Python
Lab 2

For Beginners

Project 1.

Change your code from Lab 1, Project 2 to request from the user the starting and stopping temperature values and the increment for your list of degrees C, rather than hard-coding them into the script. You may require that the values be integers. Remember you will have to convert to integer when you read in the numbers.

Project 2.

Write a function that takes a degree C as its argument and returns the corresponding degree F. Change Project 1 to use this function rather than converting each value independently.

Project 3.

Change Project 2 so that instead of obtaining the start, end, and increment values from the user, the program reads them from the command line. (Remember that the command-line arguments are stored in argv[1], argv[2], and argv[3], and that argv[0] is the name of your script). Spyder users: recall that to run with command line options, go to the menu under Run, Configure, check the box for command-line options and type them into the textbox. If you have command-line options you will need to run the code from the Run menu and you cannot run portions of it.

For Intermediates

Project 4.

Write a program to analyze a DNA sequence file. The program should contain a function countBases which takes a sequence consisting of letters ATCG, with each letter the symbol for a base, and returns a dictionary where the key is the letter and the value is the number of times it appears in the sequence. The program should contain another function printBaseComposition which takes the dictionary and prints a table of the proportions of each base, e.g.
A : 0.25
T : 0.25
C : 0.25

G : 0.25

Use the file HIV.txt in Resources/Data to test your program. You can look at the file in a text editor. It consists of a label followed by a space followed by a sequence, for each sequence in the file. Hints: read each sequence as a line. Split the line on whitespace (rstrip first) and throw out the 0^{th} element. Copy the next element of the list into a string, and use substrings to extract each letter. Build your dictionary as you step through the string. Repeat for the next line until you have read all the lines. Look back at the Day 1 notes for reminders of basic string operations.

Project 5.

Take Project 6, Lab 1, and change it (or write it) as follows:

Write a function that does the conversion from the given decimal integer to the equivalent in another base. The decimal integer and the base should be passed to the function and it should return the string to be printed as the answer. Use formatted output to print the table neatly. Read from the command line the number N for the 0 to N printout, followed by the base to which the numbers should be converted.

For Experts

Project 6.

From the Collab site download the data file Resources/Data/rebnut_US-VA_1-110.csv

This is data from the Audubon Society's Christmas Bird Count for the red-breasted nuthatch in Virginia. This bird does not breed in the state but frequently winters here.

Examine the header of the data. It tells you what each field represents.

1. Write a function to read the file and return a list of the years and another list of the corresponding numbers. The function should take as its input the name of the file and the base year for the beginning of observations. The years should be corrected to the base year, which is 1900 in this case.

2. Write a function to compute the mean number of observations.

3 Write a function to compute the standard deviation of the observations.

4. Write a function to compute the maximum number of observations. Also obtain the year in which the maximum occurred.

Use your functions in a program that reads the file, then prints the mean and standard deviation with an appropriate message explaining what the numbers are. Print the maximum number observed and the corresponding year. Write out a file in which each line consists of the year, followed by a comma, followed by the number. If you have Excel or another spreadsheet program on your computer, plot the number of observations versus year.