

**Midterm Exam 1**

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25 questions, 25 points, 50 minutes

12 pages

**Name:** \_\_\_\_\_**Student ID:** \_\_\_\_\_**Statement of Academic Integrity**

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 will neither give nor receive any assistance in taking this exam. I will not use any program other than MATLAB on my computer and have turned off all my internet connections.

Signed: \_\_\_\_\_

**Instructions**

1. Write your full name and SID in the blanks above and on the top of the bubble sheet.
2. Read and sign the above statement of academic integrity.
3. Bring your Cal ID to the exam room.
4. Mark your answers on the bubble sheet (pen or pencil is fine). There is one and only one correct choice for each question. Multiple bubbles, incomplete bubbles, or stray marks will be marked incorrect.
5. You may bring notes for this exam provided they are bundled together.
6. Only one laptop is allowed per student and only MATLAB should be running on that computer. The use of any other program or electronic device during the exam constitutes cheating and subjects the offender to immediate dismissal from the exam.
7. Please do not get up to leave until the exam is over.
8. You will be photographed during the exam for the record.
9. At the end of the exam, hand in the completed bubble sheet AND the exam to your primary section GSI.

**Do not open the exam book until instructed to do so.**

1. If you run the following code in your command window, what will the result be?

```
a = [2, 3, 5, 8];  
b = ['r', 'a', 'j', 'a'];  
class(a+b)
```

- (a) logical
  - (b) char
  - (c) struct
  - (d) double
  - (e) string
2. Which of the following are MATLAB classes?

- (a) char
- (b) logical
- (c) double
- (d) cell
- (e) All of above

3. Consider the following excerpt from the ASCII table:

```
Dec Char  
-----  
30 RS (record separator)  
31 US (unit separator)  
32 SPACE  
33 !  
34 "  
35 #  
36 $  
37 %  
38 &  
39 ,
```

What will be the output in the command window when you run the following code?

```
A = 'Hello';  
A(4) = 32
```

- (a) A = 'Hello'
- (b) A = 'Hel32o'
- (c) A = 'Helo'
- (d) A = 'Hel32'
- (e) A = 'Hel o'

4. Consider the code snippet below where  $n$  is an integer:

```
tic;
A = 1;
for i = 1 : n
    A = A * i
    Time = toc;
end
```

We would expect the final value of the variable `Time` to

- (a) remain constant as  $n$  increases
  - (b) increase linearly with  $n$
  - (c) decrease linearly with  $n$
  - (d) increase exponentially with  $n$
  - (e) None of the above
5. The encoder below is supposed to transform an input  $x$  into an output  $y = 3x + 5$ . Your professor has written the following script `testScript.m` to test the encoder:

```
1  global a;
2  a = 5;
3  x = 10;
4  result = encoder(x);
5
6  function y = encoder(x)
7      y = 3 * x + a;
8  end
```

However, when he runs the program, he receives the following error message (excerpt):

Undefined function or variable 'a'.

```
Error in testScript>encoder (line 7)
    y = 3 * x + a;
```

Your professor wants to fix the code to return the correct value for  $y$  without a MATLAB error. Which of the following solutions will work?

- (a) remove line 1
- (b) change line 7 to `"a = 5;"`
- (c) change line 7 to `"y = 3 * x;"`
- (d) insert `"global a;"` between lines 6 and 7
- (e) None of the above

6. Below is an abbreviated code (the outputs) of a function that determines if a given input is a prime number:

```
function [check, value] = myPrimeCheck(x)
% Prime number: any integer other than 0 or 1 that is not divisible without
% a remainder by any other integers except 1 and the
% integer itself.
    if isprime(x)    % x is a prime number: True/False
        check = 1; value = x;
    else
        check = 0; value = 'Non-Prime';
    end
end
```

What will display in the command window after running:

```
>> x = 15;
>> [check, value] = myPrimeCheck(x);
>> class(value)
```

- (a) ans = 'string'
- (b) ans = 'int64'
- (c) ans = 'char'
- (d) ans = 'double'
- (e) ans = 'cell'

7. Consider the three snippets of code below:

- ```
(i)   x = 5;
      while x ~= 1
          disp(x)
          x = x - 1;
      end

(ii)  for x = 1:length(1:5)
          disp(x)
      end

(iii) for x == 1:5
          disp(x)
      end
```

Which of the above snippets are executable?

- (a) (i) only  
 (b) (ii) only  
 (c) (iii) only  
 (d) (i) and (ii)  
 (e) (i), (ii) and (iii)
8. Which mathematical expression does the following function compute? Both  $a$  and  $b$  are non-negative integers.

```
function y = myFun(a, b)

if b == 0
    y = a;
else
    b = b - 1;
    y = a * myFun(a, b);
end
```

- (a)  $y = a \cdot b$   
 (b)  $y = a + b$   
 (c)  $y = a^{b+1}$   
 (d)  $y = b^a$   
 (e)  $y = b^{a+1}$
9. What is the single IEEE 754 (32-bit or 4 bytes) representation of the decimal number 3.5 ?

- (a) 0 01111111 110000000000000000000000  
 (b) 0 10000001 110000000000000000000000  
 (c) 1 10000000 110000000000000000000000  
 (d) 0 10000000 110000000000000000000000  
 (e) 1 10000001 110000000000000000000000

10. The two functions below both calculate and create `fib` which is a list of the first `n` Fibonacci numbers. Which function requires less computing time for a very large `n` and why?

```
function fib = fibA(n)
    fib = zeros(1, n);
    count = 1;
    while count <= n
        if count == 1 || count == 2
            fib(count) = 1;
        else
            fib(count) = fib(count - 1) + fib(count - 2);
        end
        count = count + 1;
    end
end
```

```
function fib = fibB(n)
    fib = [];
    if n == 1
        fib(1) = [1];
    elseif n == 2
        fib = [1, 1];
    else
        fibneg1 = fibB(n - 1);
        fib = [fibneg1, fibneg1(n - 1) + fibneg1(n - 2)];
    end
end
```

- (a) `fibA`, because it is recursive
- (b) `fibB`, because it is iterative
- (c) `fibB`, because it is recursive
- (d) `fibA`, because it is iterative
- (e) Both require similar computing time

11. Consider the following script:

```
x = ones(1,10);
y = '';

for i = length(x) : -1 : 4
    if rem(i,2) == 0
        x(i) = 0;
    end
end

for j = 1 : length(x)
    if x(j) == 0
        y(j) = '1';
    else
        y(j) = '0';
    end
end
```

What will be the value of x?

- (a) x = 1 0 1 0 1 0 1 0 1 0
- (b) x = 0 1 0 1 0 1 0 1 0 1
- (c) x = 1 1 1 0 1 0 1 0 1 0
- (d) x = 0 0 0 1 0 1 0 1 0 1
- (e) x = 1 1 1 1 1 1 1 1 1 1

12. Given the MATLAB program below:

```
v = 1;
w = 0;
[x, y] = test1(v, w);
disp(x)
disp(y)

function [v, w] = test1(a, b)
    w = 2 * test2(a);
    v = b - a;
end

function n = test2(m)
    n = m - 1;
end
```

When you run the code, what are the values of x and y?

- (a) x = -1, y = -2
  - (b) x = -1, y = -1
  - (c) x = 0, y = 0
  - (d) x = 0, y = -1
  - (e) x = -1, y = 0
13. Your friend Alan Mathison was asked to write a function as specified below, and needs your help to finish it. Read the incomplete function and fill in the blank so the function will execute as specified for any char arrays and double.

```
function result = matchingComparison(name1, id1, name2, id2)
% inputs: name1 and name2 are char arrays
% id1 and id2 are double
% output: result 'match' if both names and id's match or 'not a match' otherwise

if _____ & id1 == id2
    result = 'match';
else
    result = 'not a match';
end
```

- (a) name1 = name2
- (b) name1 == name2
- (c) strcmp(name1, name2)
- (d) (b) and (c)
- (e) (a), (b) and (c)



14. What will be the result of the following calculation? (Hint: think round up)

```
15 * int64(40/60) ^ 2
```

- (a) 6.6667
  - (b) 6
  - (c) 7
  - (d) 10
  - (e) 15
15. Given:  $a = 1$ ,  $b = 2$ ,  $c = a$ , which of the following evaluates **True** ?

- (a)  $(a==b)\&((b==c) | (c==a))$
- (b)  $(a==b) | ((b==c)\&(c==a))$
- (c)  $(a==c)\&((b==c) | (c==a))$
- (d)  $(a==c)\&((b==c)\&(c==a))$
- (e) None of the above

16. Variables a to e below show data for 5 babies, whose age is about 5 months old. The first, second, and third input shows the name, height, and weight of the babies, respectively. What would the value of the variable `ans` be after executing the below?

```
a = {'Bianca', 24.8, 15.9}; %inches & lbs
b = {'Felix', 25.3, 15.8};
c = {'Jason', 25.5, 16.1};
d = {'Monica', 24.7, 16.2};
e = {'Vanessa', 25.0, 16.3};
baby_data = {a;b;c;d;e};
```

```
baby_data{3}(1,3)
```

- (a) `[[16.10]]`
  - (b) `[[15.90]]`
  - (c) `'Bianca'`
  - (d) `'Jason'`
  - (e) `'s'`
17. Which of the following tasks can be performed with a for loop but not a while loop?
- (a) print 1 to 100
  - (b) find the first prime number  $> 10000$
  - (c) find out if an element exists in an array
  - (d) ask the user to input 20 numbers
  - (e) None of the above

18.  $A = \begin{bmatrix} 2 & 9 & 3 & 2; \\ 2 & 3 & 10 & 3; \\ 3 & 2 & 3 & 5 \end{bmatrix}$

Which of the following commands will obtain the following: `ans = [2; 3; 5]`

- (a) `A(1,:)`
  - (b) `A(:,4)`
  - (c) `A(3)`
  - (d) `A(3,2)`
  - (e) None of the above
19. Which of the following tasks can be performed with a while loop but not a for loop?
- (a) calculate the arithmetic mean of the scores of all students who take this midterm
  - (b) see how many times you have to throw a simulated dice until getting 6
  - (c) calculate the 0 to 100th elements of the Fibonacci sequence
  - (d) count down 10 seconds from 10 to 0
  - (e) None of the above
20. What is the **overall** memory consumption after the code executes in MATLAB?

```
clear
a = 123456;
b = '123456';
```

- (a) 8 bytes
  - (b) 12 bytes
  - (c) 16 bytes
  - (d) 20 bytes
  - (e) 56 bytes
21. The largest positive number IEEE 754 single precision (32 bits or 4 bytes) can represent in binary is:
- (a) 1 1111111 111111111111111111111111
  - (b) 1 1111110 111111111111111111111111
  - (c) 0 1111110 111111111111111111111111
  - (d) 0 1111110 111111111111111111111110
  - (e) 0 1111110 000000000000000000000000

22. Consider a Turing Machine with the following transition table, starting with state q1 and the tape input 'hayteresah' (starting from the left most character), what would be the output? Note: This Turing Machine never writes blank, and halts when there is no more input.

|    |        |        |        |        |        |        |        |
|----|--------|--------|--------|--------|--------|--------|--------|
|    | t      | e      | r      | s      | h      | a      | y      |
| q1 | f,R,q1 | e,R,q2 |        |        | b,R,q1 | y,R,q1 | e,R,q1 |
| q2 | t,R,qf | i,R,q2 | l,R,q2 | c,R,q2 | a,R,qf | i,R,q2 |        |

- (a) 'byefelicia'
- (b) 'aayteresah'
- (c) 'byeteresah'
- (d) 'hayfelesah'
- (e) There aren't enough base cases to run this Turing Machine.

23. Consider the code below:

```
x = 10;
for i = 1 : x
    x = x - 1;
end
```

This for loop will execute

- (a) once
- (b) 4 times
- (c) 5 times
- (d) 10 times
- (e) None of the above

24. You are given the function:

```
function count = calc(a,b)
count = 0;
for i = 1:a
    for j = 1:b
        for k = 1:a
            if a == b
                count = count + 1;
            end
        end
    end
end
end
```

The time complexity of this function is:

- (a)  $O(a + b)$
  - (b)  $O(a * b)$
  - (c)  $O(a^2 * b)$
  - (d)  $O(2a * b)$
  - (e) None of the above
25. Will the following function give the correct output as specified?

```
function result = identityComparison(id1, bd1, id2, bd2)
% inputs: id1 and id2 are double
% bd1, bd2 are char arrays formatted 'YYYY-MM-DD' representing dates of birth
% output: result 1 if both id's and birthdays match, or 0 otherwise

result = 1;
if id1 == id2
    if all(bd1 == bd2)
        return;
    else
        result = 0;
    end
end
end
```

- (a) Always yes
- (b) In certain cases yes
- (c) Always no
- (d) This function has a syntax error so it cannot run
- (e) None of the above