

MATH 251 MIDTERM I

Answers

Exercise 1 :

1. Write two ways to display the following matrix:

$$A = \begin{pmatrix} 3 & 4 & 5 & 6 & 7 \\ 13 & 14 & 15 & 16 & 17 \end{pmatrix}$$

1. `A=[3 4 5 6 7 ; 13 14 15 16 17]`
2. `A=[[3:7] ; [13:17]]`

2. Given the following command lines

```
>> Boogie = [4 6]
>> Snootie = [2 3]
```

- a) What does the following command line return?

```
>> Pookie = [Boogie; Snootie]
```

Pookie =

```
4 6
2 3
```

- b) What does the following command line return?

```
>> Pookie(1,1) + Pookie(2,2)
```

`Pookie (1,1) + Pookie (2,2) = 4 + 3 = 7`

Exercise 2 : (Two parts **A.** and **B.**)

A. Let $VCT = [35 \ 46 \ 78 \ 23 \ 5 \ 16 \ 81 \ 3 \ 35]$.

Give the value of

1. $VCT(3)$

```
>> VCT(3)
78
```

2. the seventh entry of VCT

```
>> VCT(7)
```

3. the sum of the third and the fifth entries of VCT

```
>> VCT(3)+VCT(5)
```

- B.** Let $DUR = [1 \ 4 \ 5 \ -1 \ 0 \ 7]$

1. Extract the entries 1, 3 and 5 of DUR .

```
>> DUR([1 3 5])
```

2. Square the entries 2, 4 and 6 of DUR .

```
>> DUR([2 4 6]).^2
```

3. Create a vector RUD that contains the third entry of DUR .

```
>> RUD=DUR(3)
```

Exercise 3 : Part A and b are independent.

A. Let $A = \begin{pmatrix} 6 & 4 & 3 \\ 7 & 3 & 4 \\ 9 & 6 & 5 \end{pmatrix}$

1. Using the column operator (:), create a column vector that contains all the columns of A .

```
V=[ A(:,1)' A(:,2)' A(:,3)' ]'
```

2. Using the column operator (:), create a column vector that contains all the rows of A .

```
U=[ A(1,:) A(2,:) A(3,:) ]'
```

3. Using the column operator (:), create a row vector that contains the 1st row and the 3rd column of A .

```
W=[A(1,:) A(:,3)']
```

- B.**

1. Let B be a variable that contains the sentence MY NAME IS JOHN SMITH. Write the command.

B='MY NAME IS JOHN SMITH'

2. We want to replace the word JOHN by the word BILL in the previous sentence. Write the command.

B(12:15)='BILL'

Exercise 4 :

Using the MATLAB built-in functions (*zeros, ones, eye*). Create the following matrix

$$A = \begin{pmatrix} 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

```
>> A1=zeros(2,3);  
>> A2=ones(2);  
>> A3=eye(5);  
>> A=[A1 A2;A3];
```

Solutions Mid 2-

Question 1:

4	
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Give the steps to solve the following system of linear equations using MATLAB.

$$2x-3y+4z=5$$

$$y+4z+x=10$$

$$-2z+3x+4y=0$$

```
>> A=[2 -3 4; 1 1 4; 3 4 -2];
```

```
>> B=[5;10;0];
```

```
>> X=inv(A)*B
```

Question 2:

6	
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(A)

Write the commands for drawing the curve

$$f(x, y) = -\left(\frac{x}{5}\right)^2 - \left(\frac{y}{2}\right)^2 - 16$$

for $-5 \leq x \leq 5$ and $-5 \leq y \leq 5$. Using the **surf** function.

Label the axis and give the title. Remove the grid. Color the curve in gray.

```
>> x=[-5:0.1:5];y=[-5:0.1:5];
```

```
>> [A,B]=meshgrid(x,y);
```

```
>> Z=-(A/5).^2-(B/2).^2-16;
```

```
>> surf(A,B,Z)
```

```
>> colormap gray
```

```
>> xlabel('X-Axis'); ylabel('Y-Axis');
```

```
>> title('Question-2 of Midterm 2')
```

```
>> grid off
```

- (B) Give MATLAB commands to plot, on the same figure, the two functions:

$$f=3t^2+2t-0.5$$

$$g=2t\cos(t)$$

Where the variable t varies from 0 to 10 with step 0.5

- Draw the function **f** in blue **0** and the function **g** in red *****
- Give title to your graph and label the axes.

```
>> t=[0:0.5:10];
```

```
>> f=3*t.^2+2*t-0.5;
```

```
>> g=2*t.*cos(t);
```

```
>> plot(t,f,'ob',t,g,'*r')
>> title('Question 3-B of Mid2')
>> xlabel('t values');
```

5	
---	--

Question 3:

(A) Write a user-defined MATLAB Function for the following math function:

$$Z(x, y) = e^x \cos y + \sin(x^2 - y)$$

The input to the function are x and y, the output is Z. Write the function such that x can be a vector.

(i) Use the function to calculate Z(-3,4) and Z(5,-7).

(ii) Use the function to make a 3D plot of the function Z(x,y) for $-\pi \leq x \leq \pi$ and $-\pi \leq y \leq \pi$

```
function Z=Question3(x,y)
Z=exp(x).*cos(y)+sin(x.^2-y);
```

```
>> Question3(-3,4)
>> Question3(5,-7)
>> x=-pi:0.1:pi;
>> y=-pi:0.1:pi;
>> z=Question3(x,y);
>> plot3(x,y,z)
```

(B) Write a M-File to calculate the square root of each element of the vector v=16,10,34. Display the results in the form: “The square root is v” with a total of 6 digits with 2 digits after the decimal point.

```
v=[16 10 34];
r=sqrt(v);
fprintf('The square root is %f6.2\n',r);
```

EXAM : MIDTERM I
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COURSE NUMBER: MATH 251
DATE:01/05/1433H
DURATION: 1 HOUR
INSTRUCTOR: Dr. Mohammed Messaoudi



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وزارة التعليم العالي
جامعة الإمام محمد بن سعود الإسلامية
كلية العلوم

Type: Closed Book.

Additional Materials: NO ADDITIONAL MATERIALS ALLOWED

Instructions:

1. Answer all questions; there are 5 pages.
2. Write your answers directly on the question sheets. Use the ends or back of the question pages for rough work or if you need extra space for your answer.
3. If information appears to be missing from a question, make a reasonable assumption, state your assumption, and proceed.
4. Books and notes are banned. You **cannot use MATLAB software** for this exam.
5. If you are not sure what a question means, raise your hand and ask me.
6. Write your name in the space provided below on this page and your initials at the top of each subsequent page.

Name	Id number	Group

For examiner		
Question	Mark	Out of
Question 1		4.5
Question 2		4.5
Question 3		8
Question 4		3
Total		20

Question 1:

I. Choose the correct answer (1)

1. Suppose `x` is a new variable, with the following MATLAB command,

```
>> x = [-10:-1:-15; -2:3];
```

What the is the size of `x`?

```
x =
    -10    -11    -12    -13    -14    -15
     -2     -1     0     1     2     3
```

Answer: >> size of `x` is 2 (rows) 6 (columns)

2. A matrix was generated using (1)

```
>> M = ceil(10.4);
```

Which of the following statement is **not** valid in MATLAB?

- a. `M + M * 2`
- b. `sin(M)`
- c. `exp(M)`
- d. `M(1,:) ^ 2`
- e. error

II. What is the output from the following MATLAB Commands?

1. >> `a = 3; b = 2; c = a + b` (1/2)

```
c=5
```

2. >> `d = 1:5; 2*d(3:4)` (1/2)

```
6    8
```

3. >> `who` (1/2)

```
a b c d
```

IV. What is the difference between `clc` and `clear` commands? (1)

`clc` : clears the screen,

`clear`: deletes all variables from memory

Question 2:

4.5	
-----	--

I. Are the following variable assignment is correct? If no, explain why?

(1.5)

- Two_2 (correct) ✓
- example1_1 ✓
- max a MATLAB function X
- cos_2 ✓
- which ✓
- M251 ✓

II. Find the mistake in the following commands and correct them. (3)

>>P =linespace(2,3)	P =linspace(2,3)
>>P[1, 2] = 4	P(1, 2) = 4
>>K= ones(1;3)	K= ones(1,3)

Question 3:

I. Let $A = \begin{bmatrix} 11 & -2 & 3 \\ 4 & 0 & 4 \\ 1 & 9 & 5 \end{bmatrix}$; $B = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$; $C = \begin{bmatrix} -5 & 12 & 4 \\ 3 & -6 & 2 \end{bmatrix}$; $D = \begin{bmatrix} 5 & -2 & 0 \\ 8 & 7 & 6 \end{bmatrix}$;

$$E = [1 \ 3 \ 5 \ 7 \ 6 \ 8 \ 0 \ 9 \ 4 \ 2]$$

(5)

1. Write a command for matrix Multiplication of CD

C.*D

2. Write a command to arrange the element of the vector E in ascending order.

sort(E)

3. Write a command to return the smallest element of vector E.

min(E)

4. Delete 2nd column from matrix C.

C(:,2)=[]

5. Use Left division to solve $X = A^{-1}B$

X = A\B

II. Create a 6×6 matrix in the middle two rows, and the middle two columns are 3's and the rest are 4's. (3)

A=4*ones(6,6);**A(:,3:4)=3;****A(3:4,:)=3;****Question 4:**

I. Ali went to the market. He bought 5kg of carrots (4SR/kg), 2kg of apples (7SR/kg), 6 lettuces (2 for 4SR) and 6 Pepsi (2SR each). What is the total amount?

>> total = 5*4 + 2*7 + 6/2*4 + 6*2 (1)

II. Write the MATLAB command for the following line

a. $Y = |Xe^{aX} - \cos(bX)|$ for $a = 11$, $b = \pi$ and $X = \{2, 4, 6, 8\}$

```
>>a=11; b=pi; X=[2 4 6 8];  
>>Y=abs(X.*exp(a*X)-cos(b*X));
```

(2)