Matlab Introduction

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Outline

• About Matlab
• Arithmetic and Variables
• Arrays and Indexing
• Programming
• Plotting
• Functions and m-files
• Importing and Exporting
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About MATLAB

“MATLAB® is a high-level language and interactive environment that enables you to perform computationally intensive tasks faster than with traditional programming languages such as C, C++, and Fortran.”

Incredible for piloting and development!
About MATLAB
Arithmetic and Variables

```matlab
>> 2 + 2
ans =
   4

>> 2 - 2
ans =
   0

>> 2 * 2
ans =
   4

>> 2 / 2
ans =
   1
```
Arrays and Indexing

MATLAB 7.8.0 (R2009a)

>> x = 2 + 2
x =
4
>> x = (1:5)
x =
1 2 3 4 5
>> x = (1:5)'
x =
1
2
3
4
5

MATLAB 7.8.0 (R2009a)

>> x = (1:5)' * (1:5)
x =
1   2   3   4   5
2   4   6   8  10
3   6   9  12  15
4   8  12  16  20
5  10  15  20  25
>> y = x(3:5, 2:4)
y =
6   9  12
8  12  16
10  15  20
>> z = zeros(5, 5)
z =
0   0   0   0   0
0   0   0   0   0
0   0   0   0   0
0   0   0   0   0
0   0   0   0   0
>>
Arrays and Indexing

MATLAB 7.8.0 (R2009a)

% Example 1: Creating an array and indexing
x = [1, 2, 3, 4, 5, 6]
x

% Output:
1 2 3
4 5 6

% Example 2: Creating an array of ones
x = ones(3)
x

% Output:
1 1 1
1 1 1
1 1 1

% Example 3: Creating an identity array
x = eye(4)
x

% Output:
1 0 0 0
0 1 0 0
0 0 1 0
0 0 0 1

% Example 4: Generating random numbers
x = randn(3)
x

% Output:
1.0347 0.2939 -1.1471
0.7269 -0.7873 -1.0689
-0.3034 0.3884 -0.8095

% Example 5: Deleting a row
x(3,:) = []
x

% Output:
1.0347 0.2939 -1.1471
0.7269 -0.7873 -1.0689

% Example 6: Adding a row
x = [x; 1, 2, 3]
x

% Output:
1.0347 0.2939 -1.1471
0.7269 -0.7873 -1.0689
1.0000 2.0000 3.0000

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Arithmetic and Variables

Matrix Operations:

+, -, *, /, sqrt(), sin(), det(), eig(), rank(), ...

Element Operations:

.*, ./, .^2, A.*B, A./B, ..
```matlab
>> n=10;
x=zeros(n,1);
for count=1:n
    x(count,1)=count^2;
end
x'
ans =
    1     4     9    16    25    36    49    64    81   100
```

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Programming

```matlab
>> nx=4; ny=5;
A=zeros(nx,ny);
acounter=0;
for countx=1:nx
    for county=1:ny
        A(countx,county)=countx*county;
        if countx==county;
            A(countx,county)=20;
        elseif countx~==county;
            acounter=acounter+1;
        else
            disp('hello!')
        end
    end
end
A
acounter
A =

20  2  3  4  5
2  20  6  8  10
3  6  20  12  15
4  8  12  20  20
acounter =
16
```
Plotting

```matlab
>> x=[0:0.1:2*pi];
y=sin(x);
z=cos(x);
plot(x,y,'bo',x,z,'r--','linewidth',1.25)
title('Sample Plot','fontsize',14);
xlim([0 2*pi]), ylim([-1.1 1.1])
xlabel('x variable','fontsize',14);
ylabel('y variable','fontsize',14);
legend('x variable','y variable')
grid on
```
Plotting - 2D

Sample Plot

- x variable
- y variable
Plotting - 2D

```matlab
>> x=-1:.01:1;
y=-1:.01:1;
[X,Y]=meshgrid(x,y);
Z=sin(10*pi * X)/pi./X.*sin(10*pi*Y)/pi./Y;
surf(X,Y,Z), colormap(jet)
title('2D Sinc, x_0=1, y_0=.5')
xlabel('x'), ylabel('y'), zlabel('z(x,y)')
axis tight
```

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Plotting - 3D

2D Sinc, $x_0=1, y_0=5$
Functions and m-files

Create your own functions!

```matlab
function [output1,output2] = myfunction(input1,input2)
% this is where you can put in comments
% and searchable help documentation!
[n1,p1]=size(input1);
[n2,p2]=size(input2);
output1=zeros(n1,n2);
if p1==p2
    output1=input1*input2';
else
    disp('not conformable')
end
output2=input2.^2;
```
Functions and m-files
Create your own functions!

```matlab
A=randn(3,4);
B=sqrt(5*eye(2));
[C1,C2]=myfunction(A,B);
if C1==0
    disp('no go')
end
C1
C2
```
Functions and m-files

```matlab
>> A=randn(3,4);
B=sqrt(5*eye(2));
[C1,C2]=myfunction(A,B);
if C1==0
    disp('no go')
end
C1
C2
not conformable
no go

C1 =
    0     0
    0     0
    0     0

C2 =
    5.0000     0
     0    5.0000
```
Importing and Exporting

```matlab
>> a=2
a =
    2
>> b=5
b =
    5
>> c=a*b
c =
    10
>> save mywork
```
Importing and Exporting

The file type is .mat
To read back in use “load mywork”
Importing and Exporting

```matlab
>> A = [1:3; 4:6; 7:9]

A =

1  2  3
4  5  6
7  8  9

>> dlmwrite('myfile.txt', A, 'delimiter', '	', 'precision', 6)
>> load myfile.txt
>> myfile

myfile =

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

MATLAB code:

```matlab
>> brainimage = imread('imageSWI.jpg');
figure(1)
image(brainimage)
axis image
```
Some Additional Toolboxes

• Bioinformatics Toolbox
• Curve Fitting Toolbox
• Financial Toolbox
• Image Processing Toolbox
• Optimization Toolbox
• Signal Processing Toolbox
• Statistics Toolbox
• Wavelet Toolbox
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