

MATLAB Tutorial

1. The environment

2. Arrays

(1) Create an array

Create an array from numbers

```
>> a = [1 2 3]
```

a =

```
1    2    3
```

Or

```
>> a = 1:3
```

Create an array from other arrays

```
>> b = [a a]
```

b =

```
1    2    3    1    2    3
```

```
>> b = [a; a]
```

b =

```
1    2    3
1    2    3
```

```
>> b = [a; 1]
```

Error using vertcat

Dimensions of matrices being concatenated are not consistent.

Create special arrays

```
>> z = zeros(2,3)
```

z =

```
0    0    0
0    0    0
```

```
>> z = ones(2,3)
```

```
z =
```

```
1 1 1
1 1 1
```

```
>> z = eye(2)
```

```
z =
```

```
1 0
0 1
```

```
>> z = rand(2,3)
```

```
z =
```

```
0.2760 0.6551 0.1190
0.6797 0.1626 0.4984
```

```
>> whos z
```

Name	Size	Bytes	Class	Attributes
z	2x3	48	double	

(2) All operators act on arrays

```
>> a = [1 2; 3 4]
```

```
a =
```

```
1 2
3 4
```

```
>> a + a
```

```
ans =
```

```
2 4
6 8
```

```
>> a * a
```

```
ans =
```

```
7 10
15 22
```

```
>> a .* a
```

```
ans =
```

```
1 4
9 16
```

```
>> b = a(:)
```

```
b =
```

```
1
3
2
4
```

```
>> reshape(b,[2 2])
```

```
ans =
```

```
1 2
3 4
```

(3) Index

```
>> a = magic(3)
```

```
a =
```

```
8 1 6
3 5 7
4 9 2
```

```
>> a(:,1)
```

```
ans =
```

```
8
3
4
```

```
>> a(1,:)
```

```
ans =
```

```
8 1 6
```

```
>> find(a>5)
```

```
ans =
```

```
1  
6  
7  
8
```

```
>> a(a>5) = 0
```

```
a =
```

```
0 1 0  
3 5 0  
4 0 2
```

(4) Cell array

Cell

```
>> a = 1:3
```

```
a =
```

```
1 2 3
```

```
>> b = 'dogs'
```

```
b =
```

```
dogs
```

```
>> c = 'cats'
```

```
c =
```

```
cats
```

```
>> d_cell = {a,b,c}
```

```
d_cell =
```

```
    [1x3 double] 'dogs' 'cats'
```

```
>> d3 = d_cell{3}
```

```
d3 =
```

```
cats
```

```
struct
```

```
...
```

3. for, while, if/else

Meanwhile, we will learn how to write a script/function (.m file). We will also learn how to debug.

This function is to check whether a matrix is an identity matrix.

```
function is_eye(a_mat)

% Default a_mat, if no input
if nargin < 1
    a_mat = magic(3);
end

% Check size first
% if/else
if size(a_mat,1) ~= size(a_mat,2)
    disp('not an identity matrix!');
    return;
else
    disp('size is OK!');
    N = size(a_mat,1);
end

% Check element
% for loop
for i = 1:N
    for j = 1:N
        flag = check_elem(i,j,a_mat(i,j));
        if ~flag
            disp('NOT an identity matrix!');
            return
        end
    end
end

disp('IS an identity matrix!');
disp(a_mat);
```

```
% Just for illustration of
% while loop
i = 1;
while i <= min(100,N)
    disp(a_mat(i,i));
    i = i+1;
%     if i > 100         % will only display the first 100 diag elements
%         break
%     end
end
end

% check the (i,j) element
function flag = check_elem(i,j,val)
if i == j
    flag = val == 1;
else
    flag = val == 0;
end
end
```

4. Plot

1-D data

```
>> x = linspace(1,50,10);
>> y = 3 * x + 1;
>> plot(x,y,'ko-')
```

2-D data

```
>> a = magic(3)
```

a =

```
8   1   6
3   5   7
4   9   2
```

```
>> imagesc(a)
>> contourf(a)
```

5. Input/Output

Output

```
>> dlmwrite('a.txt',a,'delimiter',' ')
```

fprintf: formatted output, mixed data (string + numbers)

Input

```
>> b = load('a.txt')
```

importdata: data with headers

textscan: mixed data...

6. Example

generate_data.m