MATLAB Exercise 1 - Matrices & Arrays

1. The distance traveled by a ball falling in the air is given by the equation

$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

Use MATLAB to calculate the position of the ball at time t=5s if $x_0 = 10m$, $v_0 = 15m/s$, and

$a = -9.81 m/\sec^2$

2. Suppose that $x = 3$, $v = 4$. Use MATLAB to evaluate the following expression:

1) $\log(x^2 + v^2)$ 2) $\dfrac{\sqrt{x-3}}{(x-2v)^2}$ 3) $\dfrac{4}{3}\pi v^2$ 4) $|\sin 2x|\, e^v$

5) $\sqrt{x-5}$ 6) $\dfrac{x}{v-4}$ 7) $\dfrac{-x}{v-4}$ 8) eps 9) $\dfrac{x-3}{v-4}$

Help Select Matlab Help in the toolbar, then select Index and input absolute value, finding the function of absolute value.

Help Select Matlab Help in the toolbar, then select Index and input exponential(指数) , finding the exponential function .

Remark: From above example we know, the name of Matlab function is always the abbreviation of its term.

3. **4/2**

4\2

4. 1) Try to input a vector **d = [23, 20, 17, 14, 11, 8, 5, 2]** in different ways. Use **numel** to count the number of elements in d.

2) Please input matrix $a = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 6 & 8 \\ 3 & 6 & 9 & 12 \end{pmatrix}$ at least in three different methods.

5.

1) Compute the size of a.

Help Select Matlab Help in the toolbar, then select Index and input size, understand the different applications of this function

2) Show the value of a(2,3)? Obtain a subarray **b** which is composed by the 1st and 3rd columns of a.

3) Obtain an new matrix **c** by exchanging the 2nd and 3rd rows of a.

4) Obtain a vector **x** which is the last column of a. (end)

5) Replace the value of a(1,1) with 0.

6) Input

a (10)

a (10) = 20

a (10)

and observe what happen.

7) Input

a (2, :)
a (:, 3)
a (:, :)
a (:, 2 : 3)
a (:)
a (2 : 3)

8) Add a new column to a to form a 3×5 matrix **a35**, add a new row to a as its 1st row to form a 4×4 matrix **a44**.
9) Input **a (20) = 100; a** and observe what happen.
10) Input **d = a'; d** and compare the value of a with d.
11) Input **e = a ([1 3]; :)**
12) *Input **help format** to study "format"

Help In command window input **help format**
Display the value of **pi** in **short** / **long** format.
Display **0.5** in **short e** / **rat** format

13) *In help windows seach **fprintf** to study "fprintf"
Display the value of **pi** as an **integer** / **exponential format** / **at the second new line**
14) Input a 3×5 matrix **newmatrix**, compare the results after the following commands
a .* newmatrix
a * newmatirx
a .+ newmatrix
a + newmatrix
a ^ newmatrix
a .^newmatrix

6. Try to solve for x in the equation Ax = B where $A=\begin{pmatrix}1 & 2 & 1\\ 2 & 3 & 2\\ -1 & 0 & 1\end{pmatrix}, B=\begin{pmatrix}1\\ 1\\ 0\end{pmatrix}$. Compare the command A\B and A/B, try to explain the result.
Help Select Matlab Help in the toolbar, then select Index and input **/ (or \)**, distinguish the difference between them (corresponding to Exercise 3.).
7. Set **A = round (10*rand(6))**. Let us change the 6th column A so as to make the matrix singular (奇异). **B = A'; A (:, 6) = -sum (B (1 : 5, :))'**
1) Set **x = ones (6,1)** and compute **A*x**. Explain why do we know A must be singular.
2) Set **C = round (10*rand (6))**. Check whether AC=CA, why?
Help in command window input help round, understand the effect of this function.
8. Set **A = magic (8)**. Compute its sum of elements on each row, column and diagonal respectively.
Help in command window input help magic to understand how to construct the magic matrix
9. Examine the following statements by MATLAB, and show whether they are true.
1) If A≠0 and AC = AD, then C = D;
2) If A and B are nonsingular (可逆), then $(A+B)^{-1}=A^{-1}+B^{-1}$
3) For any 3×3 matrices A and B, $(A+B)^2=A^2+2AB+B^2$

4) A+A' is a symmetric matrix. (对称)

10. * Genetrite some spetial matrices
    1) Generate a symmetric matrix (对称阵) by using function randn and operators ' +;
    2) Genetrate a upper matrix with positive diagonal elements by using functions round, rand, diag, triu and abs.
11. * Some tests

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test1 = linspace (1, 11, 6)
test2 = linspace (1, 11, 5)
num_test1 = numel (test1)
[ i ] = find (test1 > 4)
test1 ( find (test1 ==3)) = 0
test = [test1; 1:2:11]
test (:, 2) = [ ]
Magic = magic (5)
Magic_diag = diag (Magic, 0)
Magic_diag = diag (Magic, 1)
Magic_diag = diag (Magic, -1)
help clc
clc
help clear
clear test test1
clc
```