COMS W3101-2 – Spring 2010

Homework 3

The main goal of the first homework is to have you practice with advanced MATLAB structures (structs, cells, strings), files I/O, and creating your own MATLAB functions

For this assignment you should write a principal m-script file called hw3.m, and then other .m files containing the required functions. At the top of each file you should put your name and ID in a comment. There are 6 exercises in this assignment, 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 30, at beginning of class, no exceptions.

Put your code (.m file) and any additional files 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.

Exercises:

You have been transported through a time machine to the age where humans, squirrels and dinosaurs coexisted…the ice age!

1. (**15 points**) All the species are quite worried about the steady decrease of temperature they have witnessed over the past years. They want to scientifically conclude if the ice age is really coming, and they need a tool to compute statistics on the measurements they have been collecting.
   Design a MATLAB function *vectorOperations()* that
   1.1. Asks the user to insert a vector, and reads it when provided in command window
   1.2. Displays to command window a menu with options
   - Mean (1)
   - Max(2)
   - Min(3)
   - Median(4)

   1.3. Gets the user choice from command window (performing a validity check on it)
   1.4. Displays the result

2. (**15 points**) A new group of squirrels-scientists just arrived from Europe, and the only thing they share with theirs American cousins is the love for nuts. In fact, they can't understand the temperature measurements collected in the US.
   Write a function *c2f(value,f)* that converts degrees from Celsius to Fahrenheit, and vice versa. The function should take 2 values as input:
   - value : the value to convert; it can be either a scalar or a vector
   - f: a flag specifying if the conversion is from Celsius to Fahrenheit (f=0) or from Fahrenheit to Celsius (f=1)

   The function should perform error checking on the input

   Use the conversion function $C = \frac{5}{9}(F - 32)$

3. (**20 points**) Sid, the clumsy sloth, decided that he had enough of the cold nd wants to move to a warmer place, namely a French volcano. He is doing some research on the place, and is given a sheet (the file *Temperature.txt*) with the measurements of the temperature of the volcano over time, in the format Hour/Minute/Second/Temperature. Since the temperatures were measured in France, they are reported in Celsius degrees. However, Sid is American and wants to see them in Fahrenheit.
   3.1. Read the data from the sheet, keeping time and temperature separate
   3.2. Convert the temperatures from Celsius to Fahrenheit
   3.3. Convert the time into seconds (you might want to use/modify the function *hms2secs* we saw in class)
   3.4. Plot the temperatures against time and find the time at which the volcano reached the highest 3 temperatures

4. (**20 points**) The human kid that Manny the mammoth, Sid the sloth and Diego the Smilodon saved during the movie now goes to igloo school. His teacher is analyzing the results of the last class test.
   Write a script that:
   4.1. Reads the names and grades from the file *grades.txt*
   4.2. Erases all the names and grades of students with grade lower than 7
   4.3. Reorder the remaining names and grades on descending grade order
   4.4. Saves the updated lists in the file *newgrades.txt*, with the same format of *grades.txt*

5. (**15 points**) William Blake somehow arrived with the same time machine to the ice age. After seeing Diego the Smilodon, he gets the inspiration to compose the following famous poem:

Tyger, tyger, burning bright
In the forests of the night,
What immortal hand or eye
Could frame thy fearful symmetry?

In what distant deeps or skies
Burnt the fire of thine eyes?
On what wings dare he aspire?
What the hand dare seize the fire?

And what shoulder and what art
Could twist the sinews of thy heart?
And, when thy heart began to beat,
What dread hand and what dread feet?

What the hammer? what the chain?
In what furnace was thy brain?
What the anvil? what dread grasp
Dare its deadly terrors clasp?

When the stars threw down their spears,
And watered heaven with their tears,
Did he smile his work to see?
Did he who made the lamb make thee?

Tyger, tyger, burning bright
In the forests of the night,
What immortal hand or eye
Dare frame thy fearful symmetry?

5.1. Find the number of occurrences of the word 'what' in the poem (case insensitive)
5.2. Split the poem into multiple strings in a cell array, using the questions marks as separators
5.3. Plot a bar graph with the number of occurrences of the letter 't' (case sensitive) in each string of the cell

6. (**15 points**) Temperatures are steadily decreasing, and the dinosaurs must find a new place to go if they want to survive. They hear that a clue to a possible destination is included in a Ceasar Cypher (http://en.wikipedia.org/wiki/Caesar_cipher) that was found in a nearby cave. Copy the following string into a variable *ciphertext:*

   hgx lftee lmxi yhk ftg hgx zbtgm exti yhk ftgdbgw

   Write a **for** loop deciphering and printing to command window the text according to the 26 possible shifts. Only 1 phrase will make sense, which one? What is the correct shift then? Where should the dinosaurs go?