____ _____ _____ _____

  end
```

C.3. (6 Points) Consider the following *tree* structure of letters:

(a) Write the sequence of letters that results from the *preorder* traversal of this tree

_____

(b) Write the sequence of letters that results from the *postorder* traversal of this tree

_____

(c) List the *leaves* in this tree

_____

D.1. (2 Points) Check the boxes of all those MATLAB statements below that find one of more roots of the equation $x^3 + x = 1$ as written:

⊔ `>> find(x^3 + x = 1)`

☐ `>> roots([1 0 1 -1])`

⊔ `>> fzero('x^3 + x - 1',[0.1 1])`

⊐ `>> eval('x^3 + x - 1',0.5)`

D.2. (9 Points) Complete the following MATLAB function that solves the equation $x^3 + x = 1$ to within a given tolerance using Newton's method:

```
function root = midterm2_newton(x0,tol)
%This function calculates the root of the equation x^3 + x = 1
%using Newton's method
% Inputs:   x0  - the initial guess
%           tol - the error tolerance
% Output:   root - the calculated root of the equation

xold = _____

delta_x =_____

while _____

   xnew = _____

   delta_x = _____

   xold = _____
end
root = _____
```