Midterm Exam
3/2/2016
25 questions, 50 minutes, 10 pages
Version 321465

Name:_____

Student ID:_____

GSI name/Lab number:_____

UC Berkeley Honor Code: "As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others."
On my honor, I have neither given nor received any assistance in the taking of this exam.

Signed: _____

Instructions:

1. Write your full name on the front of the bubble sheet and write your GSI name and lab group number in the box labeled Version.

2. Bubble in your student ID number.

3. Record your answers on the bubble sheet (pen or pencil is fine). There is one correct answer for each question. Multiple bubbles, incomplete bubbles, or stray marks will be marked incorrect.

4. Bubble sheets will not be returned, so mark your answers on these pages as well for future reference.

5. You may use one 8.5" by 11" sheet of notes (both sides) for this exam provided you do not disturb those sitting nearby.

6. No electronic devices are permitted in your work area.

7. There will be no questions regarding the exam during the examination time except in cases where there is a missing page or printing problem with your exam.

8. Please do not get up to leave until the exam is over.

9. At the end of the exam, hand in the completed bubble sheet AND the questions to your primary GSI.

1. When executing the following piece of code, which line will generate an error?

```
a = [2 3 4];   % Line 1
b = 0.5*a;     % Line 2
c = d + b./a; % Line 3
d = 0.5*c;     % Line 4
```

   (a) Line 1
   (b) Line 2
   (c) Line 3
   (d) Line 4
   (e) MATLAB will not return an error

Consider this function for the next two questions:

```
function [output] = myStructArray(input)
n = length(input)/2;
    for i = 1:n
        output(i).name = input{i};
        output(i).instrument = input{i+n};
    end
end
```

Then the following is typed into the command window:

```
>>input = {'Paul','John','George','Ringo','Bass','Guitar','Guitar','Drums'};
>>output = myStructArray(input);
```

2. What does `output(4).instrument` return?

   (a) `Drums`
   (b) `Bass`
   (c) `Guitar`
   (d) `Ringo`
   (e) MATLAB will return an error.

3. What does `class(output(3).name)` return?

   (a) `string`
   (b) `double`
   (c) `cell`
   (d) `char`
   (e) None of the above.

4. You are writing a function that takes two numbers and gives a result. To help handle a case that causes an error, you add a branching statement into the function that displays an error message when that condition occurs, like this:

```
function [result] = myFunction(A,B)
    if isa(A,'char')
        fprintf('Cannot run function! \n');
    else
        result = 2*A*B;
    end
end
```

You now run your function in Matlab by defining variable A as 'test' and B as 10, so that A should be caught by your branching condition:

```
u = myFunction('test',10)
```

But, you still get an error. Why is an error generated in this case?

(a) The branching statement did not check the input B

(b) The branching statement should be using an `elseif` instead of an `else`

(c) The branching statement has one too many `end` statements

(d) The function is not returning a value if the error condition is met

(e) The function is actually correct now and should run without an error

5. Consider the function:

```
function [result] = myFunction(x,y,z)
    zz = z / y;
    result = x / y - z;
    result = zz;
end
```

What will be the value of variable `zz` after typing the following into the command window?

```
xx = 4;
yy = 2;
zz = 10;
result = myFunction(xx, yy, zz);
```

(a) The variable `zz` will be undefined

(b) The code will produce an error

(c) -8

(d) 5

(e) 10

6. Which of the following keywords can be used more than one time in relation to a single `if` statement:

   (a) `if`
   (b) `elseif`
   (c) `else`
   (d) `otherwise`
   (e) None of them can be used more than once.

7. What will be the value of variable `T` after executing the following code:

```
T = 10;
if T > 0
    T = 2 * T;
elseif T > 5
    T = 3 * T;
else
    T = 0;
end
```

   (a) 10
   (b) 20
   (c) 30
   (d) 0
   (e) Variable `T` will be undefined

8. Given two matrices, `A = [2, 7, 6; 9, 5, 1; 4, 3, 8]` and
   `B = [5, 4, 3; 10, 6, 4; 5, 5, 0]`, which of the following expressions will evaluate to `true`?

   (a) `sum(A(1,:)) == sum(B(:,2))`
   (b) `(A(2,2)*B(1,3))/sum(A(:,2)) == 1`
   (c) `isa(A,'double')`
   (d) A and B only
   (e) A, B, and C

9. Choose the most precise answer. Quicksort is efficient because it

   (a) uses a recursive algorithm.
   (b) uses an iterative algorithm.
   (c) is an exponential algorithm.
   (d) uses a divide and conquer algorithm.
   (e) saves storage space.

10. Arrays `A`, `B`, and `C` are defined below. Which array will be sorted (into ascending order) in the fewest number of steps using a bubblesort algorithm?

```
A = [6 1 2 3 4 5];
B = [2 3 4 5 6 1];
C = [6 5 4 3 2 1];
```

   (a) A

   (b) B

   (c) C

   (d) They all will require the same number of steps

   (e) It is impossible to tell

11. Suppose you have the following code in your script file:

```
for j = 10:-2:4
    A(j) = (2 + j)^2;
end
```

   Upon completion of this code, what is the value of `j`?

   (a) j = 144

   (b) j = 4

   (c) j = 36

   (d) j = 10

   (e) An error will result.

12. To rotate a matrix counter-clockwise, you create the following function:

```
function [new_mat] = rotate_ccw (mat)
[rows columns] = size(mat);
new_mat = zeros(columns,rows);
for r = 1:rows
    for c = 1:columns
        new_mat(c,r) = <EXPRESSION>;
    end
end
```

   Fill in for <EXPRESSION>. For example, if a = [1 2 3; 4 5 6] then b = `rotate_ccw(a)` should yield b = [3 6; 2 5; 1 4]. Hint: try out the expressions below for the matrices given here.

   (a) mat(rows, columns)

   (b) mat(r, c)

   (c) mat(rows - r + 1, c)

   (d) mat(r, columns - c + 1)

   (e) mat(rows - r + 1, columns - c + 1)

13. What will be the value of j after the execution of the following piece of code ?

```
n=10;
j=0;
while j<n
    j=j+1;
end
```

   (a) 0

   (b) 1

   (c) 9

   (d) 10

   (e) 11

14. Which of the following conditions MUST be true AFTER the while loop finishes?

```
while (A < A_max) || (B < B_max)
    A = A + 5;
    B = B + 10;
end
```

   (a) (A >= A_max) || (B >= B_max)

   (b) (A <= A_max) && (B >= B_max)

   (c) (A <= A_max) || (B >= B_max)

   (d) (A >= A_max) && (B >= B_max)

   (e) None of the above.

15. You are given the function:

```
function [ ] = weirdMultiplier(num)
    fprintf('num = %f \n', num);
    if num <= 100
        weirdMultiplier(2*num);
    end
end
```

   A user enters the command weirdMultiplier(25) in MATLAB's command window. How many *recursive* calls are made? (That is, how many calls are made to the function weirdMultiplier from within itself?)

   (a) 2

   (b) 3

   (c) 4

   (d) 25

   (e) none of the above

16. You are given the function:

```
function [output] = myAlgorithm(P,n,x)
    output=P(n+1);
    for i=n:-1:1
        output=output*x+P(i);
    end
end
```

where `P` is an array containing `n+1` elements.

The time complexity of this function is:

(a) $O(1)$

(b) $O(\log n)$

(c) $O(n)$

(d) $O(n^2)$

(e) $O(n \log n)$

17. Which of the following is NOT true about floating point variables (in IEEE format):

(a) Floating point variables can represent a much larger range of numbers in the same amount of space (memory) as integers.

(b) MATLAB uses 64 bit double-precision floating point numbers as a default for storing decimal values.

(c) Floating point variables can exactly represent all decimal numbers within their range.

(d) Operations on floating point variables often generate small amounts of error.

(e) Floating point variables have variable spacing between representable numbers.

18. You are given this function:

```
function [y] = Division(n)
    y=0;
    while n>1
        n = n/3;
        y=y+1;
    end
end
```

The time complexity of this function is:

(a) $O(n^2)$

(b) $O(n)$

(c) $O(C^n)$

(d) $O(\log n)$

(e) $O(n^3)$

19. What will `y` equal after running the following code?

```
string = '1001';
if string(3)=='0'
    j=5;
else
    j=10;
end
y=j*length(string);
```

   (a) 20
   (b) 40
   (c) 70
   (d) 5
   (e) 10

20. What will be the value of the variable `z` after the following function is called with the command `z = NestedBranching(5, 3)`?

```
function [out] = NestedBranching(x,y)
    if x>2
        if y<2
            out=x+y;
        else
            out=x-y;
        end
    else
        if y>2
            out=x*y;
        else
            out=1;
        end
    end
end
```

   (a) 8
   (b) 2
   (c) 15
   (d) 1
   (e) null

21. What is the 8-bit binary representation of the integer 49?

    (a) 01000011
    (b) 00110001
    (c) 00111000
    (d) 01100001
    (e) 00110010

22. Which line will produce an error if the function below is called with the command
    `out = sweetFunc([1 2 3 4 5 6 7 8])`?

```
function [out] = sweetFunc(a) %a is a 1D array
    for n = 1:length(a)              %Line 1
        z(n) = 0.5*(a(n)+a(n+1));    %Line 2
    end                              %Line 3
out = z;                             %Line 4
end
```

    (a) Line 1
    (b) Line 2
    (c) Line 3
    (d) Line 4
    (e) None of these

23. The variables `A`, `B`, and `C` are defined below:

```
A = [1 2 3 4; 5 6 7 8];
B = [1 1 1 1; 2 2 2 2];
C = B';
```

    Which of the following commands will generate an error?

    (a) `A + B`
    (b) `3*A - 2*B`
    (c) `3*A*B`
    (d) `6*A*C`
    (e) `4 + C`

For the next two questions, consider the function called `partition` below.

```
function [out] = partition(M, evenorodd)
out = [];
if strcmp(evenorodd,'even')
   for i = 2:2:length(M)
       out = [out, M(i)];
   end
else
   for i = 1:2:length(M)
       out = [out, M(i)];
   end
end
end
```

24. What will be the output, `out`, if the following is typed in the command window:

    ```
    >> out = partition([5:3:20],'odd')
    ```

    (a) out = [5, 8, 11]
    (b) out = [8, 14, 20]
    (c) out = [5, 11, 17]
    (d) out = [5, 8, 11, 14, 17, 20]
    (e) An error will be thrown and `out` will not be assigned a value.

25. What will be the output, `out`, if the following is typed in the command window:

    ```
    >> out = partition('What A Wonderful World!','even')
    ```

    (a) out = 'A World!'
    (b) out = 'htAWneflWrd'
    (c) out = 'Wa odru ol!'
    (d) out = 'htWneflod'
    (e) out = 'What Wonderful'