Assignment 2 — Looping, Functions, and Lists

COMP 150 : Introduction to Programming

(100 points)

Brief Description

This assignment amounts to **10%** of the entire course grade. In particular, whatever your obtains as a score will be scaled to this value for final grade computation. You are required to work **ALONE**. No late submission will be permitted (see deadline above).

The goal of this assignment is to assess your knowledge and skills on Control structures. You will find a grading scheme at the end of this document – to guide you on instructor's expectations while preparing your submission.

Problem Definitions

1. **Ontario's Income Tax Calculator:** Employees within the province of Ontario are taxed at different levels - Federal and Provincial. Other deductions like Canadian Pension Plan (CPP), Employment Insurance, and Tax amounts are computed according to salary brackets. (See Payroll Deduction for Ontario Province – Effective January 1, 2020)

   Ontario's (i.e., provincial) tax due is given as follows: 5.05%, 9.15%, 11.16%, 12.16% and 13.16% for taxable incomes in [$0 .. $44,740.01), [$44,740.01 .. $89,482.01), [$89,482.01 .. $150,000.01), [$150,000.01 .. $220,000.01) and [$220,000.01+) brackets respectively.

   In 2020, federal (this includes employees in Ontario) tax due is given as follows: 15.0%, 20.5%, 26.0%, 29.0% and 33.0% for taxable incomes in [$0 .. $48,535.01), [$48,535.01 .. $97,069.01), [$97,069.01 .. $150,473.01), [$150,473.01 .. $214,368.01), and [$214,368.01+) brackets respectively.

   ****You are to note that the computations for provincial and federal taxes are have been revised in comparison with the first assignment**. For example, if gross income is $93,230.00 the taxes are computed below:

   - **Provincial Tax: $6,771.54** = $(2,259.37 + 4,093.89 + 418.28)
     - 1st category $44,740.00 is tax at the rate of 5.05% ⇒ $2,259.37
     - 2nd category ($89,482.01 - $44,740.01) is taxed at the rate of 9.15% ⇒ $4,093.89

- Remainder (i.e., \$93,230.00 - \$89,482.01) is taxed at the rate of 11.16% ⇒ \$418.28

- **Federal Tax: \$16,442.72** = \$(7,280.25 + 9,162.47)
  - 1st category \$48,535.00 is tax at the rate of 15.0% ⇒ \$7,280.25
  - Remainder (i.e., \$93,230.00 - \$48,535.01) is taxed at the rate of 20.5% ⇒ \$9,162.47

Other deductions include CPP (Canada Pension Plan) and EI (Employment Insurance). While CPP is 5.25% of the gross income (but to a maximum amount of \$2,898.00), EI is 1.58% of the gross income (but to a maximum amount of \$856.36).

Besides, the deductions above is the health premium. Ontario employees are charged health premiums using the following rules:

(a) If the taxable income is less than or equal to \$20,000.00, the premium is \$0.00.

(b) If the taxable income is greater than \$20,000.00 and less than or equal to \$36,000.00, the premium is equal to the **lesser of**: (i) \$300.00 and (ii) 6% of (*taxable income* - \$20,000.00);

(c) If the taxable income is greater than \$36,000.00 and less than or equal to \$48,000.00, the premium is equal to the **lesser of**: (i) \$450.00 and (ii) 300 + 6% of (*taxable income* - \$36,000.00);

(d) If the taxable income is greater than \$48,000.00 and less than or equal to \$72,000.00, the premium is equal to the **lesser of**: (i) \$600.00 and (ii) 450 + 25% of (*taxable income* - \$48,000.00);

(e) If the taxable income is greater than \$72,000.00 and less than or equal to \$200,000.00, the premium is equal to the **lesser of**: (i) \$750.00 and (ii) 600 + 25% of (*taxable income* - \$72,000.00);

(f) If the taxable income is greater than \$200,000.00, the premium is equal to the lesser of: (i) \$900.00 and (ii) 750 + 25% of (*taxable income* - \$200,000.00).

(1) **Write a program that:**

- **take gross income of N employees from the user;**
- **compute their net incomes (i.e., after deducting appropriate provincial and federal level taxes, CPP, EI and health premium);**
- **compute and display mean (μ) and standard deviation (σ) of the entire net incomes; and**
- **display a list of all gross incomes and a list of all net incomes.**

You are to implement your work with the following equations to compute mean and standard deviation of any dataset of your choice:

$$\sigma = \sqrt{\frac{\sum_{i=1}^{N}(x_i - \mu)^2}{N}}, \qquad (1)$$

$$\mu = \frac{\sum_{i=1}^{N} x_i}{N} \qquad (2)$$

Hint: Develop your program using Python' s program mode. In particular, write a file for your program and document your program accordingly. Your program would be wrong if it allows negative salary. For each concern, provincial and federal level taxes, health premium, mean μ, and standard deviation σ - you are to develop separate functions with return statements (where applicable), then couple them in a sensible manner. You can use any in-built function except *mean* and *standarddeviation*.

(2) A duplicate (i.e., having the same functionalities) of the program you have developed in (a) - above, using population mean μ and standard deviation σ functions imported from the **statistics module**.

An example test run of the program is given in figure 1. Thus, your program should produce thefollowing output (using the same format and set of taxable incomes) if everything is right:

```
Enter the number of employees: 6


------------------------ Enter Employees' Salaries (i.e., Gross Incomes) Below ------------------------
Enter an employee's gross income: 20000
Enter an employee's gross income: 25000
Enter an employee's gross income: 37000
Enter an employee's gross income: 49000
Enter an employee's gross income: 75000
Enter an employee's gross income: 201000


------------------------ Ontario's Tax Calculator ------------------------
Employees' taxable incomes CAD($): [20000.0, 25000.0, 37000.0, 49000.0, 75000.0, 201000.0]
Employees' net incomes (after tax deductions) CAD($): [14624.0, 17980.0, 26694.4, 35028.57, 52761.9, 131269.58]
Mean of net incomes : CAD($) 46393.07
Standard deviation of net incomes : CAD($) 39954.87
```

The following scheme will be used to grade your submission. Therefore, you may also use it as a guide in preparing your deliverable.

Please note that in addition to submission of the files, you need to record a video and explain your answer.

Submit the link to your video clip (roughly about 5min, not more than 6min) that **explains clearly each of the components of flowcharts, design, and your approach, run your code, and demonstrate your solution.** You could provide the link to your video (on Youtube/Vimeo/…) in the body of your submission.

Grade Item	**Weight**
A syntactically and semantically correct program.	40
Video describing the code and demo that it works	30
A program with detailed program design	10
A flowchart of your program must be included. This must rep resent your program. You can use pen and paper for drawings. You may also decompose the problem into separate components, draw them each and show how the components will be coupled to realize your code.	10
Program efficiency. That is, using efficient but correct control structures.	5
A program with detailed program documentation and uses sensible variable names. Your program's file name and other files should be zipped and named in the following format: [firstName_lastName_studentID]	5
Total	**100**