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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• Summary
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

\begin{verbatim}
>> x=2+2
x =
4
>> x=(1:5)
x =
     1     2     3     4     5
>> x=(1:5)'
x =
     1     2     3     4     5

>> 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
\end{verbatim}
Arrays and Indexing

```
>> x=[1, 2, 3; 4, 5, 6]

x =
  1  2  3
  4  5  6

>> x=ones(3)

x =
  1  1  1
  1  1  1
  1  1  1

>> x=eye(4)

x =
  1  0  0  0
  0  1  0  0
  0  0  1  0
  0  0  0  1

>> x=randn(3)

x =
  1.0347  0.2939  -1.1471
  0.7269  -0.7873  -1.0689
 -0.3034   0.8884   0.8095

>> x(3,:)=[]

x =
  1.0347  0.2939  -1.1471
  0.7269  -0.7873  -1.0689

>> x=[x;1,2,3]

x =
  1.0347  0.2939  -1.1471
  0.7269  -0.7873  -1.0689
  1.0000  2.0000  3.0000
```
Arithmetic and Variables
Matrix Operations:
+, -, *, /, sqrt(), sin(), det(), eig(), rank()...

Element Operations:
.*, ./, .^2, A.*B, A./B, ..
Programming

MATLAB 7.8.0 (R2009a)

```
>> 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
```
\begin{verbatim}
>> nx=4; ny=5;
A=zeros(nx,ny);
counter=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  8  8 10
     3  6 20 12 15
     4  8 12 20 20
acounter =
    16
\end{verbatim}
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
```

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Plotting - 2D

Sample Plot

- x variable
- y variable

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
>>
```
Plotting - 3D
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 7.8.0 (R2009a)

```
>> 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','\t','precision',6)
>> load myfile.txt
>> myfile

myfile =

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

```
>> 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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