

Computer Lab Assignment 1

Introduction to Matlab

Start Matlab and type the following in command window.

(1) Matlab as calculator. Try to predict what Matlab does and then type in the following lines:

```
>> 1+1
>> 3 -- 3           (What does Matlab do with this funny line?)
>> 1000/10
>> cos(0)
>> sin(180)        (Why do not you get zero in this case? How would you get zero?)
>> 4^4
>> 10^6
>> 1.0e6           (What does the “e” do?)
>> log(10)
>> log10(10)      (What is the difference between the last two lines?)
>> pi
```

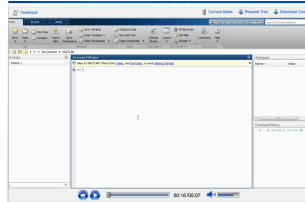
(2) Now define your own variables (This section contains two errors.)

```
>> a=6
>> a=6;           (What is the difference between the last two lines?)
>> 10*a           (Does the variable “a” get used correctly?)
>> b=19
>> b=19.8
>> C = a*b
>> D = sin(c)
>> 2f = 2*f
```

(3) Compute the density, ρ , of the Earth. Radius $R=6371$ km and mass $M=5.9736 \times 10^{24}$ kg. Use $\rho=M/V$ and volume $V=4\pi/3 \cdot R^3$. Compare your answer to the density of *water* (1 g/cc), *rock* (2.7 g/cc), and *iron* (7.8 g/cc).

Matlab comes with a few videos that explain basic and advanced features. They are useful but also rather inefficient way to learn. In a web browser, please open the following link

<http://www.mathworks.com/support/2014a/matlab/8.3/demos/GettingStartedwithMATLAB.html>



(4) Define *row* and *column* vectors. What is the difference between the two?

```
>> r = [0 3 4]
>> c = [2;4;6]
>> c(3)
>> c(2) = r(3)*2
```

```

>> size(c)
>> size(c,1)
>> size(c,2)
>> norm(r)
>> c(3)
>> r*c
>> c*r           (What is the difference between r*c and c*r ?)
>> c*c           (Have a guess why Matlab is not happy.)
>> r*r
>> r(:) = 10     (What is the difference between this and the following line?)
>> r = 10

```

(5) The colon operator “:”

```

>> 1:10
>> 1 : 0.5 : 10
>> 100 : -5 : 50
>> r = [0 3 4]
>> r(1:2)
>> r(:)
>> c(1:2)
>> c(:)

```

(6) Make a 2D plot (copy and paste the following lines)

```

>> x = 0:0.1:1
>> y = sin(10*x)
>> plot(x,y)
>> xlabel('X Axis')
>> ylabel('Plot Y Axis')
>> title('My first X-Y graph')
>> plot(x,y,'o-')

```

Make an improved XY plot:

```

>> x = 0:0.01:1
>> y1 = sin(10*x);
>> y2 = sin(5*x);
>> plot(x,y1,'r+',x,y2)
>> xlabel('X Axis')
>> ylabel('Y Axis')
>> title('My second X-Y graph')
>> plot(x,y1,'r+',x,y2,'r:')
>> plot(x,y1,'r+',x,y2,'-o')           (What is the difference of the last two lines?)
→ Now save the graph as a PNG file (In the graphics window: file→save as, select PNG)

```

(7) Define a matrix. (Do not be scared, a matrix is simply an array of numbers.) Which of the following commands does actually define a matrix?

```
>> v = [1 2 3]
>> v2 = [v v v]
>> v3 = [v,v,v]
>> M = [v;v;v]
>> A = [16 3 2 13; 5 10 11 8; 9 6 7 12; 4 15 14 1]
>> B = zeros(5,4)
>> C = ones(10,5)
```

(8) Before entering the following lines, guess what they would do:

```
>> A(1,2)
>> A(1)
>> A'
>> A(1:4,1)
>> A(2,:)
>> size(A)
```

(9) Use Matlab’s documentation system to learn about the function “size”. Click on the HELP→Documentation button in upper menu bar and type in “size” in the search field. Since Matlab has various uses for the size function, you need to select the “right” one about array dimensions: The emerging window should look like:

```
>> sum(A(1:4,end))
>> B = zeros(5,4)
>> size(B)
>> size(B,1)
>> B(:, :) = 10
>> B = 10
```

(10) Make a 3D plot

```
>> [X,Y] = meshgrid(-8:.5:8); (What does meshgrid do? Investigate X and Y!)
>> R = sqrt(X.^2 + Y.^2) + eps;
>> Z = sin(R)./R;
>> mesh(X,Y,Z,'EdgeColor','black')
>> surf(X,Y,Z)
>> colormap hsv
>> colorbar
```

Now rotate the 3D graphics with your mouse. Then save the graphics as PNG file (file→export)

(11) Make a contour plot (containing lines of constant altitude) using the predefined functions peaks:

```
>> [x,y,z] = peaks;
```

```
>> pcolor(x,y,z)
```

```
>> shading interp
```

```
>> hold on
```

(do not erase the earlier, just add contour lines)

```
>> contour(x,y,z,20,'k')
```