FE-520 Assignment 1

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Submission Requirement:

For all the problems in this assignment you need to design and use Python 3, output and present the results in nicely format.

Two ways to submit homework:

1. If you use Jupyter Notebook, go to File - Download as - click HTML(.html) and Python(.py), you need to submit both HTML file and Python to Canvas.
2. If you use Other IDE, screenshot your code and result into PDF, you need to submit both PDF file and Python to Canvas.

You are strongly encouraged to write comment for your code, because it is a convention to have your code documented all the time.

Do NOT copy and paste from others, all homework will be firstly checked by plagiarism detection tool.

1 Print (10pts)

1. Define a string variable, and print it. (3pts)
2. Define a string (I'm a student), print it. (3pts)
3. Defind a string: (4pts)
   (How do you think of this course?
   Describe your feeling of this course)
   print it in multiple line.

2 Operator (15pts)

Define a = 100, b = 9, calculate following problems, (1pts)

1. c = a + b, print c out. (2pts)
2. print the quotient of a/b. (2pts)

3. print the integer part of a/b. (2pts)
4. print the remainder part of a/b. (2pts)
5. print the result of 'a' to the power of b. (2pts)
6. Using logic operator to return a Boolean value for a unequal to b. (2pts)
7. Using logic operator to return a Boolean value for a greater than b. (2pts)

3 List Practice (20pts)

1. Define a list Name it List_A), whose items should include integer, float, and string. Please notice the length of the list should be greater than 5. (4pts)
2. Using extend and append to add another list(Name it List_B) to List_A. (4pts)
3. Insert a string ('FE520') to the second place of List A, and delete it after that. (4pts)
4. Return and delete the last element in the List_A, and print the new list. (4pts)
5. Return a new list (Name is List_C), slicing the List_A from 3rd to the end. (4pts)
6. Double size your List_C. (5pts)
7. Reverse your sequence of List_C. (5pts)

4 Practice Dictionary (15 pts)

1. Define a list A = [1, 2, 3, 2, 1, 7].
2. Write a loop to count the number of each unique digit into dictionary, where your keys are digit in the list A, and value is the count corresponding to each digit. Your result should look like :
   {1: 2, 2: 2, 3: 1, 7: 1}

5 Loop Practice: Sum (10 pts)

Write a loop for calculate the average of a list.

For example: if you have a list A = [1, 2, 3, 4, 5, 6], after your loop calculation, you need to get a total_num equals to 3.5.

6 Loop Practice: Gradient Decent (30 pts)

In statistics, linear regression is a linear approach to modelling the relationship between a dependent variable and one or more independent variables. Let X be the independent variable and Y be the dependent variable. We will define a linear relationship between these two variables as follows:

$$Y = mX + c$$

This is the equation for a line that you studied in high school. m is the slope of the line and c is the y intercept. Today we will use this equation to train our model with a given dataset and predict the value of Y for any given value of X.

Our challenge today is to determine the value of m and c, such that the line corresponding to those values is the best fitting line or gives the minimum error.

One way to solve this problem is to use **Gradient Decent** (The reference here contain more details of Gradient decent and sample code, try not use numpy in this question):

The Algorithm of gradient decent to find m and c is :

1. Set initial variable. m=0 and c=0, Learning rate L=0.001, number of iterations.
2. Write a for loop, in this loop, go over all pair (x_i, y_i):
   (a) calculate $y_i^{pred} = x_i * m + b$
   (b) calculate $x_i(y_i - y_i^{pred})$, and store it in list D_m
   (c) calculate $(y_i - y_i^{pred})$, and store it in list D_c
3. calculate the average for list D_m and D_c equal to d_m and d_c
4. update m by: $m = m - L \times d_m$
5. update c by: $c = c - L \times d_c$
6. (Bonus 5 pts) What you have done above are one iteration of gradient descent, once you repeat from step 2 to 5 again and again, the m and c will be converged to the true value. Can you wrap them in big loop for 200 iteration?