CS1110 Lab 10 (Apr 28-29, 2015)

First Name: _____ Last Name: _____ NetID: _____

The lab assignments are very important and you must have a CS 1110 course consultant "tell CMS" that you did the work. (Correctness does not matter.) This can be done any time up until the start of the next lab (May 5-6). Thus, if you have trouble with a problem, then you have one week to get help from the teaching staff. If you finish before the hour is over, then you can leave early or you can work on the current assignment. Indeed, you are not required to physically attend the labs at all. Just make sure your work is "checked off" by a consultant. And remember this: *The lab problems feed into the assignments and the assignments define what the exams are all about.*

1 Getting Set Up

Review Lectures 22, 23, and 24 which cover numpy, 2D arrays, reading data from a file, and elementary pylab graphics. From the Lab webpage download `Lab10.zip`. Unzip this file and house the contents in a folder/directory `Lab10`. In the command shell, navigate the file system so that this folder is THE CURRENT WORKING DIRECTORY.

2 2D Array Basics

Set up the usual times table:

```
>>> from numpy import *
>>> A = zeros((9,9))
>>> for i in range(9):
>>>     for j in range(9):
>>>         >>> A[i,j] = (i+1)*(j+1)
>>> A
```

(a) What is `A[2,:]` ?

(b) What is `A[:,3]` ?

(c) What is `A[5,6:7]` ?

(d) What is `A[2:4,8]` ?

(e) What values are assignmed to `m` and `n`? `(m,n) = A.shape` ?

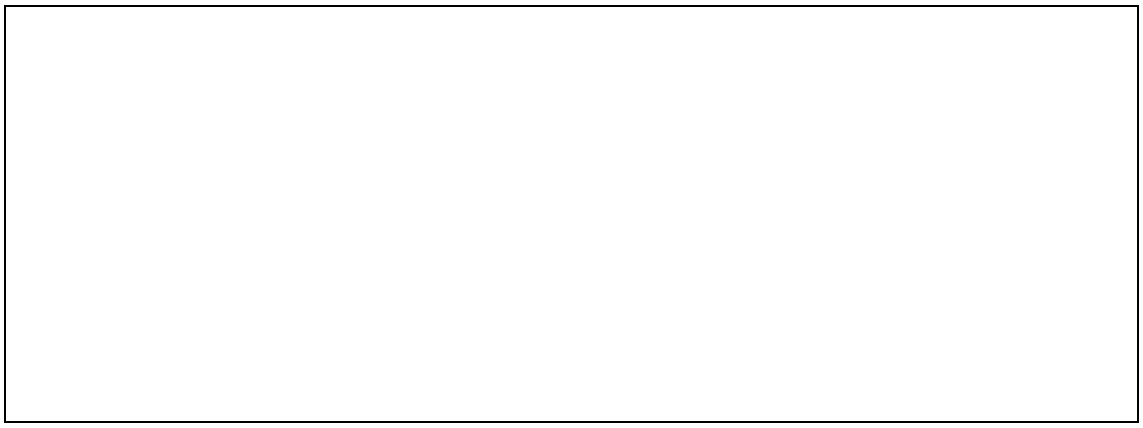
(f) What is `sum(A[:,0])` ?

3 Numpy

Take a look at the module `ShowNumpy.py`.

(a) Add a function `max1D(x)` that returns the sum of the absolute values of the entries in the 1D array `x`. No loops necessary.

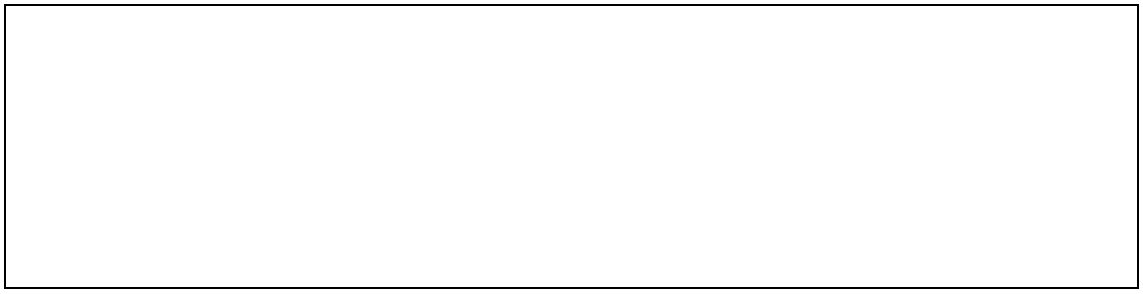
(b) Add a function `max2D(A)` that applies `max1D` to every column in the 2D array `A` returns the largest of these values.



(c) Consider the loop in the application script:

```
for k in range(2*n):
    x = Update(A,x)
    prettyPrint(x)
```

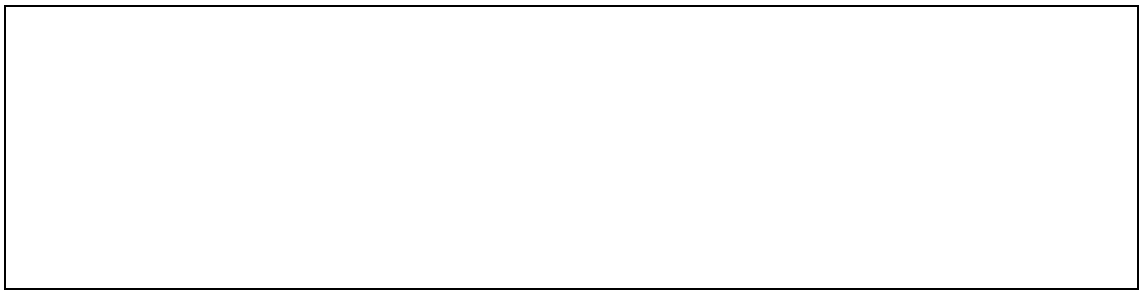
Modify the loop so that in addition to displaying the `x` array each iteration, it also it prints out the value obtained when `max1D` is applied to the array that is the difference between the current `x` and its update.



4 Cost/Inventory

Take a look at the module `ShowCompany.py`, especially the method `Update`.

(a) Add a method `Buy(self,supply)` that takes an array `supply` that has as many entries as there are products and adds that amount of inventory to the inventory of every factory. Don't forget to maintain the class environment.



(b) Add a method `Swap(self,i,j)` that swaps the inventory between factories `i` and `j`. Don't forget to maintain the class invariant.

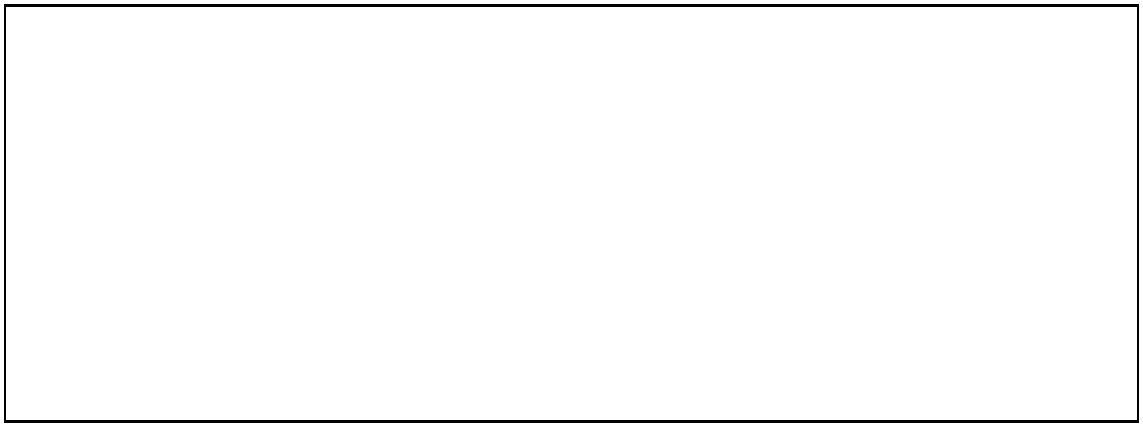
5 Reading Data from a File

Run the module `RiseSet.py`. Modify the application script so that it prints out a 3-column table that reports the latitude and longitude of every city. Do this WITHOUT using the class `Daylight`. Thus, the new application script will read all the files and simply extract the city name and location information which is all it needs to produce the table.

6 Pylab Graphics

(a) Modify `ShowPyLab1.py` so that it adds green grid lines that are halfway between all the red grid lines. Indicate the code you had to add here:

(b) Modify `ShowPyLab2.py` so that it displays the sun-up data of all cities that are in the southern hemisphere. Do not include a legend.



(c) Modify `ShowPyLab3.py` so that it displays monthly bar plots of the sun-up data for 4 different cities. Use `subplot(2,2,1)` `subplot(2,2,2)`, `subplot(2,2,3)`, and `subplot(2,2,4)`.