MAE-10 : Winter Quarter 2011

Midterm Examination #2

Instructions: You have until the end of the class period to complete the exam. Notes on one side of an 8.5"x11" sheet of paper are allowed. Books and calculators are not allowed.

Section 1: Short Answer. (2 points each)

(1.1) What does the `\n` formatting command do?

(1.2) What task does the Babbage Difference Engine #2 perform?

(1.3) What command is used to open a file? What command is used to close a file?

(1.4) By default, variables and arrays are locally defined. What does that mean?

(1.5) How many elements of the array `AB` will be displayed on the screen?

```
AB = [ 2:5 ; 3:6 ]
fprintf('%f %g %i' , AB)
```

Section 2: Identify all errors in the following segments of code, if any exist, and give an explanation of the error. If you believe that there are no errors write "No errors." (2 points each)

(2.1)
```
x = [10, 20, 30];
y = [20.5, 20.5, 20.5];
if( x(2) > y(2) )
   fprintf('%f' , x(2) )
else
   fprintf('%f', y(1), y(2) )
end
```

(2.2)
```
x = 2:4:6 ;
for j=x
   disp( x(j) )
end
```

(2.3)
```
n = 10;
for i=1:n
   for j=1:i
     if( i+j > 3 )
        break
     else
        continue
     end
   end
end
```

(2.4)
```
i = 1;
j = 2;
while( i < 5 )
   j = j - 1;
   a(k) = k^2;
   i = i + 1;
end
```

(2.5)
```
x = 1:2:5 ;
y = 1:1:2 ;
fprintf('%f %f %f %f %g %i %g', x)
fprintf('%6.2i \n %10.0e \n', y)
```

(2.6)
```
hi = 'bye';
bye = 'hi';
fprintf( '%c', hi )
fprintf( '%s \n \t' , bye )
```


Problems (2.7) through (2.10) contain a function program and the "main" program that calls the function, each stored in a separate m-file. Assume both m-files are stored in the same directory. Identify all errors in the "main" or function programs, if any exist, and give an explanation of the error. If you believe that there are no errors write "No errors."

(2.7)
In the "main" program:
```
y = 4;
x = funky(y,7);
fprintf('%7.2f', x , funky(x,7) )
```

In the m-file containing the function `funky`:
```
function [ result ] = funky(x,y)
result = x + y;
return
endfunction
```

(2.8)

In the "main" program:

```
x = 5:5:10 ;
y = 7:7:77 ;
w = funky(x) + funky(y);
```

In the m-file containing the function `funky`:

```
function [ answer ] = funky(w)
w = w .+ 1;
answer = mean(w);
return
endfunction
```

(2.9)

In the "main" program:

```
x = 1:1:10;
y = 1:4:10;
func1(x);
func1(y);
```

In the m-file containing the function `func1`:

```
function [ ] = func1(w)
for i=1:5
   disp( w(i) )
end
return
endfunction
```

(2.10)

In the "main" program:
```
x = [1:5 ; 2:6 ; 3:7 ];
disp( func2( x(2:3,2:3) , x(:,end) ) )
```

In the program containing the function `func2`:
```
function [ w ] = func2(a, b)
w = mean( a(:) ) + mean( b(:) );
return
endfunction
```

Section 3: Write the output from the following segments of code exactly as it would appear if it were executed in Matlab or Octave. Assume that there are no errors. If you are given specific formatting instructions, <u>use underscores to indicate blank spaces</u>. (4 points each)

(3.1)
```
x = (1:5);
y = (2:10);
for i=1:y(1)
   w(i) = x(i) + x(i+1);
end
fprintf('%3i\n', w)
```

(3.2)
```
x = 1;
i = (0:5);
while( i(x) < i(3) )
   y(x) = i(x) + 1 ;
   x = x + 1;
end
fprintf('%4i %4i\n', y )
```
% Note: there is one space between `%4i` and `%4i`

(3.3)
```
x = (1:2) ;
y =   x.^2 ;
z =   x.^3 ;
table1 = [z ; y ; x ];
fprintf('%2i %2i\n' , table1)
```
% Note: there is one space between `%2i` and `%2i`

(3.4)
```
x = 1:3;   w = 2:4;
for i=1:numel(x)-1
  y = x(i);
  while(y < numel(x))
    y = y + 1;
    w(y) = w(y) + 1;
  end
end
fprintf('%5.1f\n', w)
```

Problems (3.5) through (3.7) contain function(s) and the "main" program that calls the function(s), each stored in a separate m-file. Assume all m-files are stored in the same directory. Write the output from the code exactly as it would appear if it were executed in Matlab or Octave.

(3.5)
In the "main" program that calls `funky`:
```
a = 0;   b = 0.5;
y = 9;   w = 9.5;
[w, y] = funky(w, y);
fprintf('%5.1f\n', w)
fprintf('%5.1f\n', y)
```

In the m-file containing the function `funky`:
```
function [a, b] = funky(a, b)
a = b;
w = a + b;
y = a - b;
fprintf('%5.1f\n', w)
fprintf('%5.1f\n', y)
return
endfunction
```

(3.6)

In the "main" program that calls `funky`:
```
a = (1:5);
b = (10:20);
[ a, b ] = funky( a(2:4) , b(2:4) );
fprintf('%3i\n', a )
fprintf('%3i\n', b )
```

In the m-file containing the function `funky`:
```
function [ a , b ] = funky (a, b)
for i=1:a(1)
    a(i) = a(i) + 1;
    b(i) = b(i) - 1;
end
endfunction
```

(3.7)

In the "main" program that calls `func1` and `func2`:
```
a = 1;   b = 2;
c = [3, 4];
w = func1(a, b)  +  func2( c(2) );
fprintf('%3i', w)
```

In the m-file containing the function `func1`:
```
function [ out ] = func1 (x, y)
out = func2(x) + func2(y);
return
endfunction
```

In the m-file containing the function `func2`:
```
function [ out ] = func2 (y)
fprintf('%3i\n', y  )
out = 2*y;
return
endfunction
```

Section 4: Write a function to complete the following tasks. You do not have to write the output of the code.

(4.1) (5 points) A program calls a function called `maxmin`:

```
[ maxval, minval ] = maxmin( A );
```

Write the function `maxmin` that takes as input an array called `A`. The function finds the maximum and minimum values in the array. For example, if `A` contains the values,

```
-2    34   78
99   100   21
-3    -4    0
 6     9    0
```

`maxval` would be `100` and `minval` would be -4.

Your function must be general for any sized `A` array. You <u>cannot</u> use any of Matlab/Octave's built-in functions for this problem except functions that determine the number of elements, rows, or columns in an array.

(4.2) (5 points) A program calls a function called `pdiff`:

    [maxdiff, mindiff] = pdiff(temps);

Write the function `pdiff` that takes as input an array called `temps`. This array contains two columns of temperatures recorded at UCI over many days. The first column of the array contains the lowest temperature on a particular day and the second column contains the highest temperature on the same day. The function returns as output the maximum difference (`maxdiff`) and minimum difference (`mindiff`) between the high and low temperatures. For example, if `temps` contained the following data:

    56   65
    55   68
    49   70
    51   66

`maxdiff` would be `21` and `mindiff` would be `9`.

Your function must be general for any sized `temps` array. You <u>cannot</u> use any of Matlab/Octave's built-in functions for this problem except functions that determine the number of elements, rows, or columns in an array.

(4.3) (5 points) A program calls a function called `switchrow`:

      `y = switchrow(x,a,b)`

Write the function called `switchrow` that takes as input an array `x` and returns as output an array `y` whose rows `a` and `b` are switched. For example,

if `a` is **1**, `b` is **3**, and array `x` contains,   the array `y` would contain,

1	2	3	4			6	7	8	9
4	5	6	7			4	5	6	7
6	7	8	9			1	2	3	4

Your function must be general for any `a`, `b`, and `x`. Assume the values of `a` and `b` do not exceed the total number of rows in `x`. You <u>cannot</u> use any of Matlab and Octave's built-in functions for this problem except functions that determine the number of elements, rows, or columns in an array.