Sri Lanka Institute of Information Technology
Discrete Mathematics
LabSheet 01
Year 2 , Semester 2

GNU Octave

What is GNU Octave

GNU Octave is a free software designed for scientific computing. It is intended primarily for solving numerical problems. In linear algebra, we will use Octave's capabilities to solve systems of linear equations and to work with matrices and vectors. Octave can also generate sophisticated plots.

Installing Octave

Octave will work with Windows, Macs, or Linux.
Go to https://www.gnu.org/software/octave/download.html and look for the download that matches your system.
Beginning with version 4.0, Octave uses a graphical user interface (GUI) by default. When you start Octave, you should see the below interface Figure 1.1

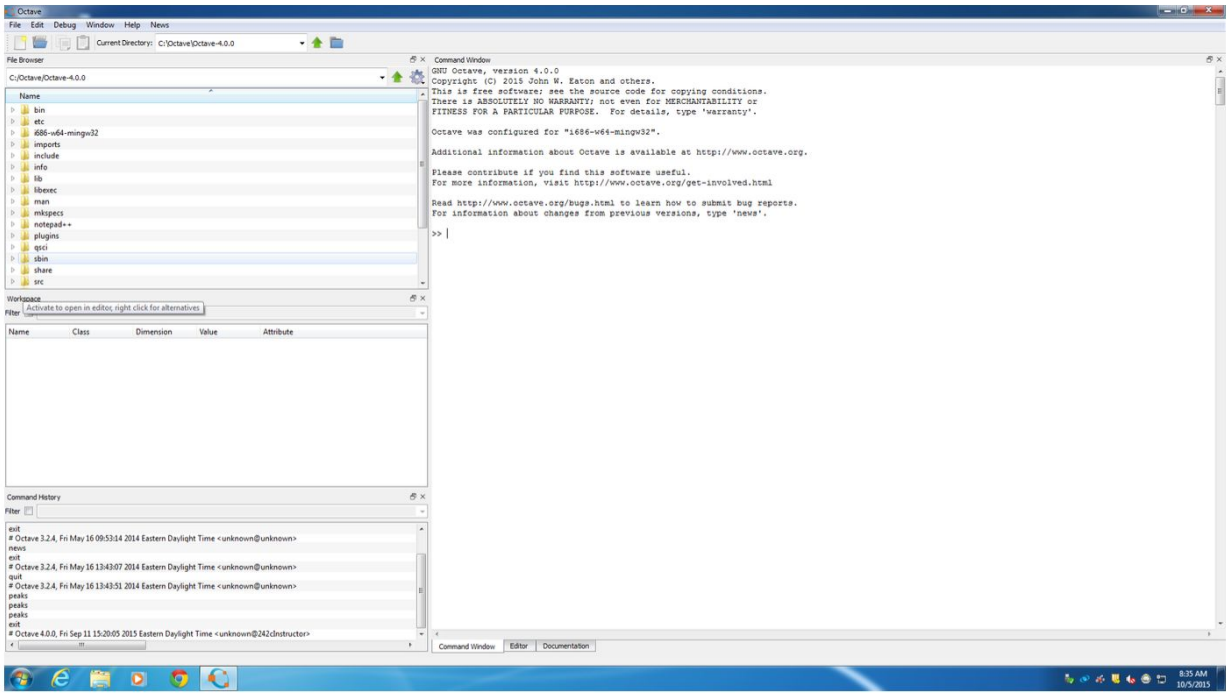

Figure 1.1

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The user can customize the arrangement of windows. By default, you will have a large command window, which is where commands are entered and run, a file browser, a workspace window displaying the variables in the current scope, and a command history.

Getting started

There are several good help resources on the web and built-in help functions within Octave. The shell command "help" can be used at the Octave prompt. In particular, if you know the name of the command, you want to use, "help NAME" will give the correct syntax.
Here are two good free, online resources:

The Octave Manual:
http://www.gnu.org/software/octave/octave.pdf

Wikibooks Tutorial:
https://en.wikibooks.org/wiki/Octave_Programming_Tutorial

Additional help can be found with internet searches. Depending on what you are looking for, searches for Octave commands and searches for MATLAB commands can both be useful. Numerous commercial user's guides and textbooks for Octave and/or MATLAB are available. Linear algebra textbooks sometimes contain MATLAB code examples and these generally work in Octave as well.

The best way to get started is to try some simple problems. Use the following examples as a tutorial to learn your way around the program. Octave knows about basic arithmetic. Try something simple like:

```
>> 2*6 + ( 7 − 4 ) ^2
ans = 21
```

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Exercise 01

Find the answer for following simple algorithms

1. 3*5 - (4-8)
2. 6^2 + (6+5)
3. (7-4)+(8-3)
4. (17+42)/26
5. (9*4) + (7*2)
6. (45/5) - (36/6)
7. ((8+6)*4^2) - ((12-5)*(5+7))

Vectors and matrices are basic variable types, so it is easier to learn Octave syntax if you already know a little linear algebra. Try this example to enter a row vector and name it **u**.

```
>> u = [ 1 −4 6 ]
u =
1 −4 6
```

To create a column vector instead, use semicolons:

```
>> u = [ 1 ; −4; 6 ]
u =
    1
   −4
    6
```

Notice that the function of the semicolon is to begin a new row. The same basic syntax is used to enter matrices. For example, let's see how to enter a matrix:

```
>> A = [ 1 2 −3; 2 4 0 ; 1 1 1 ]
A =
    1 2 −3
    2 4 0
    1 1 1
```

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Example

First, enter the column vector **u** from above, if it is not already in memory.

```
>> u = [ 1 ; −4; 6 ]
u =
1
−4
6
```

Now enter another column vector **v** and try the following vector operations which illustrate linear combinations, **dot product**, **cross product**, and **norm**.

```
>> v = [ 2 ; 1 ; −1]
v =
2
1
−1

>> 2*v + 3*u
ans =
7
−10
16

>> dot ( u , v )          % dot product
ans = −8

>> c r o s s ( u , v )    % cross  product
ans =
−2
13
9

>> norm( u )              % length of vector  u
ans = 7. 2 8 0 1
```

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Exercise 02

1. Find cross(v, u). How does that compare to u × v?
2. Calculate the length of v, ||v||, using **norm**(v).

Exercise 03

X = [2 1 -5] , Y = [3 -2 4]

1. Create row vector for **X** and **Y**
2. Create column vector for **X** and **Y**
3. Using X and Y Find the answer for following vector operations
   - 3*X + 4*Y
   - 5*Y - 2*X
   - (7*X + 3*Y)/4
4. Find **dot product**, **cross product** of **(X,Y)**
5. Find **norm** of **X** and **Y**