

COMS W3101-2 – Spring 2010

Homework 1

The main goal of the first homework is to make you familiarize with the MATLAB environment and try out some of the basic functions we saw in class.

For this assignment you should write a single m-script file called `hw1.m`. At the top of the file you should put your name and ID in a comment. There are 4 exercises in this assignment, each worth 25 points, for a total of 100 points. For each exercise you will have to write a single or series of MATLAB commands. Make sure you place a comment before the code solving each of the exercises, in order to specify which part of code solves what exercise and to write the answers to the exercise.

This homework is due on March 9, at beginning of class, no exceptions.

Put your code (.m file) in a single folder, name it `youruni_hw_1` and zip it.

Upload the zipped folder to [CourseWorks](#). Also, bring a printout of your code to class.

NOTE: please print graphs in separate figures if not otherwise specified

Exercises:

This story will let you discover some things you may not know about the Na'vi tribe of planet Pandora from the movie Avatar.

1. **(25 points)** On Pandora, Na'vis love to play NaviBall, a sport consisting in blowing inflatable soap balls and hang them to the Tree of souls. Every year there is a contest, and this year's winner blew a ball of radius 30cm.

What is the volume (http://en.wikipedia.org/wiki/Sphere#Volume_of_a_sphere) of the winning ball?

If last year's winner blew a ball with radius 20cm, how bigger (in percentage) is this year's winning ball with respect to last year's?

2. **(25 points)** The heir to the chieftainship of the tribe, Tsu'tey, is stronger in taming Toruks than in performing calculations. At the Hometree school his teacher asked him to do some operations with matrices. Tsu'tey is so desperate that he asks you, a human, for help with his homework, since he knows that you are a MATLAB pro. Here is what he has to do:

2.1. Create a row matrix in variable r :

Next create a column matrix in variable *c*:

```
1
2
3
```

Set another variable *m* equal to *c* times the first 3 elements of *r* (matrix multiplication, not elemental multiplication)

Find the location of the maximum minimum values of *m* and store them in the variables *maxLoc* and *minLoc*

2.2. Create a vector *vec* with the following values: 1 1 3 2 5 6 1 8 9.

Fill the two vectors *vecOdd* and *vecEven* with the elements in the odd and even positions of *vec*, respectively

Put the elements of *vec* into a 3x3 matrix *A*

2.3. Using matrix *A* from the previous exercise:

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

Compute its inverse *Ainv*

Verify that the multiplication of *A* and *Ainv* returns the identity matrix

HINT: take a look at the MATLAB *inv()* function

2.4. Create a vector *x1* of 100 elements, all equal to 7. Create another vector *x2* of 100 elements, each element with a value corresponding to its position (for example, the third element will have value equal to 3)

Compute the Euclidean distance (http://en.wikipedia.org/wiki/Euclidean_distance) between the two vectors and store it in variable *eucDist*

2.5. Create a vector *x* with 41 equally spaced elements ranging from -10 to 10.

Compute $y = x^3 - 5x^2 + 3x$

Plot *y* against *x*, but consider only the *x* interval [0 6].

Label the axes with the names of the variables they represent

Find manually the minimum value in the plot, and report it together with its location in the comment for this exercise

3. **(25 points)** 5 years after the end of the movie, Na'vis and humans have reached a peaceful agreement and trade unobtanium. 5 members of the tribe work in a new

unobtainium factory, which produces unobtainium batteries. Table 1 describes their working hours and salaries:

	Member1	Member2	Member3	Member4	Member5
Salary (per hour)	5	5.50	6.50	6	6.25
Weekly hours	40	43	37	50	45
Batteries produced (per hour)	1000	1100	1000	1200	1100

Table 1

How much does each member earn in one week?

What is the sum of the combined weekly salary all the members?

How many batteries do they produce in a week?

What is the average cost for producing a battery, considering that the only cost involved in producing batteries are the salaries of the workers?

How many hours are required on average to produce a battery?

Which member of the tribe is the most efficient worker?

4. **(25 points)** Each member of the Na'vi tribe is ranked according to the length of their hair tail. The elite of the tribe has 10 members, and their hairs' length (in inches) is the following: 13, 25, 18, 9, 4, 24, 7, 12, 17, 10.

One day they decide to establish who has the longest hair tail, so they ask you to plot a bar graph of it (unfortunately, they don't have MATLAB on the Hometree).

Even with the graph in front of their eyes, they still cannot determine which is the longest, so they ask you to plot the same type of graph, but this time with the values sorted in ascending order and with the bars printed in the color cyan, which is everyone's favorite on the island.

They also would like to compare the two graphs, so they ask the two plots to be in the same figure, but not in the same graph.

Finally, the tribe decides that all the members with hair shorter than 15 inches should get no candy for dinner. How many members won't have sweet dreams tonight?