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

```
>> 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
\end{verbatim}

\begin{verbatim}
>> 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

>> v=zeros(5,5)
v =
    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

```matlab
>> 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
```

```matlab
>> x=randn(3)
x =
1.0347  0.2839  -1.1471
0.7269  -0.7873  -1.0689
-0.3034  0.8884  -0.8095
>> x(3,:)=[]
x =
1.0347  0.2839  -1.1471
0.7269  -0.7873  -1.0689
>> x=[x; 1, 2, 3]
x =
1.0347  0.2839  -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

```
>> 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
```
```matlab
>> nx=4;, ny=5;
A=zeros(nx,ny);
acounter=0;
for countx=1:nx
    for country=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
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;
end
```
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 conformae
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','\t','precision',6)
>> load myfile.txt
>> myfile

myfile =

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

D.B. Rowe
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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