

Midterm Exam 2

Instructor: Prof. Reza Alam

11/22/2019

20 questions, 50 minutes, 13 pages

Version A

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 electronic devices during the exam.

Signed: _____

Instructions

1. The exam is closed book. No electronic device is permitted (no calculator, no cellphone, no laptop, no MATLAB).
2. Bring your Cal ID to the exam room.
3. You may bring two 8.5” × 11” sheet of paper of handwritten notes.
4. Please do not get up to leave until the exam is over.
5. Read and sign the above statement of academic integrity.
6. Write your full name and SID in the blanks above and on the top of the bubble sheet.
7. Mark the version of your exam on the bubble sheet. Incorrectly marked exam version may result in 0 point in your exam grade.
8. Mark your answers on the bubble sheet with pen or pencil. There is one and only one correct choice for each question. Multiple bubbles, incomplete bubbles, or stray marks will be marked incorrect.
9. At the end of the exam, hand in the completed bubble sheet AND the exam.

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

1. What is the output when executing the following MATLAB code?

```
sum = 0;
for i = 10:-2:3
    sum = sum + 1;
end
disp(i)
```

- (a) 2
(b) 3
(c) 4
(d) 5
(e) Matlab returns a error
2. Which one of the following will give you an error:

(a)

```
g = @(x) x.^2 + x + 1;
```

(b)

```
g=@tan;
```

(c)

```
g=@(x) sin(x)+tan(x);
```

(d)

```
g=@(x,y) (x^2 + y^2 + x*y);
```

(e) None of the above.

3. codeTest function is defined as:

```
function [x,message]=codeTest (A,b)

try
    x=A\b;
    disp('message=Solution complete')
catch
    x=0;
    disp('message=Matrix dimensions are mismatched or solution does not exist')
end

end
```

What is the output when you execute the following command:

```
A=[1,2;3,4];
b=[1;1];
[x,message]=codeTest (A,b)
```

(a)

```
x=0;
message='Matrix dimensions are mismatched or solution doesnot exist';
```

(b)

```
x=[-1;1];
message='Solution complete';
```

(c)

```
x=[2;4];
message='Solution complete';
```

(d)

```
x=[1;-1];
message='Solution complete';
```

(e) MATLAB returns an error.

4. Three matrices are defined as

$$\begin{aligned} A &= \begin{bmatrix} 6 & -1 \\ 12 & 8 \\ -5 & 4 \end{bmatrix}; \\ B &= \begin{bmatrix} 4 & 0 \\ 0.5 & 2 \end{bmatrix}; \\ C &= \begin{bmatrix} 2 & -2 \\ 3 & 1 \end{bmatrix}; \end{aligned}$$

How many of the following matrix multiplications can be computed without error?

A*B
A*C
B*A
B*C
C*A
C*B

- (a) 5
- (b) 2
- (c) 4
- (d) 6
- (e) 3

5. Which of the following functions will calculate y as follows?

$$y(n) = n^2 + (n - 1)^2 + (n - 2)^2 + \dots + 2^2 + 1$$

(a)

```
function y = myFunc(n)
if n == 1
    y = 1;
else
    y = myFunc(n-1);
end
```

(b)

```
function y = myFunc(n)
if n == 1
    y = 1;
else
    y = myFunc(n+1)+n^2;
end
```

(c)

```
function y = myFunc(n)
if n == 1
    y = 1;
else
    y = myFunc(n-1)+n^2;
end
```

(d)

```
function y = myFunc(n)
if n == 1
    y = 0;
else
    y = myFunc(n)+n^2;
end
```

(e) None of the above.

6. Let the variable `tree` be defined as follows:

```
>> tree = { 1:3 [1 2 3; 7 8 9];  
'elastic' true };
```

What is the output of the following command?

```
>> size(tree{1,1}==tree{1,2})(2 ,:)
```

- (a) 1 1
 - (b) 1 3
 - (c) 3 1
 - (d) 2 3
 - (e) MATLAB Error
7. Let the variable `exp` be defined as follows:

```
>> exp.force = -2:2;  
>> exp.disp = (-2:2).^2;  
>> exp.title = 'non-linear';  
>> p.data = exp;  
>> p.project = {'Mechanical' 'Engineering'};  
>> p.date = [6 28 2019];
```

What is the output of the following command?

```
>> class(p.data.title)
```

- (a) cell
 - (b) string
 - (c) char
 - (d) struct
 - (e) MATLAB Error
8. What will be the values of 'm' and 'n' after executing the following code?

```
Names = { 'Alice', 'Ben', 'Sarah', 'jack'};  
Grades = { 89 , 91, 92, 87};  
dum = struct('Names', Names, 'Grades',Grades);  
[m, n] = size(dum)
```

- (a) 4,2
- (b) 5,2
- (c) 4,1
- (d) 1,4
- (e) MATLAB returns an error

9. Which of the following statements is correct after executing the following code?

```
A = {2019, {'E7'};  
     'fall', 'MATLAB'};  
a = A(1,1);  
b = A{1,2};  
c = A(2,1);  
d = A{2,2};
```

- (a) only **a** is a cell array
- (b) only **a** and **b** are cell arrays
- (c) only **a**, **b** and **c** are cell arrays
- (d) only **b**, **c** and **d** are cell arrays
- (e) **a**, **b**, **c** and **d** are all cell arrays

10. Which of the following commands will generate a set of 1000 random numbers drawn from a uniform distribution between the values [-1,1]?

(a)

```
2*rand(1000) - 1
```

(b)

```
2*rand(1000) + 1
```

(c)

```
rand(1,1000) - 1
```

(d)

```
rand(1,1000) - 2
```

(e)

```
2*rand(1,1000) - 1
```

11. Which of the following will be the closest to the outcome of the following code?
Hint: Please note the difference between 'randn' and 'rand'.

```
N = 10000000;  
X = 5*randn(N,1)-2 + 3*rand(N,1);  
disp(mean(X))
```

- (a) -2
 - (b) 2
 - (c) -0.5
 - (d) 0
 - (e) MATLAB returns an error
12. An observer observed the number of cars passing the Bay Bridge from 8am to 8pm for 30 days and recorded the result in a vector A. You plotted a histogram using the command histogram(A). Each bin on the x-axis represents an integer number. Assuming there is only one peak, the value that peak of the histogram occurs can always be called:
- (a) Mean
 - (b) Median
 - (c) Mode
 - (d) Standard Deviation
 - (e) Variance
13. Let the function g be defined as follows:

```
function y = g(n)  
    if n ==1  
        y = 1;  
    else  
        y = n + g(n-2);  
    end  
end
```

What is the output of the following command?

```
>> g(8)
```

- (a) 20
- (b) 1
- (c) 36
- (d) 8
- (e) MATLAB Error (Infinite Recursion)

14. Which block of MATLAB codes solves the following system of linear equations? The solution should be saved in variable x whose three elements correspond to x_1 , x_2 and x_3 ?

$$x_1 - 2x_3 + 4 = 0$$

$$x_1 - x_2 + x_3 = 3$$

$$3x_2 + 1 = 2x_3$$

(a)

```
A = [1 -2 4;
     1 -1 1;
     3 1 0];
b = [0; 3; 2];
x = A\b;
```

(b)

```
A = [1 -2 0;
     1 -1 1;
     3 0 -2];
b = [-4; 3; -1];
x = A\b;
```

(c)

```
A = [1 0 -2;
     1 -1 1;
     0 3 2];
b = [-4; 3; -1];
x = A\b;
```

(d)

```
A = [1 0 -2;
     1 -1 1;
     0 3 -2];
b = [-4; 3; -1];
x = A\b;
```

(e)

```
A = [1 -2 4;
     1 -1 1;
     0 3 1];
b = [0; 3; 2];
x = A\b;
```

15. Consider a system of linear equations represented by $Ax=b$, where A and b are MATLAB variables with proper sizes. For which of the following case there is a unique solution?

(a)

```
rank(A) == size(A,1)
```

(b)

```
rank(A) == rank([A, b]) && rank(A) == size(A,1)
```

(c)

```
rank(A) == rank([A, b]) && rank(A) == size(A,2)
```

(d)

```
rank([A,b]) >= size(A,2)
```

(e)

```
rank(A) == size(A,2)
```

16. Write the following system of equation into $Ax = b$ form:

$$x_1 + 2x_2 + x_3 + x_4 = 2$$

$$x_2 + x_4 = 1$$

$$2x_1 + 4x_2 + 2x_3 + 2x_4 = 4$$

What is the rank of A :

(a) 4

(b) 3

(c) 2

(d) 1

(e) None of the above.

17. Consider the matrix A and the vector b listed below.

$$A = \begin{bmatrix} 2 & 4 & 3 \\ 2 & 4 & 1 \end{bmatrix};$$
$$b = \begin{bmatrix} 5 \\ 5 \end{bmatrix};$$

Which of the following lines of code provide a solution x , when the system is defined as $Ax = b$?

```
(I) x = inv(A)*b  
(II) x = A\b  
(III) x = pinv(A)*b
```

- (a) Only I
- (b) Only II
- (c) Only III
- (d) Both I and II
- (e) Both II and III

18. Consider the following sequence of numbers:

$$\begin{aligned} &1 \\ &1+2 \\ &1+2+3 \\ &1+2+3+4 \\ &\dots \\ &\sum_{i=1}^N i \end{aligned}$$

We would like to store these numbers in a 1 by N structure. Which of the following codes can achieve this?

(a)

```
S.a(1) = 1;
for i = 2:N
    S.a(i) = i+S.a(i-1);
end
```

(b)

```
S(1).a = 1;
for i = 2:N
    S(i).a = i+S(i-1).a;
end
```

(c)

```
S(1).a(1) = 1;
for i = 2:N
    S(i).a(i) = i+S.a(i-1);
end
```

(d)

```
S.a = 1;
for i = 2:N
    S.a = sum(1:i);
end
```

(e)

```
S.a = 1;
for i = 2:N
    S.a = i+S.a;
end
```

19. Let the function E be defined as follows:

```
function output=E(a,b)
if (b == 0)
    output=0;
elseif (mod(b,2) == 0)
    output=E(a+a, floor(b/2));
else
    output=E(a+a, floor(b/2))+a;
end
```

What is the value of **a** after executing the following command?

```
>> a=E(4,3)
```

- (a) 16
- (b) 12
- (c) 8
- (d) 3
- (e) Infinite recursion occurs

20. Let the function G be defined as follows:

```
function output=G(a,b)
if a == b
    output=a
elseif a>b
    output=G(a-1,b)+b
else
    output=G(a,b-1)+b
end
```

What is the value of **a** after executing the following command?

```
>> a=G(2,6)
```

- (a) 20
- (b) 10
- (c) 2
- (d) 6
- (e) Infinite recursion occurs