Assignment #1

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Python and Applications to Business Analytics Fall 2018, Module 1

September 6, 2018

Exercise 1. Develop a Python application to verify that the following equation is true for any positive integer k.

$$\begin{aligned}\sum_{i=1}^{k+1} i &= \left(\sum_{i=1}^{k} i\right) + (k+1) \\ &= \frac{k(k+1)}{2} + k + 1 \\ &= \frac{k(k+1) + 2(k+1)}{2} \\ &= \frac{(k+1)(k+2)}{2} \\ &= \frac{(k+1)((k+1)+1)}{2}.\end{aligned}$$

Your application's design should include the following:

- Input - Retrieve input, verify that the input is valid, an if necessary, tell the input provider that the input is invalid.
- Output - Visually appealing way to display results.
- Algorithm - Methodology to take input and generate output.

Exercise 2. Develop a Python application to do the following:

- Input: From the Wikipedia site of List of Cities by Population, input each city's name, country, population, and total area in km^2.
- Output: A sorted view by country and density showing city population density in people-per-km^2 and people-per-$miles^2$.
- Algorithm - Whatever you like, but be as efficient as possible.

Exercise 3. Ordinary Least Squares (OLS) Regression: Develop a Python application to do the following:

- Input: A series of (x_i, y_i) values where $i = 1...N$.
- Output: From OLS, the linear equation $y = a + bx$.
- Methodology: By definition, OLS means to compute a and b so as to minimize the sum of all squared residuals. In equation form, we need to find a and b so as to

$$min \sum_{i=1}^{N} (y(x_i) - y_i)^2$$