Syllabus

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Department of Mathematical and Statistical Sciences

Department of Mathematical and Statistical Sciences

Marquette University

Syllabus

Fall 2020

Course: MSSC 6010 Computational Probability

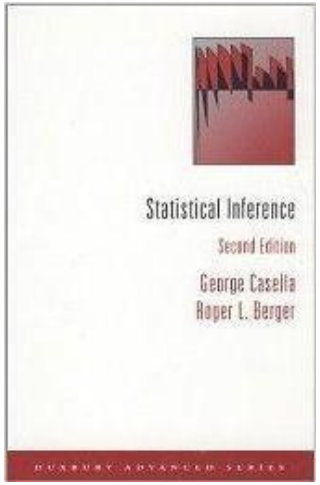
Time: TuTh 5:00-6:15 Cudahy Hall 417

Instructor: Daniel B. Rowe, Ph.D.

Office Hours: TuTh 4:00-5:00 pm

Office: Via Teams/Cudahy Hall 313

E-mail: daniel.rowe@marquette.edu



Text: (reference) Casella, G. & Berger, R.L. (2002). *Statistical Inference*, Second edition, Duxbury.
ISBN: 0-534-24312-6

Grading: A take-home midterm on Oct 24, weekly homework & class participation, and a final project presented on Dec 2, 5:45 pm – 7:45 pm.
Homework & Participation (30%), Mid-Term (30%), Final (40%).

Matlab Introduction

-Arithmetic and Variables, Arrays and Indexing, Programming, Plotting, Functions and m-files, Importing and Exporting Images

Math Review

-Differentiation, Integration

Discrete Distributions

-properties, moments, expectation, MGF, transformation of variable

-Bernoulli, binomial, Poisson, hypergeometric

Continuous Distributions

-properties, expectation, moments, MGF, transformation of variable

- uniform, beta, normal, chi square, gamma, exponential, student t, F,

- random samples, likelihood, MLE, hypothesis testing, LRT

Multivariate Distributions

-normal, student t, Wishart, inverse Wishart

Numerical Flavor

All slides are a summary of the material and do not contain all detail. Book is ultimate authority.

Matlab Introduction

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Outline

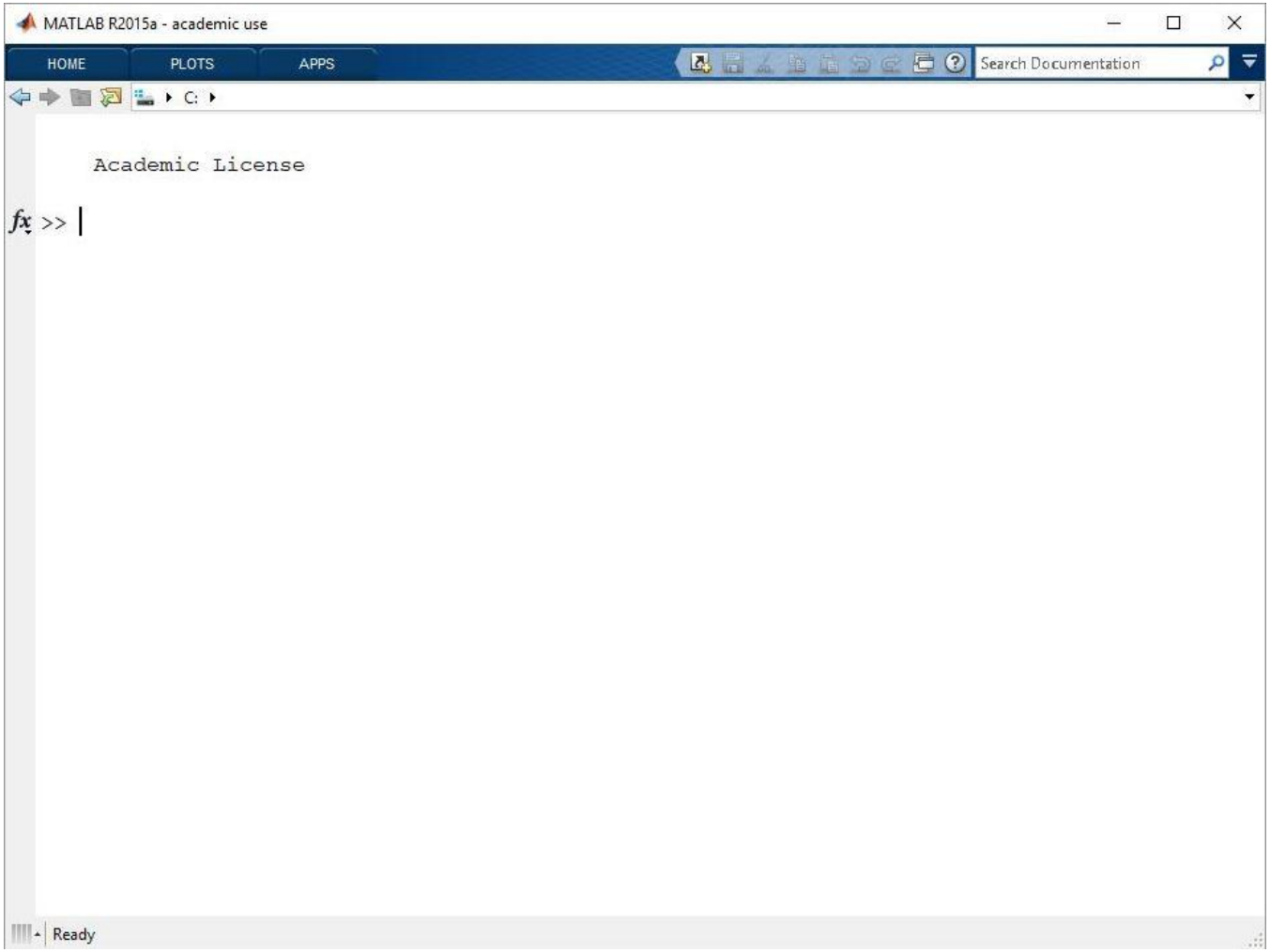
- About Matlab
- Arithmetic and Variables
- Arrays and Indexing
- Programming
- Plotting
- Functions and m-files
- Importing and Exporting
- Images
- Summary

About MATLAB

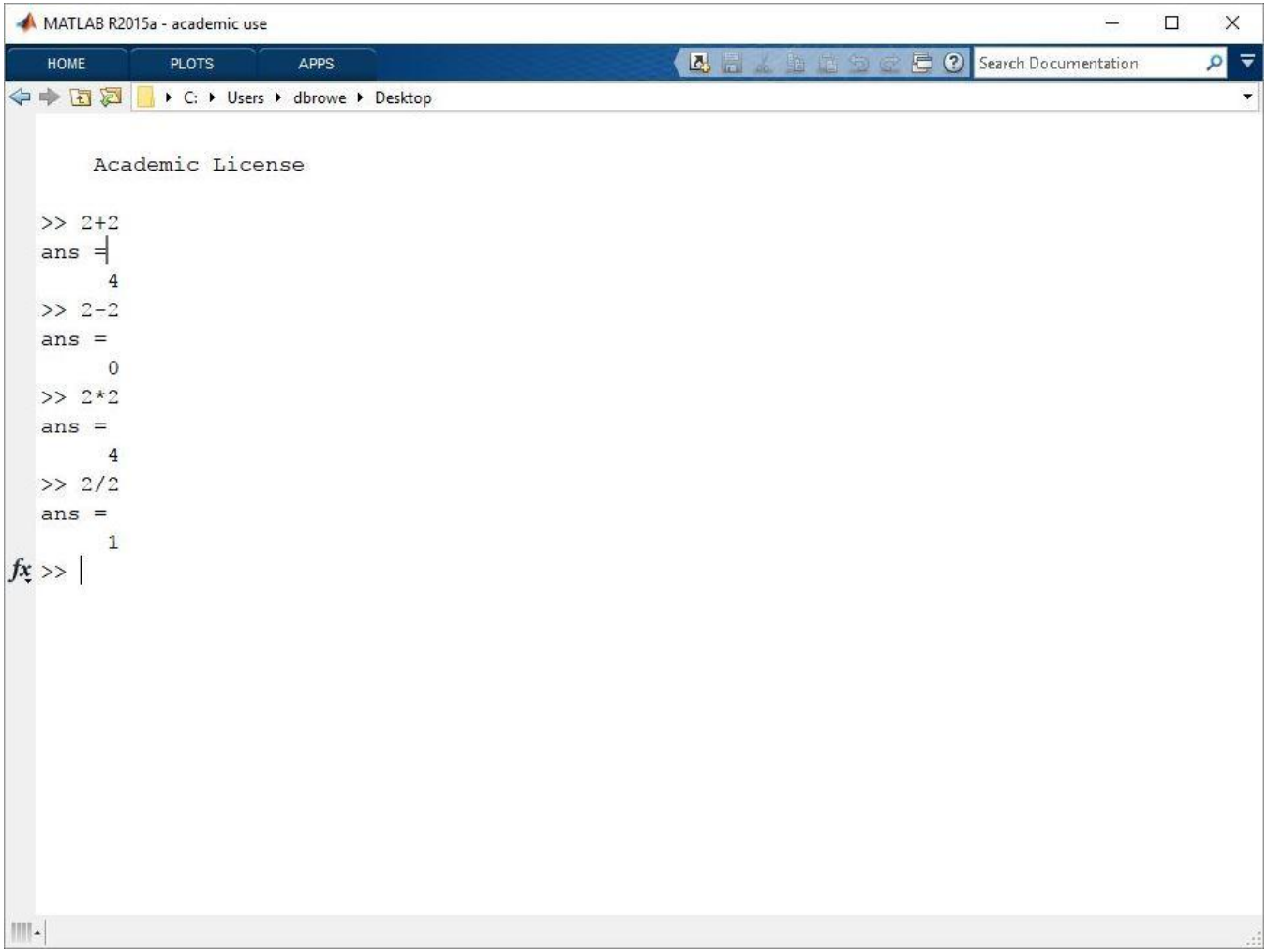
"MATLAB® is a high-level language and interactive environment that enables you to perform computationally intensive tasks faster than with traditional programming languages such as C, C++, and Fortran."

Incredible for piloting and development!

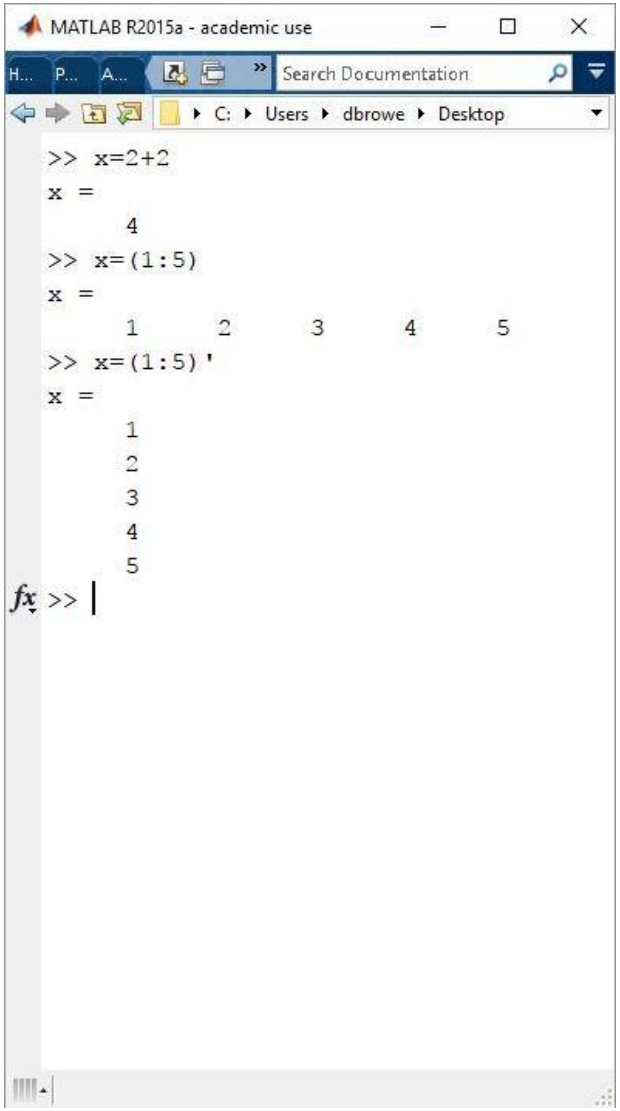
About MATLAB

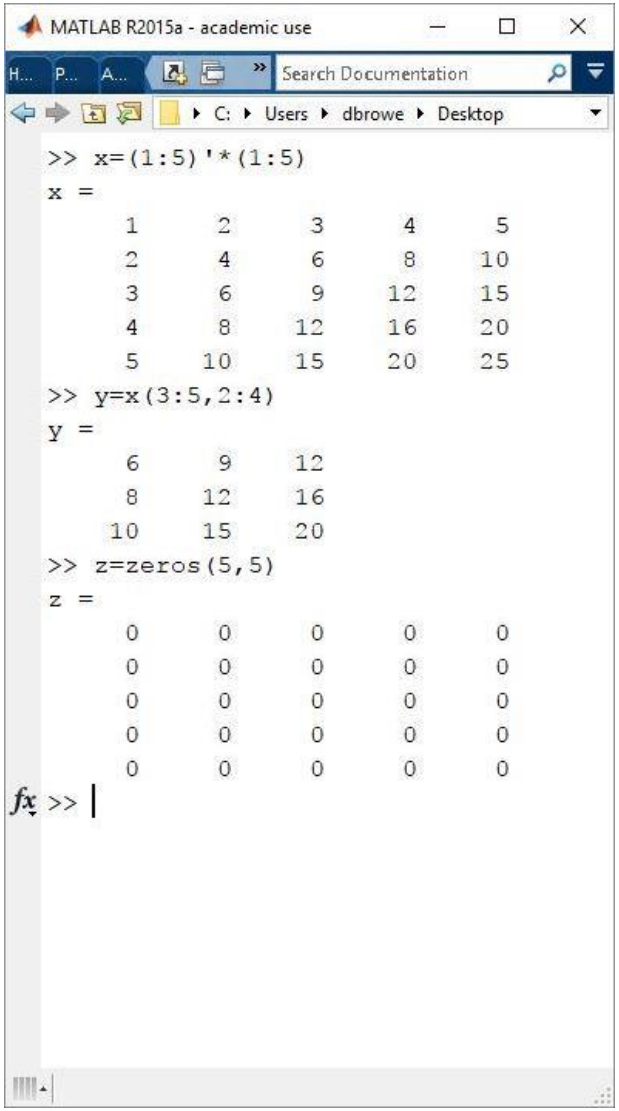


Arithmetic and Variables

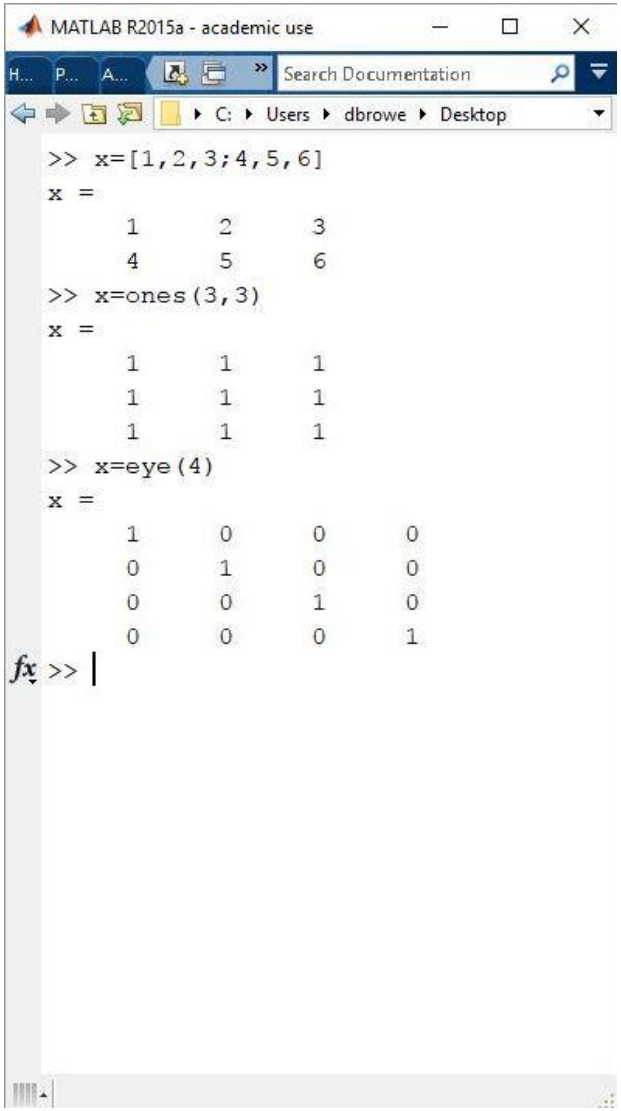


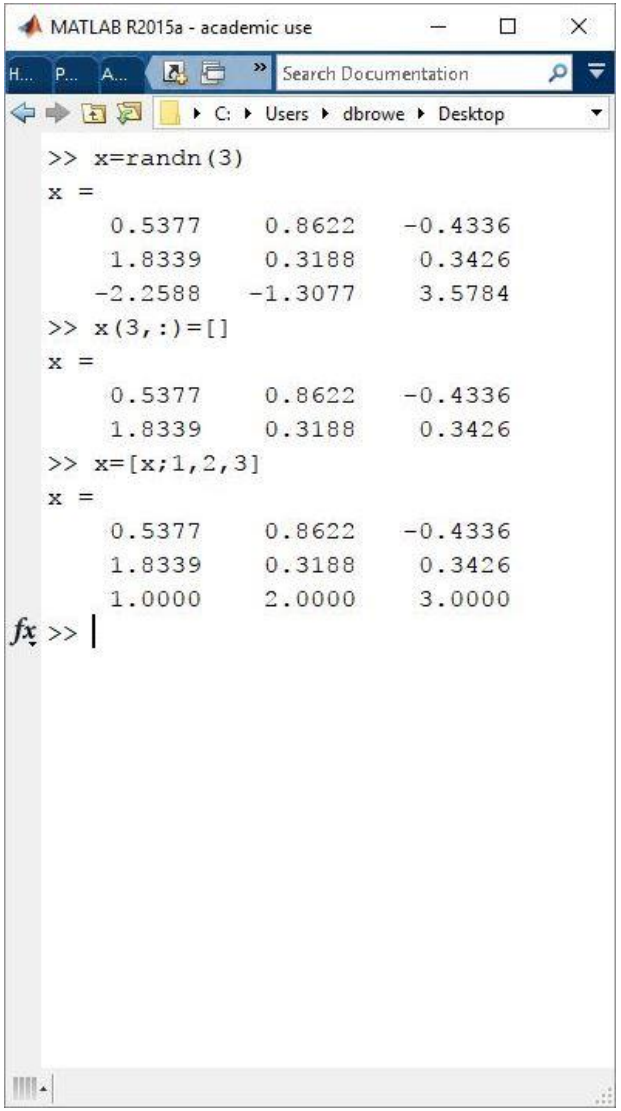
Arrays and Indexing





Arrays and Indexing





Arithmetic and Variables

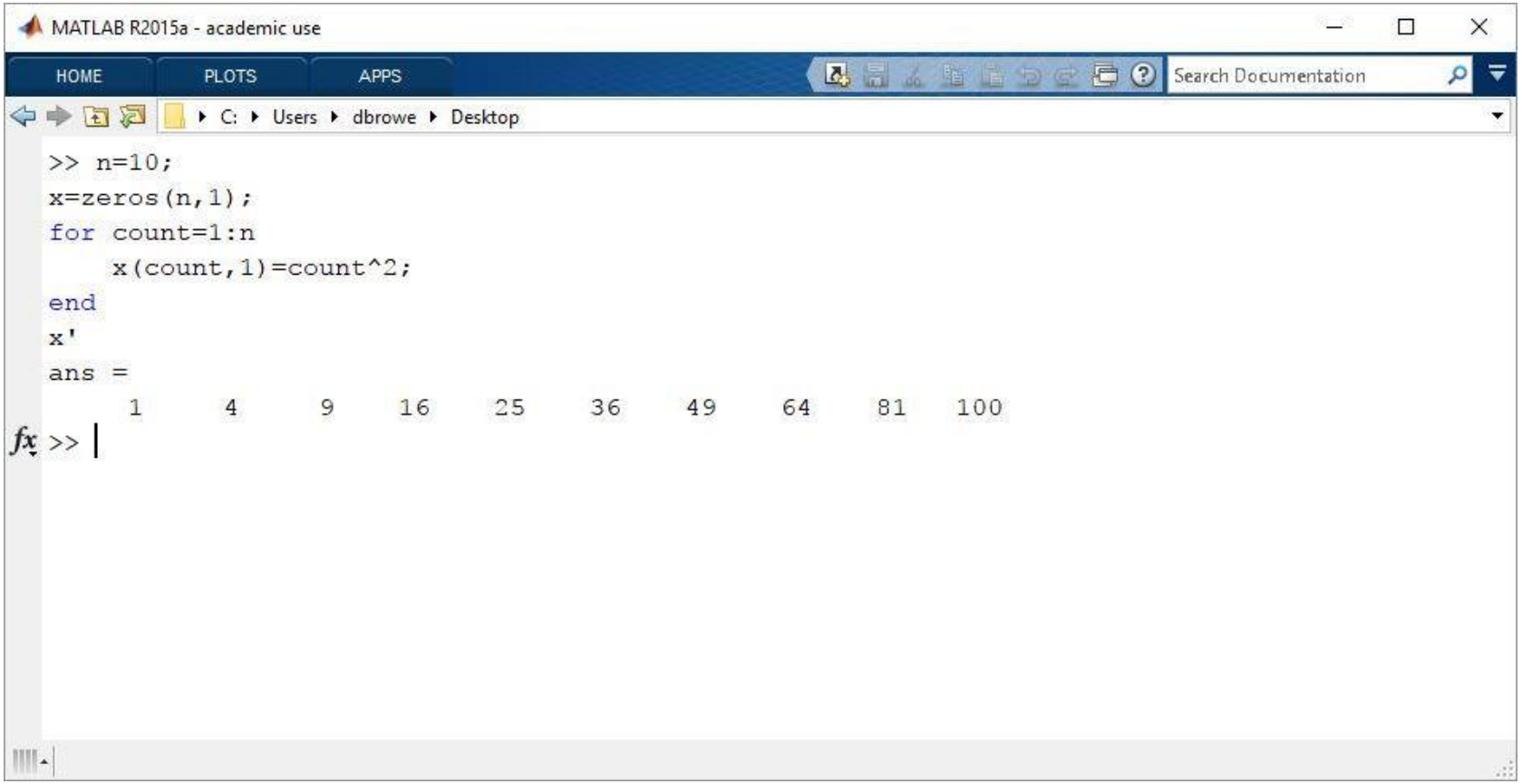
Matrix Operations:

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

Element Operations:

.*,./,.^2,A.*B,A./B,..

Programming



Programming

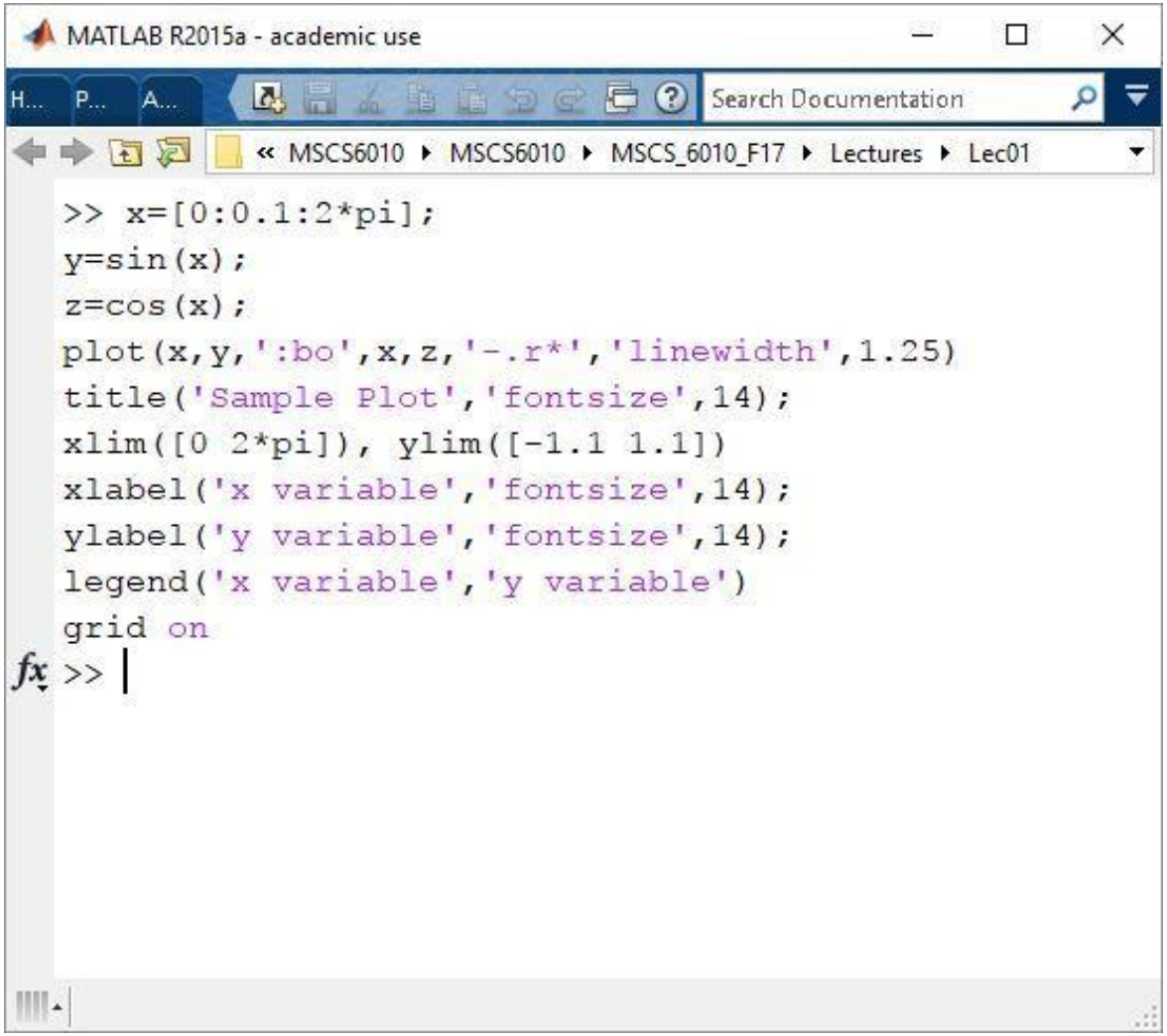
MATLAB R2015a - academic use

HOME PLOTS APPS Search Documentation

C: ▸ Users ▸ dbrowe ▸ Desktop

```
>> 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
fx >>
```

Plotting


MATLAB R2015a - academic use
Search Documentation
« MSCS6010 ▸ MSCS6010 ▸ MSCS_6010_F17 ▸ Lectures ▸ Lec01
>> 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

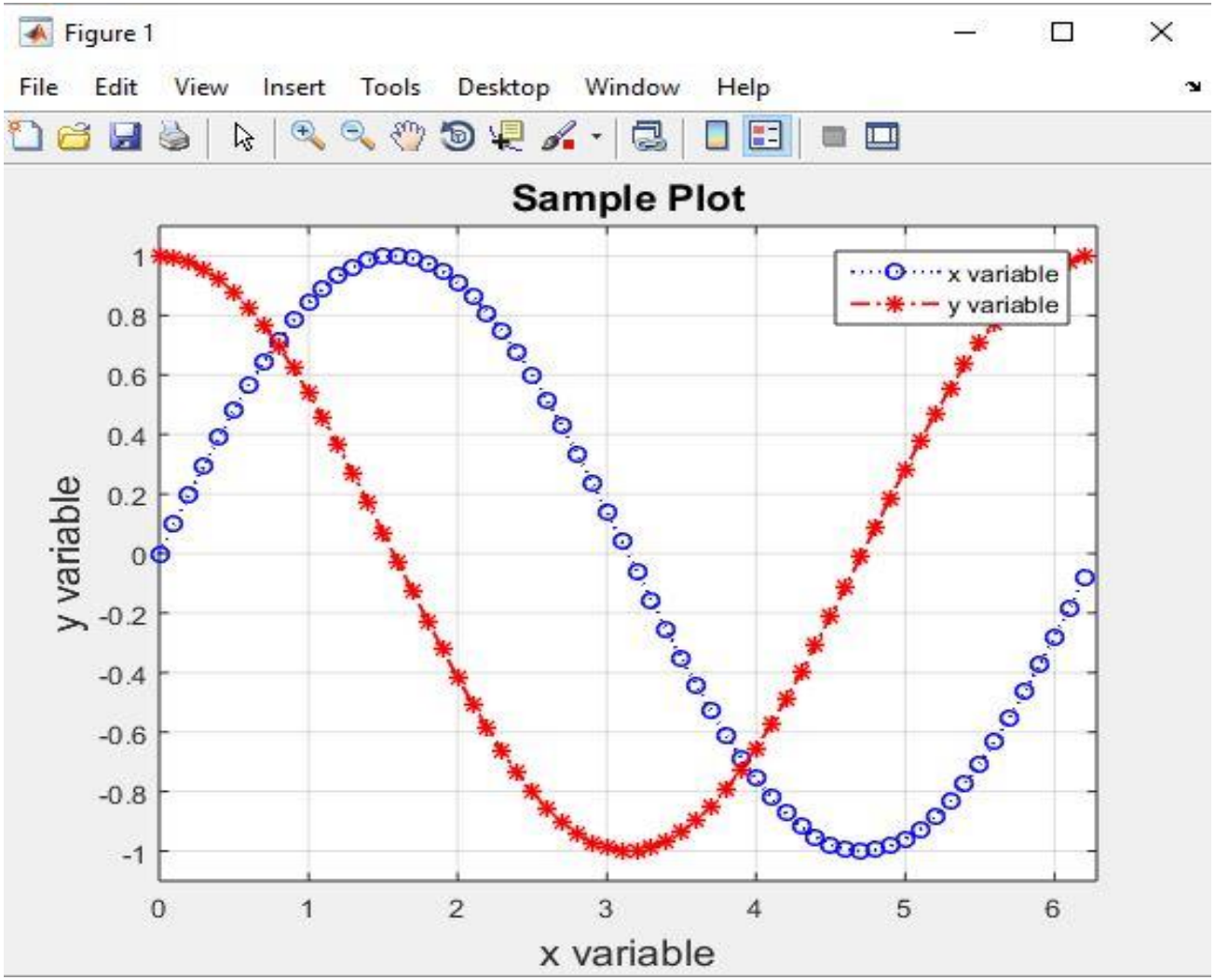
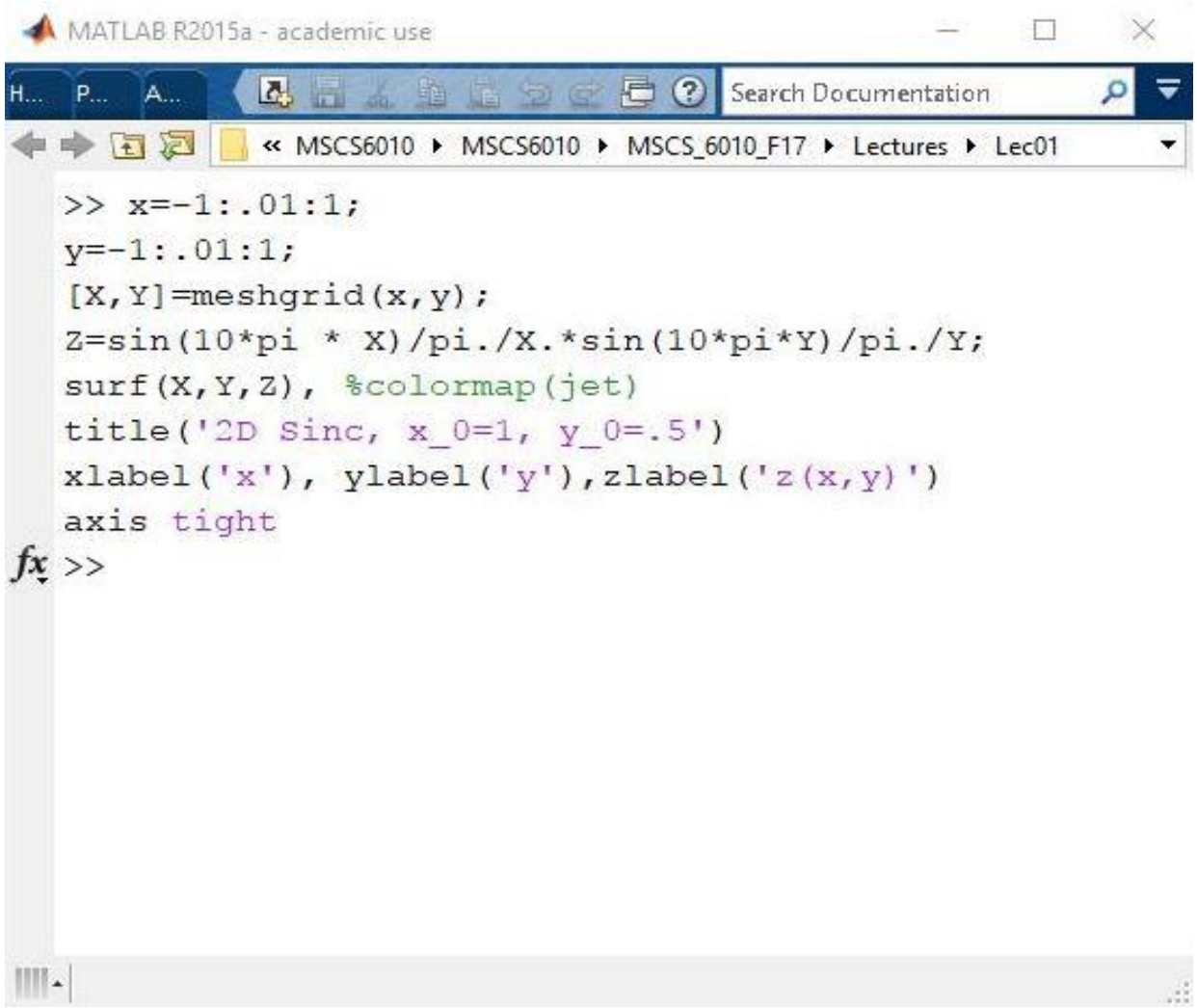


Figure 1
File Edit View Insert Tools Desktop Window Help
Sample Plot
x variable
y variable
y variable
x variable
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
1
2
3
4
5
6

Plotting - 3D


MATLAB R2015a - academic use
Search Documentation
« MSCS6010 ▸ MSCS6010 ▸ MSCS_6010_F17 ▸ Lectures ▸ Lec01
>> 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

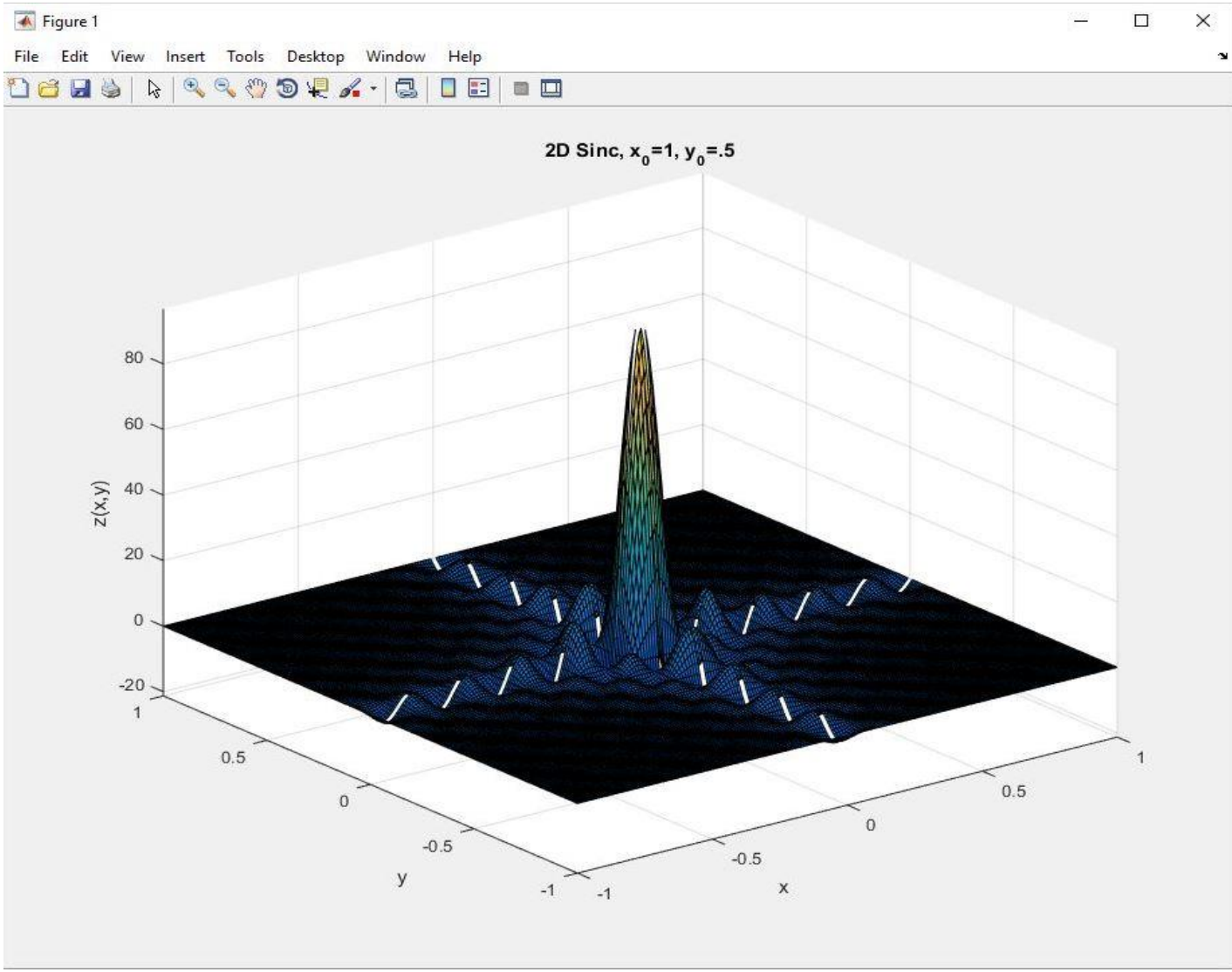
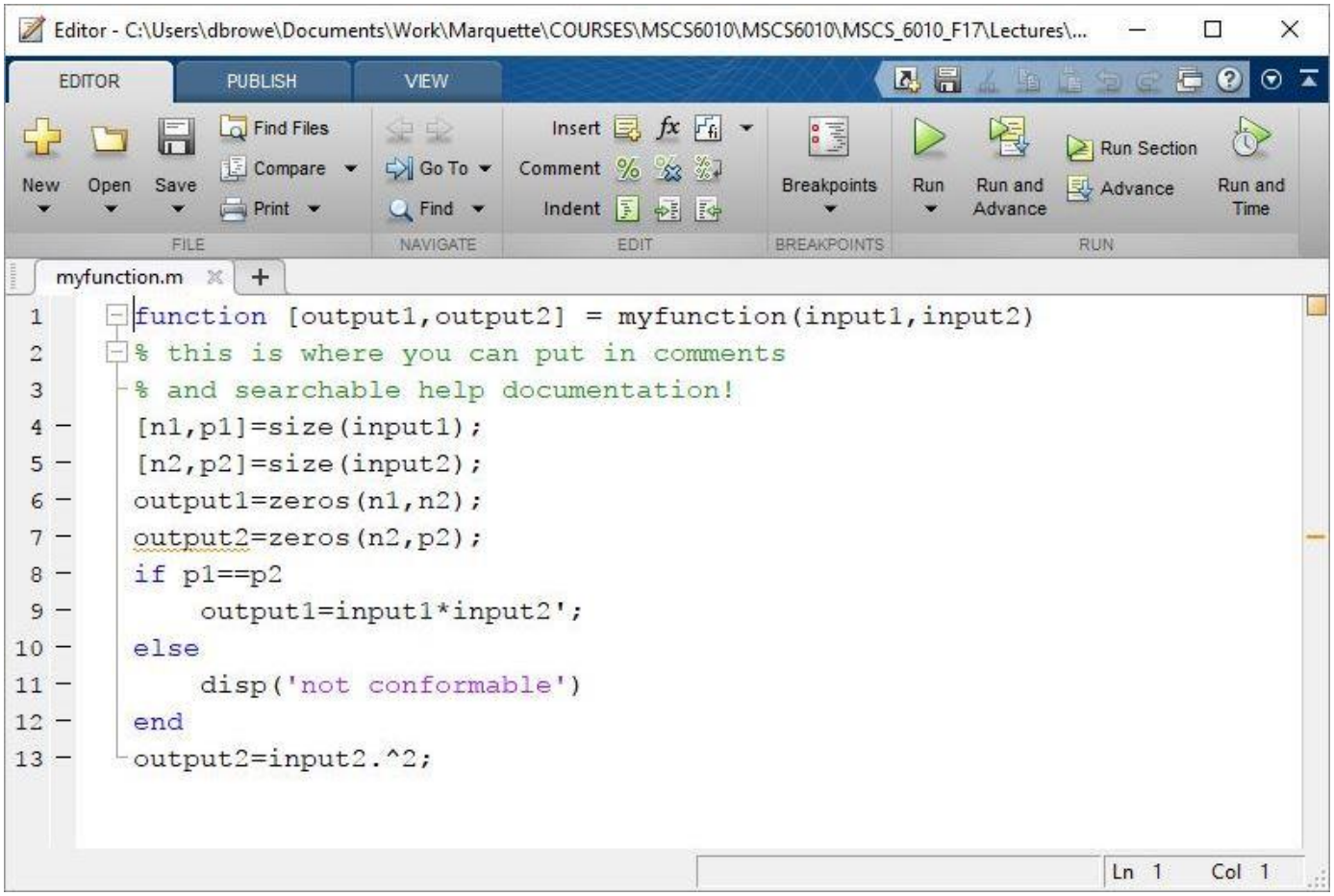


Figure 1
File Edit View Insert Tools Desktop Window Help
2D Sinc, x_0=1, y_0=.5
z(x,y)
80
60
40
20
0
-20
1
0.5
0
-0.5
-1
y
-1
-0.5
0
0.5
1
x

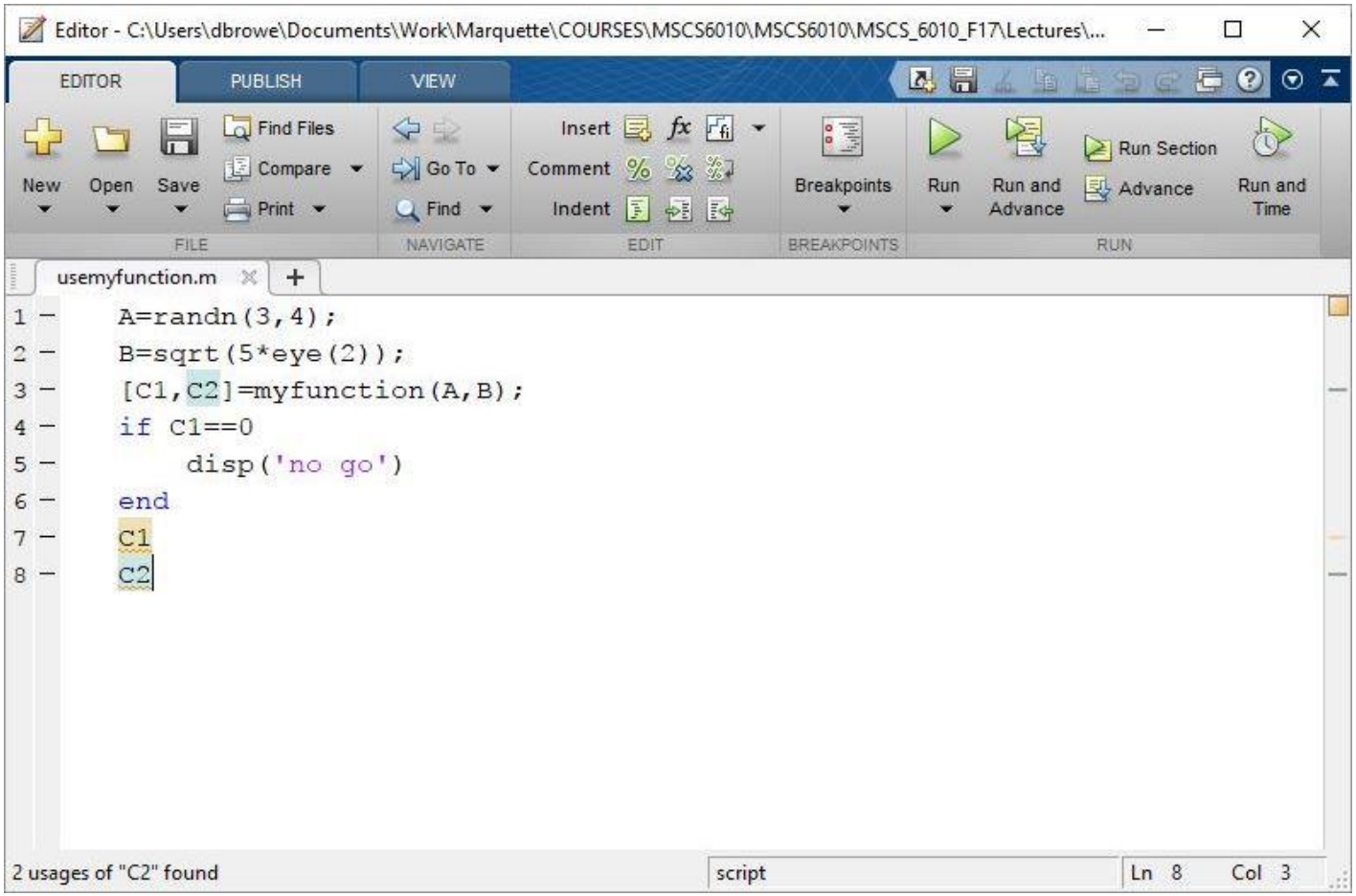
Functions and m-files

Create your own functions!

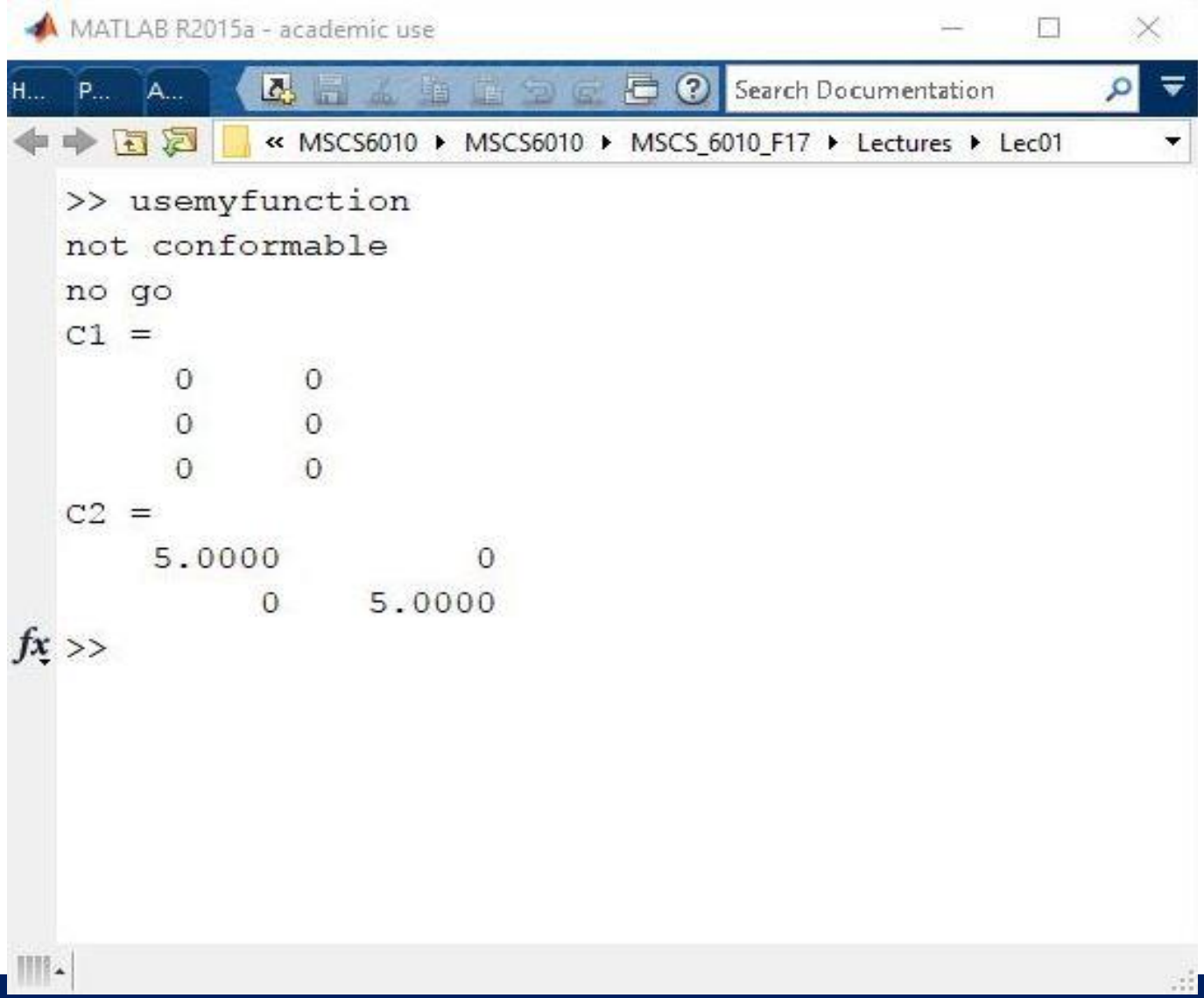


Functions and m-files

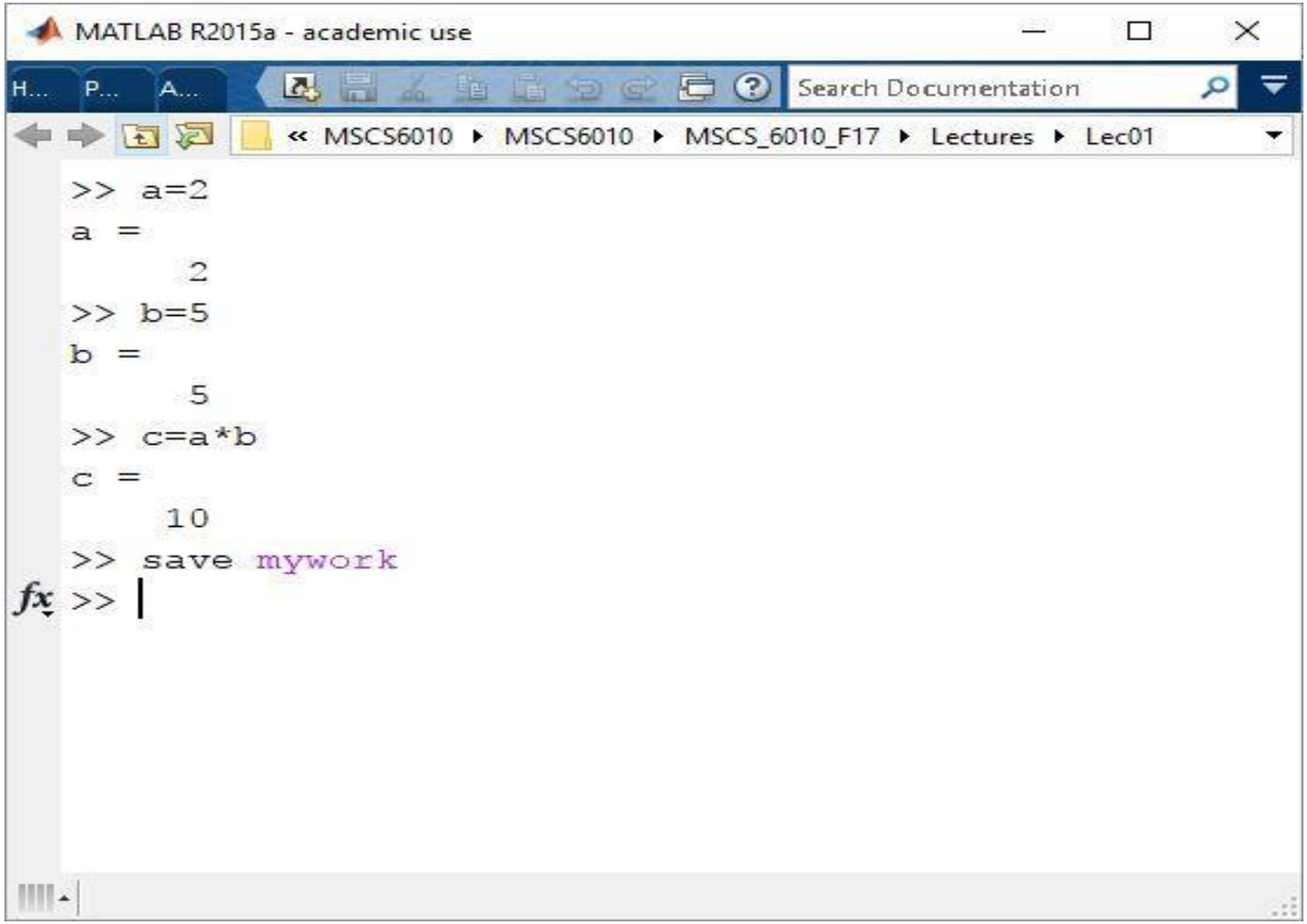
Create your own functions!



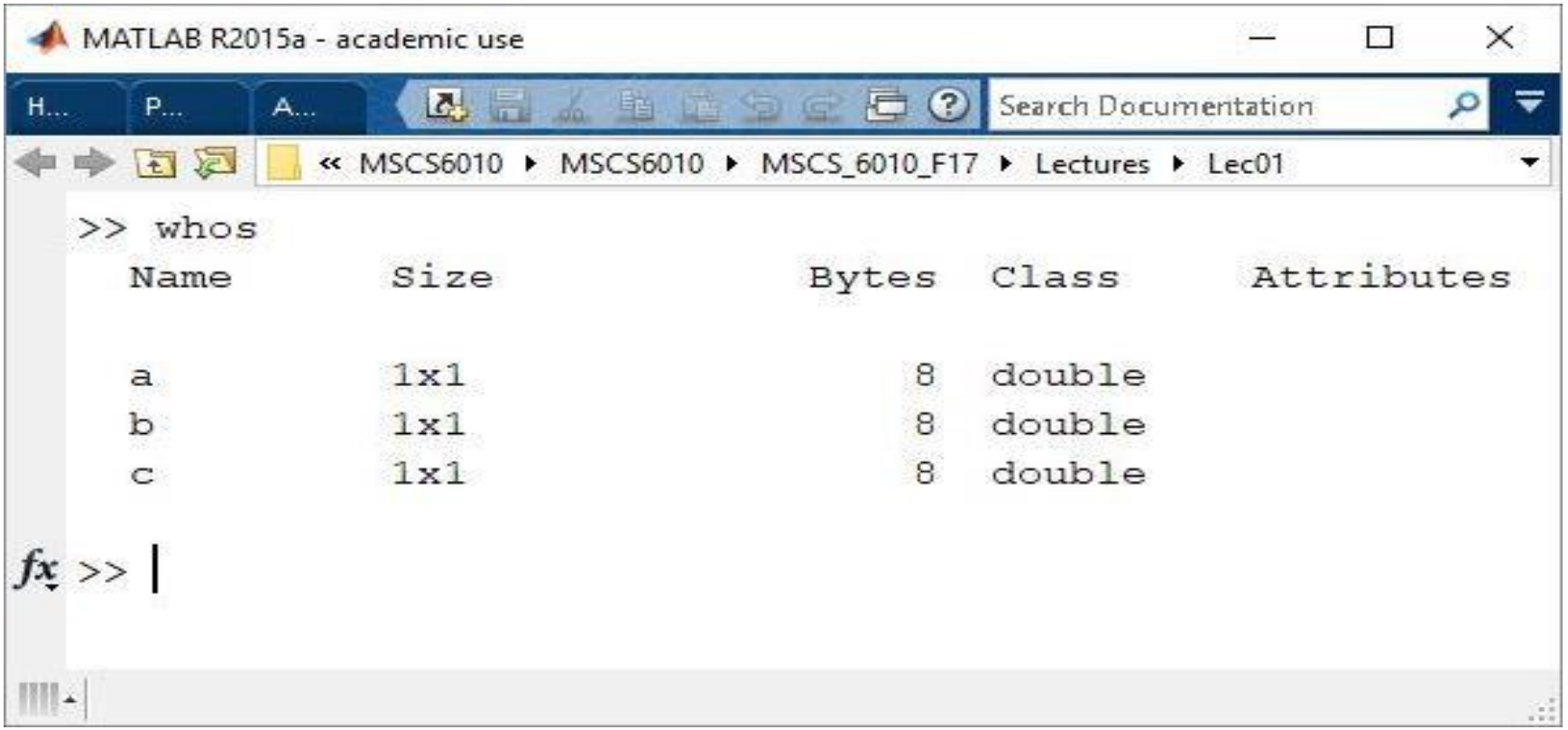
Functions and m-files



Importing and Exporting



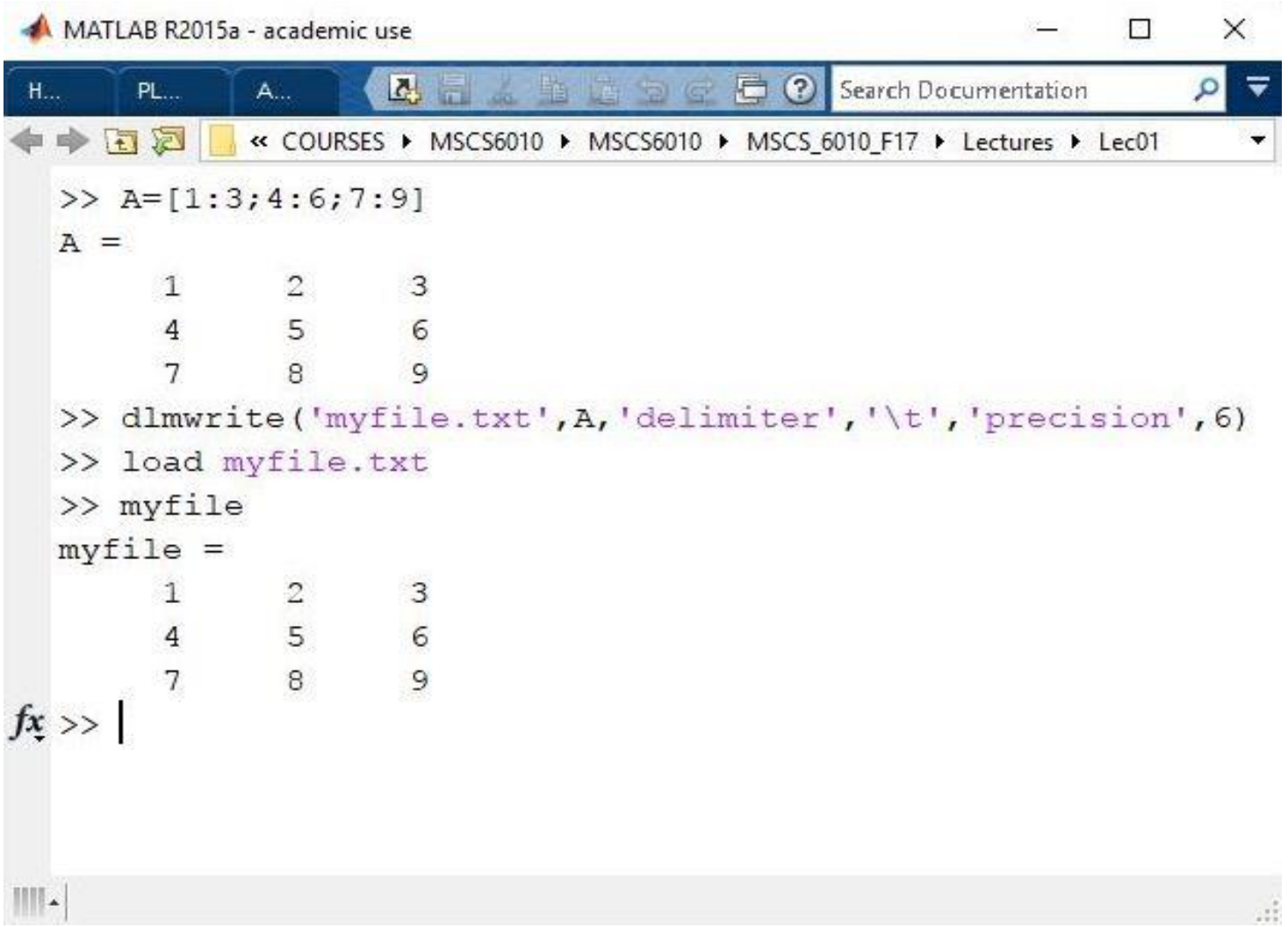
Importing and Exporting



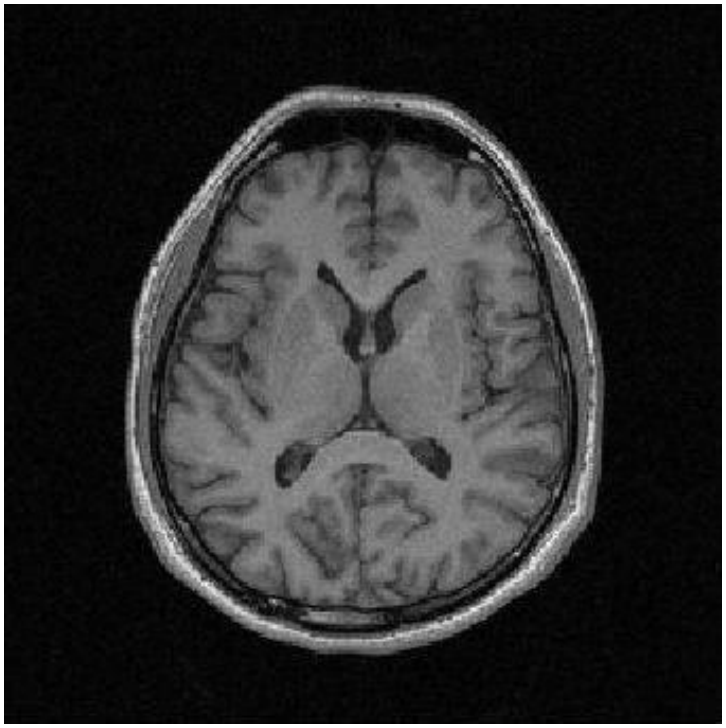
The file type is .mat

To read back in use “load mywork”

Importing and Exporting



Images



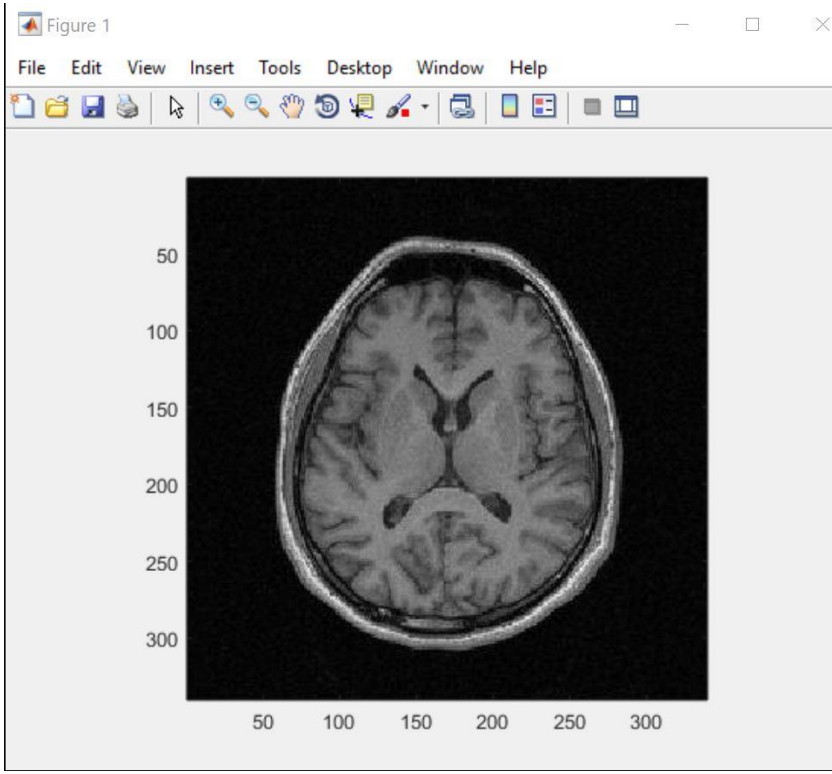
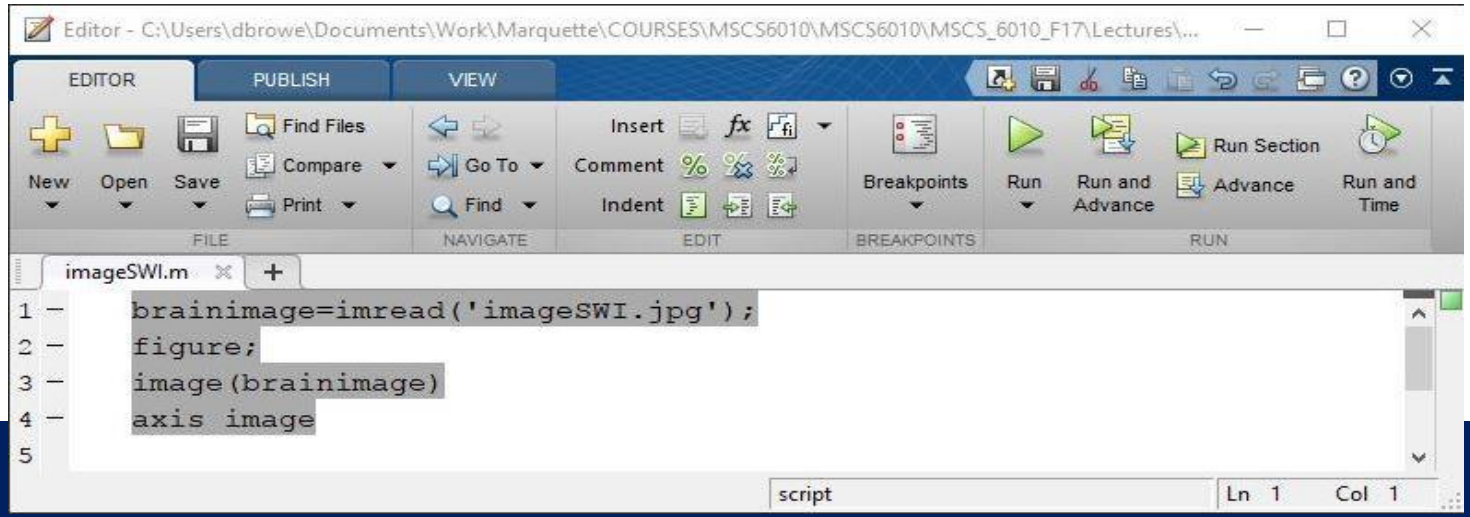


Figure 1
File Edit View Insert Tools Desktop Window Help
50
100
150
200
250
300
50 100 150 200 250 300


Editor - C:\Users\dbrowe\Documents\Work\Marquette\COURSES\MSCS6010\MSCS6010\MSCS_6010_F17\Lectures\...
EDITOR PUBLISH VIEW
New Open Save Find Files Compare Print
Go To Find
Insert Comment Indent
Breakpoints Run Run and Advance Run Section Advance Run and Time
FILE NAVIGATE EDIT BREAKPOINTS RUN
imageSWI.m
1 brainimage=imread('imageSWI.jpg');
2 figure;
3 image(brainimage)
4 axis image
5
script Ln 1 Col 1

Movies

Some Additional Toolboxes

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

Summary

- About Matlab
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- Images