

CS 8, Winter 2015
Homework Assignment #? (draft)

Assignment Overview

This assignment will give you more experience with dictionaries, functions and lists.

The Problem

Sunspots, storms that occur on the sun, are a cyclic process. These geomagnetic storms can adversely affect electric power grids, disrupt terrestrial electronic telecommunications and cause disorientation or failure of communications satellites. There are a number of agencies that record the sunspot activity, for example the National Oceanic and Atmospheric Agency (NOAA). You will write some code that manipulates this data.

Assignment Specifications:

You will write the following functions:

1. **init_dictionary (file_string)**: This function takes as an argument the name of file to open and return a database (dictionary). The key should be the year; the data should be a list of sunspots data for the months of that year.
2. **input_query_period ()**: This function is for interactively prompting the user on the console the beginning month-year and the end month-year to specify a time period of interest.
3. **extract_data (sunspot_dict, year_tuple, month_tuple)**: This function takes the initialized sunspot dictionary and two tuples. Each tuple is in the form (start, end) where start and end are inclusive. The first is a year tuple (with a potential range from 1749 to 2011 inclusive) and the second is a month tuple (with a potential range from 1 to 12 inclusive). The sunspot_dict data comes from init_dictionary and the year and month tuple data come from input_query_period. This function is also responsible for tabulating, formatting and printing the extracted data on the console.
4. **average_data ()**: This function calculates the average sunspots based on data returned from extract_data.
5. You must provide error checking for all of these functions! The ranges must be correct or an error is indicated. The file must be available or an error results. Think about what errors should be checked.
6. You must provide an entry function called “query” that takes a single argument of a file name storing the sunspots data. This function should call the all other functions (read and parse input file; interactive user prompt; extract, format and print data; and calculate average number of sunspots).

Assignment Deliverables

The deliverable for this assignment is the following file:

sunspots.py – the source code for your Python program

Be sure to use the specified file name and submit it for grading via the **turnin** system before the project deadline.

Sample Outputs

```
>>> sunspots.query('MONTHLY.txt')
enter the beginning month year: 12 1981
enter the end month year: 1 1981
end month-year must be later than begin month-year, try again
enter the beginning month year: 1 1900
enter the end month year: 12 1900
Year   Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
1900   9.40  13.60  8.60  16.00  15.20  12.10  8.30  4.30  8.30  12.90  4.50  0.30
12 record extracted and the average sunspots is : 9.458333
enter the beginning month year: 1 1981
enter the end month year: 12 1980
end month-year must be later than begin month-year, try again
enter the beginning month year: -1 1981
invalid begin date specification, please try again
enter the beginning month year: 12 1981
enter the end month year: 7 1985
Year   Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
1981   150.10
1982  111.20  163.60  153.80  122.00  82.20  110.40  106.10  107.60  118.80  94.70  98.10  127.00
1983   84.30  51.00  66.50  80.70  99.20  91.10  82.20  71.80  50.30  55.80  33.30  33.40
1984   57.00  85.40  83.50  69.70  76.40  46.10  37.40  25.50  15.70  12.00  22.80  18.70
1985   16.50  15.90  17.20  16.20  27.50  24.20  30.70
44 record extracted and the average sunspots is : 69.172727
enter the beginning month year: 11 1987
enter the end month year: 12 1987
Year   Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
1987   39.90  27.10
2 record extracted and the average sunspots is : 33.500000
enter the beginning month year: 6 1910
enter the end month year: 3 1915
Year   Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
1910   12.30  14.10  11.50  26.20  38.30  4.90  5.80
1911   3.40  9.00  7.80  16.50  9.00  2.20  3.50  4.00  4.00  2.60  4.20  2.20
1912   0.30  0.00  4.90  4.50  4.40  4.10  3.00  0.30  9.50  4.60  1.10  6.40
1913   2.30  2.90  0.50  0.90  0.00  0.00  1.70  0.20  1.20  3.10  0.70  3.80
1914   2.80  2.60  3.10  17.30  5.20  11.40  5.40  7.70  12.70  8.20  16.40  22.30
1915  23.00  42.30  38.80
58 record extracted and the average sunspots is : 7.950000
enter the beginning month year: |
```