

## Programming Project 05

This assignment is worth 45 points (4.5% of the course grade) and must be **completed and turned in before 11:59 PM on Monday, October 15, 2018.**

### Assignment Overview

(learning objectives)

This assignment will give you more experience on the use of:

1. Functions
2. File input and output
3. try-except

The goal of this project is to analyze population data. Use of advanced data structures such as list, sets, and dictionaries is prohibited.

### Assignment Background

We take a file of population data that is organized by columns. You will read each line of the file and figure out the maximum increase in population between columns for that continent (that line). You will also find the maximum increase overall, i.e. for all continents.

Here is a file. The first two header lines of the file will always be identical (in particular, the years will be the same). For the data lines the first field (name) is 15 characters wide followed by seven fields where each is 6 characters wide (right-justified, digits only). The field width specification allows you to use slicing to extract values from each line.

Continent Population by Year (millions)							
Continent	1750	1800	1850	1900	1950	2000	2050
Africa	106	107	111	133	221	767	1766
Asia	502	635	809	947	1402	3634	5268
Australia	2	2	2	6	13	30	46
Europe	163	203	276	408	547	729	628
North America	2	7	26	82	172	307	392
South America	16	24	38	74	167	511	809

You will examine successive columns to determine the percentage change from one column to the next. Consider Africa from 1900 to 1950. You use the two values from those years, 133 and 221, to calculate the change:

$$\text{change} = (221 - 133) / 133$$

You need to examine each pair of values for Africa, that is 106 & 107, 107 & 111, 111 & 133, etc. and determine the maximum change for Africa. Display that as a percent. See samples below for display formatting.

### Project Description

Your program must meet the following specifications:

1. At program start prompt the user for a file to be analyzed
2. You have to use the five functions in the provided proj05.py skeleton. You have to implement and use the

- a. `open_file()` : Returns the file pointer to the file opened by asking user for the file name. Error checking is required. That is, keep prompting until a valid file is entered. Use 'Error. Please try again.' for the error message.
- b. `print_headers()` : Print the headers for the output. See samples.
- c. `calc_delta(line, col)` : Takes one line (string) of data from the data file as an argument along with a column index (int) in the line (where the continent's name is "column 0", the first data value is in "column 1", etc.).

You will examine successive columns to determine the percentage change from one column to the next. Consider Africa from 1900 to 1950. You use the two values from those years, 133 and 221, to calculate the change:

$$\text{change} = (221-133)/133$$

To extract the two values, 133 and 221, you need to construct a slice whose values are a function of the column number. You will use the fact that the continent name is in a 15-character wide field and that each value is in a 6-character wide field.

Return change as a float.

(Hint: I developed the slice values by writing a short program that had a string that was one line of the file and then I looped through the string using slicing to print the pairs of values, e.g. for Africa I printed 106 & 107, 107 & 111, 111 & 133, etc. Once I could do that, I knew that I could slice out the desired values and then the rest was easy.)

- d. `format_display_line(continent, year, change)` : Takes as arguments the continent name (string), year (int), and change (float) and returns a formatted string. The continent name will be in a field of 26 characters left justified, the year and its predecessor (year-50) are printed with a hyphen between in a field width of 9 and no spaces on either side of the hyphen, the change will be displayed as a percent with no fractional values including the percent sign in a field width of 10. See samples below. For example, if the parameters are ('Antarctica', 2018, 0.12567), the string returned will be:
- e. `main()` : Takes no input. Returns nothing. Call the functions from here. Close the file here.

Antarctica	1968-2018	13%
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## Assignment Deliverable

The deliverable for this assignment is the following file:

`proj05.py` – the source code for your Python program

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

## Assignment Notes

- 1) To clarify the project specifications, sample output is appended to the end of this document.
- 2) The algorithm for finding a maximum is as follows (finding minimum is similar):
  - a) Initialize the maximum to be a small number, e.g. zero. This is usually done before a loop.
  - b) If a new value is greater than the existing maximum, assign maximum to be the new value.
 Also, you may want to update associated values, e.g the year of the new maximum.
- 3) Items 1-9 of the Coding Standard will be enforced for this project.
- 4) We provide a `proj05.py` program for you to start with.

- 5) Use of advanced data structures such as list, sets, and dictionaries is prohibited.
- 6) If you “hard code” answers, you will receive a grade of zero for the whole project. An example of hard coding is to simply print an average rather than calculating an average and then printing the calculated average.

## Test Cases

### Function Test calc\_delta (calculates change for all six pairs in the input line.)

```
Input line:  Antarctica      160    213    275    418    537    727    625
change:      0.33125
change:      0.29107981220657275
change:      0.52
change:      0.284688995215311
change:      0.3538175046554935
change:      -0.14030261348005502
```

### Function Test format\_display\_line

```
continent,max_delta_year,max_delta = 'Antarctica', 2018, .12567
```

#### returns

```
Antarctica          1968-2018          13%
```

### Test 1 (data.txt)

```
Enter a file name: data.txt
```

#### Maximum Population Change by Continent

Continent	Years	Delta
Africa	1950-2000	247%
Asia	1950-2000	159%
Australia	1850-1900	200%
Europe	1850-1900	48%
North America	1800-1850	271%
South America	1950-2000	206%

```
Maximum of all continents:
```

```
North America      1800-1850      271%
```

### Test 2 (blind test)

## Grading Rubric

Computer Project #05

Scoring Summary

General Requirements:

( 5 pts) Coding Standard 1-9

(descriptive comments, function headers, etc...)

Implementation:

( 5 pts) open\_file function (no Mimir test)

-3 Did not use try/except

( 2 pts) print\_headers function (no Mimir test)

(10 pts) calc\_delta function

( 4 pts) format\_display\_line function

(10 pts) Test1

( 9 pts) Test2 blind test

Note: hard coding an answer earns zero points for the whole project  
-10 points for not using main()