Laboratory Exercises #1

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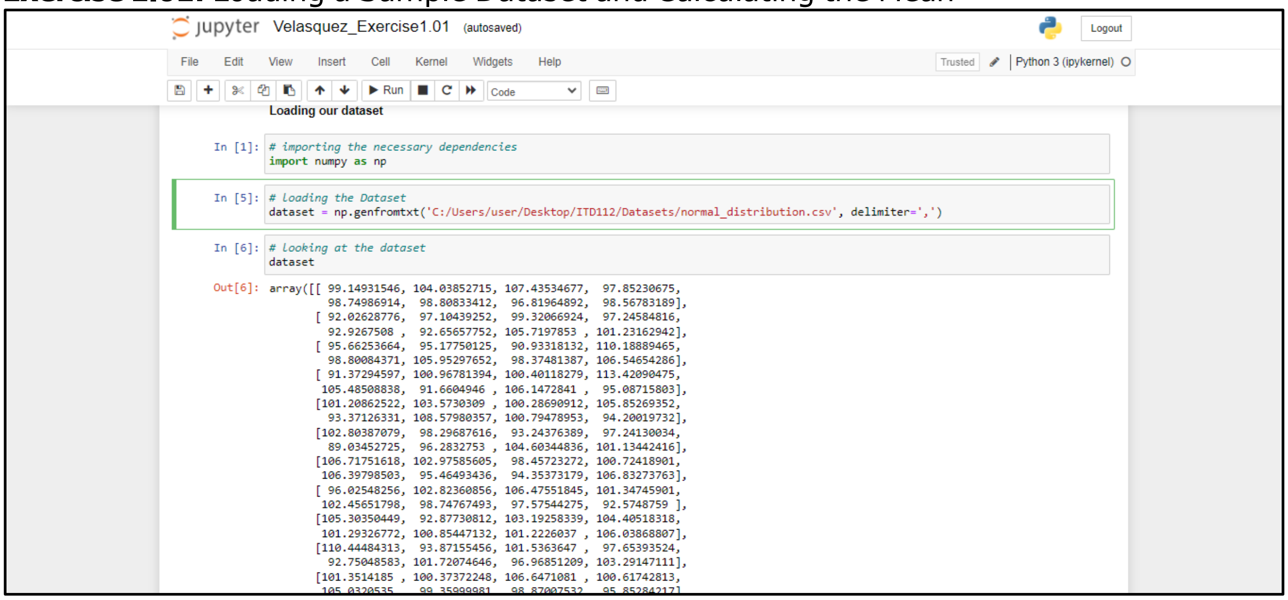
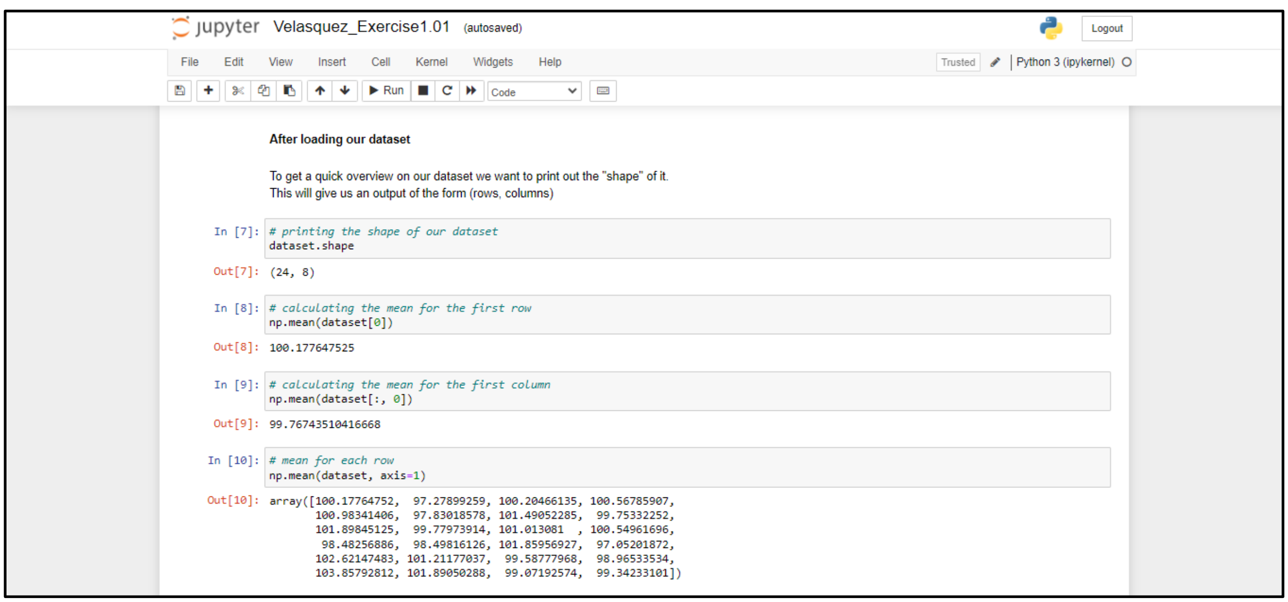
Perform the following exercises. Screenshot your output. Submit in pdf format.

Source Code Link: https://github.com/kiyojiii/ITD112

Exercise 1.01: Loading a Sample Dataset and Calculating the Mean





jupyter Velasquez_Exercise1.01 (autosaved)

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```
In [10]: # mean for each row
         np.mean(dataset, axis=1)

Out[10]: array([100.17764752,  97.27899259, 100.20466135, 100.56785907,
                100.98341406,  97.83018578, 101.49052285,  99.75332252,
                101.89845125,  99.77973914, 101.013081  , 100.54961696,
                 98.48256886,  98.49816126, 101.85956927,  97.05201872,
                102.62147483, 101.21177037,  99.58777968,  98.96533534,
                103.85792812, 101.89050288,  99.07192574,  99.34233101])

In [11]: # mean for each col
         np.mean(dataset, axis=0)

Out[11]: array([ 99.7674351 ,  99.61229127, 101.14584656, 101.8449316 ,
                 99.04871791,  99.67838931,  99.7848489 , 100.44049274])

In [12]: # calculating the mean for the whole matrix
         np.mean(dataset)

Out[12]: 100.16536917390624
```

When looking at the mean values we can really nicely see the effect of calculating the mean of several vaules taken from a normal distribution.
If we had even more data we would get even close to 100.

Exercise 1.02: Indexing, Slicing, Splitting, and Iterating

jupyter Velasquez_Exercise1.02 (unsaved changes)

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Exercise 1.02: Indexing, Slicing, Splitting, and Iterating

Our client wants to prove that our dataset is nicely distributed around the mean value of 100.
They asked us to run some tests on several subsections of it to make sure they won't get a non-descriptive section of our data.

Look at the mean value of each subtask.

Loading the dataset

```
In [1]: # importing the necessary dependencies
        import numpy as np

In [2]: # loading the Dataset
        dataset = np.genfromtxt('C:/Users/user/Desktop/ITD112/Datasets/normal_distribution_splittable.csv', delimiter=',')
```

Indexing

Since we need several rows of our dataset to complete the given task, we have to use indexing to get the right rows.
To recap, index:

- the second row
- the last row
- the first value of the first row
- the last value of the second to the last row

jupyter Velasquez_Exercise1.02 (unsaved changes)

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- the first value of the first row
- the last value of the second to the last row

```
In [3]: # indexing the second row of the dataset (2nd row)
        second_row = dataset[1]

        np.mean(second_row)

Out[3]: 96.90038836444445

In [4]: # indexing the last element of the dataset (last row)
        last_row = dataset[-1]

        np.mean(last_row)

Out[4]: 100.18096645222221

In [5]: # indexing the first value of the first row (1st row, 1st value)
        first_val_first_row = dataset[0][0]

        np.mean(first_val_first_row)

Out[5]: 99.14931546

In [6]: # indexing the last value of the second to last row (we want to use the combined access syntax here)
        last_val_second_last_row = dataset[-2, -1]

        np.mean(last_val_second_last_row)

Out[6]: 101.2226037
```

jupyter Velasquez_Exercise1.02 (unsaved changes)

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In [7]:
```python
# slicing an intersection of 4 elements (2x2) of the first two rows and first two columns
subsection_2x2 = dataset[1:3, 1:3]

np.mean(subsection_2x2)
```

Out[7]: `95.63393608250001`

Why is it not a problem if such a small subsection has a bigger standard deviation from 100?

Several smaller values can cluster in such a small subsection leading to the value being really low.
If we make our subsection larger, we have a higher chance of getting a more expressive view of our data.

In [8]:
```python
# selecting every second element of the fifth row
every_other_elem = dataset[4, ::2]

np.mean(every_other_elem)
```

Out[8]: `98.35235805800001`

In [9]:
```python
# reversing the entry order, selecting the first two rows in reversed order
reversed_last_row = dataset[-1, ::-1]

np.mean(reversed_last_row)
```

Out[9]: `100.18096645222222`

jupyter Velasquez_Exercise1.02 (unsaved changes)

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Splitting

Our client's team only wants to use a small subset of the given dataset.
Therefore we need to first split it into 3 equal pieces and then give them the first half of the first split.
They sent us this drawing to show us what they need:

```
1, 2, 3, 4, 5, 6          1, 2    3, 4    5, 6          1, 2
3, 2, 1, 5, 4, 6    =>    3, 2    1, 5    4, 6    =>    3, 2    =>    1, 2
5, 3, 1, 2, 4, 3          5, 3    1, 2    4, 3                        3, 2
1, 2, 2, 4, 1, 5          1, 2    2, 4    1, 5          5, 3
                                                        1, 2
```

> **Note:**
> We are using a very small dataset here but imagine you have a huge amount of data and only want to look at a small subset of it to tweak your visualizations

In [10]:
```python
# splitting up our dataset horizontally on indices one third and two thirds
hor_splits = np.hsplit(dataset,(3))
```

In [11]:
```python
# splitting up our dataset vertically on index 2
ver_splits = np.vsplit(hor_splits[0],(2))
```

In [12]:
```python
# requested subsection of our dataset which has only half the amount of rows and only a third of the columns
print("Dataset", dataset.shape)
print("Subset", ver_splits[0].shape)
```

```
Dataset (24, 9)
Subset (12, 3)
```

jupyter Velasquez_Exercise1.02 (autosaved)

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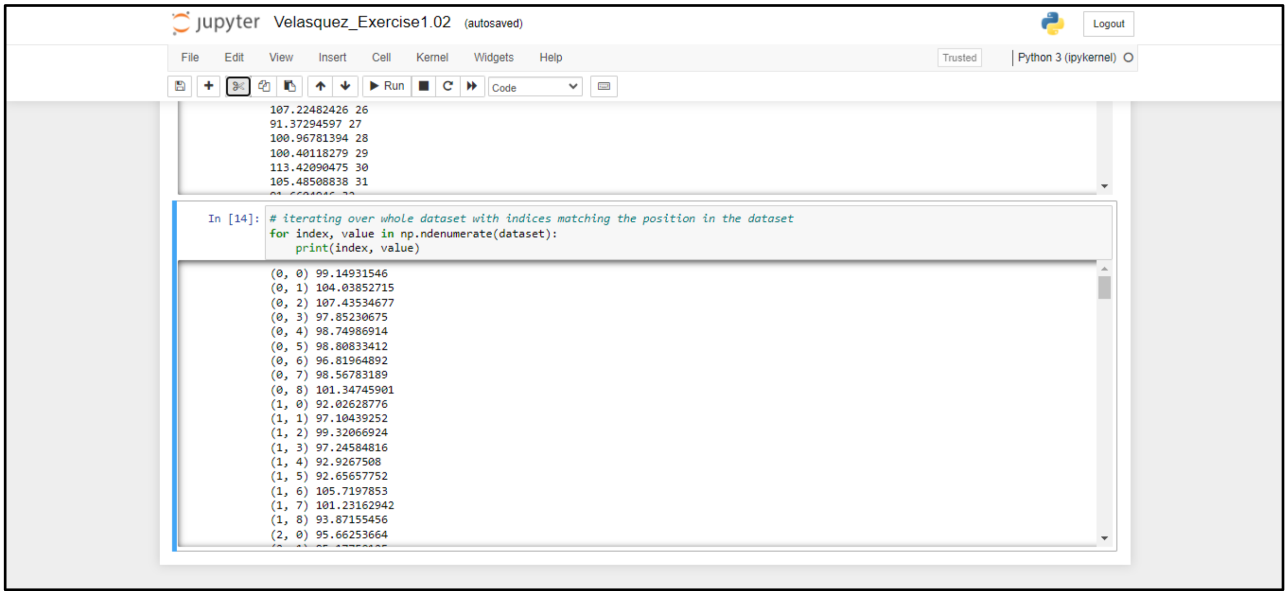
list.
However, they want to also now the position in the dataset itself.

They send you this piece of code and tell you that it's not working as mentioned.
Come up with the right solution for their needs using the `ndenumerate method`.

In [13]:
```python
# iterating over whole datagmaiset (each value in each row)
curr_index = 0
for x in np.nditer(dataset):
    print(x, curr_index)
    curr_index += 1
```

```
99.14931546 0
104.03852715 1
107.43534677 2
97.85230675 3
98.74986914 4
98.80833412 5
96.81964892 6
98.56783189 7
101.34745901 8
92.02628776 9
97.10439252 10
99.32066924 11
97.24584816 12
92.9267508 13
92.65657752 14
105.7197853 15
101.23162942 16
93.87155456 17
95.66253664 18
```

In [14]:
```python
# iterating over whole dataset with indices matching the position in the dataset
```



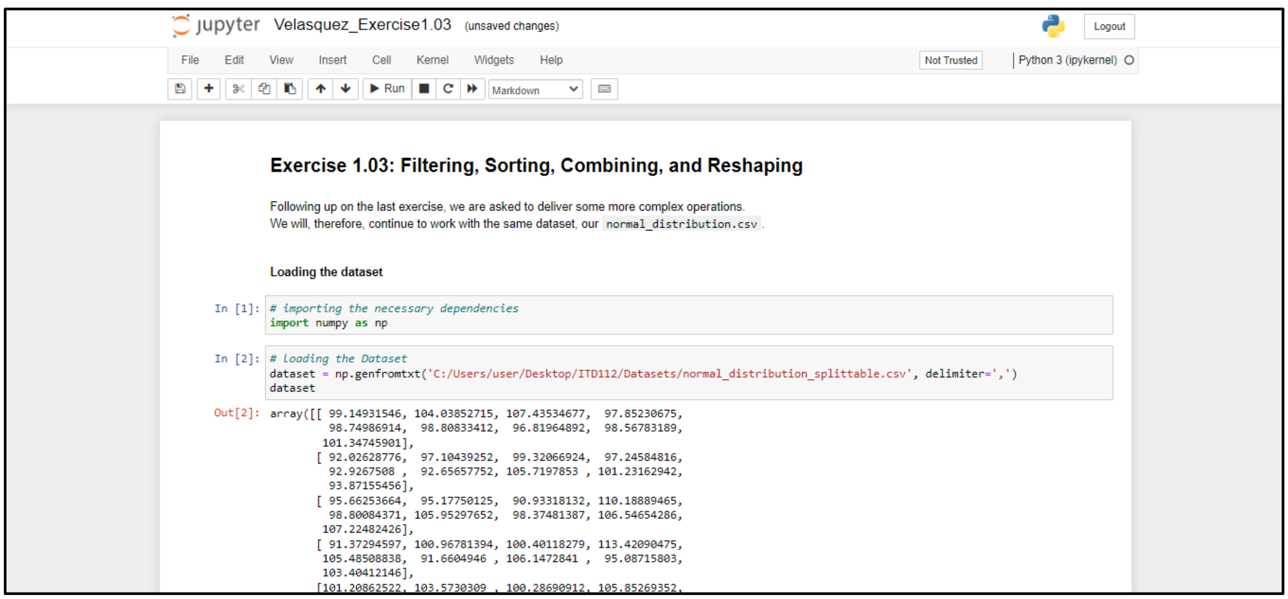
jupyter Velasquez_Exercise1.02 (autosaved)

```
107.22482426 26
91.37294597 27
100.96781394 28
100.40118279 29
113.42090475 30
105.48508838 31
```

In [14]:
```python
# iterating over whole dataset with indices matching the position in the dataset
for index, value in np.ndenumerate(dataset):
    print(index, value)
```

```
(0, 0) 99.14931546
(0, 1) 104.03852715
(0, 2) 107.43534677
(0, 3) 97.85230675
(0, 4) 98.74986914
(0, 5) 98.80833412
(0, 6) 96.81964892
(0, 7) 98.56783189
(0, 8) 101.34745901
(1, 0) 92.02628776
(1, 1) 97.10439252
(1, 2) 99.32066924
(1, 3) 97.24584816
(1, 4) 92.9267508
(1, 5) 92.65657752
(1, 6) 105.7197853
(1, 7) 101.23162942
(1, 8) 93.87155456
(2, 0) 95.66253664
```

Exercise 1.03: Filtering, Sorting, Combining, and Reshaping



jupyter Velasquez_Exercise1.03 (unsaved changes)

Exercise 1.03: Filtering, Sorting, Combining, and Reshaping

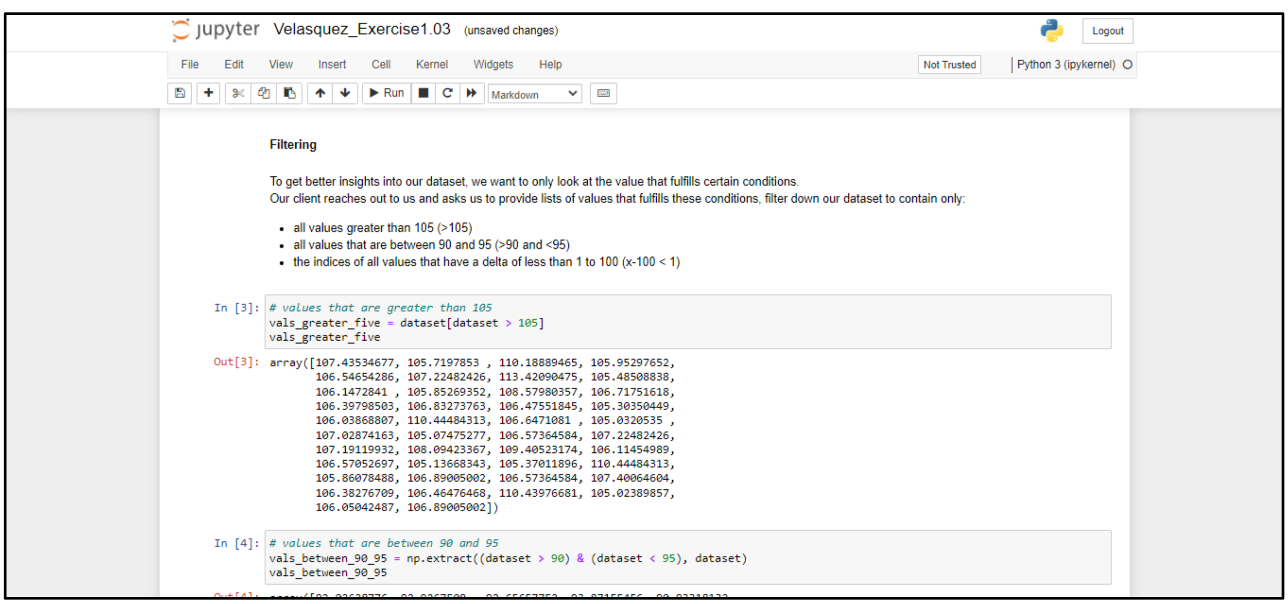
Following up on the last exercise, we are asked to deliver some more complex operations.
We will, therefore, continue to work with the same dataset, our `normal_distribution.csv`.

Loading the dataset

In [1]:
```python
# importing the necessary dependencies
import numpy as np
```

In [2]:
```python
# loading the Dataset
dataset = np.genfromtxt('C:/Users/user/Desktop/ITD112/Datasets/normal_distribution_splittable.csv', delimiter=',')
dataset
```

Out[2]:
```
array([[ 99.14931546, 104.03852715, 107.43534677,  97.85230675,
         98.74986914,  98.80833412,  96.81964892,  98.56783189,
        101.34745901],
       [ 92.02628776,  97.10439252,  99.32066924,  97.24584816,
         92.9267508 ,  92.65657752, 105.7197853 , 101.23162942,
         93.87155456],
       [ 95.66253664,  95.17750125,  90.93318132, 110.18889465,
         98.80084371, 105.95297652,  98.37481387, 106.54654286,
        107.22482426],
       [ 91.37294597, 100.96781394, 100.40118279, 113.42090475,
        105.48508838,  91.6604946 , 106.1472841 ,  95.08715803,
        103.40412146],
       [101.20862522, 103.5730309 , 100.28690912, 105.85269352,
```



jupyter Velasquez_Exercise1.03 (unsaved changes)

Filtering

To get better insights into our dataset, we want to only look at the value that fulfills certain conditions.
Our client reaches out to us and asks us to provide lists of values that fulfills these conditions, filter down our dataset to contain only:

- all values greater than 105 (>105)
- all values that are between 90 and 95 (>90 and <95)
- the indices of all values that have a delta of less than 1 to 100 (x-100 < 1)

In [3]:
```python
# values that are greater than 105
vals_greater_five = dataset[dataset > 105]
vals_greater_five
```

Out[3]:
```
array([107.43534677, 105.7197853 , 110.18889465, 105.95297652,
       106.54654286, 107.22482426, 113.42090475, 105.48508838,
       106.1472841 , 105.85269352, 108.57980357, 106.71751618,
       106.39798503, 106.83273763, 106.47551845, 105.30350449,
       106.03868807, 110.44484313, 106.6471081 , 105.0320535 ,
       107.02874163, 105.07475277, 106.57364584, 107.22482426,
       107.19119932, 108.09423367, 109.40523174, 106.11454989,
       106.57052697, 105.13668343, 105.37011896, 110.44484313,
       105.86078488, 106.89005002, 106.57364584, 107.40064604,
       106.38276709, 106.46476468, 110.43976681, 105.02389857,
       106.05042487, 106.89005002])
```

In [4]:
```python
# values that are between 90 and 95
vals_between_90_95 = np.extract((dataset > 90) & (dataset < 95), dataset)
vals_between_90_95
```

jupyter Velasquez_Exercise1.03 (unsaved changes)

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```
        106.05042487, 106.89005002])
```

In [4]:
```python
# values that are between 90 and 95
vals_between_90_95 = np.extract((dataset > 90) & (dataset < 95), dataset)
vals_between_90_95
```

Out[4]:
```
array([92.02628776, 92.9267508 , 92.65657752, 93.87155456, 90.93318132,
       91.37294597, 91.6604946 , 93.37126331, 94.20019732, 93.24376389,
       94.35373179, 92.5748759 , 91.37294597, 92.87730812, 93.87155456,
       92.75048583, 93.97853495, 91.32093303, 92.0108226 , 93.18884302,
       93.83969256, 94.5081787 , 94.59300658, 93.04610867, 91.6779221 ,
       91.37294597, 94.76253572, 94.57421727, 94.11176915, 93.97853495])
```

> **Note:**
> Conditional filtering can be done either using the brackets syntax or NumPys `extract` method

In [5]:
```python
# indices of values that have a delta of less than 1 to 100
rows, cols = np.where(abs(dataset - 100) < 1)

one_away_indices = [[rows[index], cols[index]] for (index, _) in np.ndenumerate(rows)]
one_away_indices
```

Out[5]:
```
[[0, 0],
 [1, 2],
 [3, 1],
 [3, 2],
 [4, 2],
 [4, 6],
 [6, 3],
```

jupyter Velasquez_Exercise1.03 (autosaved)

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Sorting

They also want to experiment with some more plotting techniques so they ask you to also deliver these datasets. Sort our dataset with:

- values sorted in ascending order for each row
- values sorted in ascending order for each column
- the matrix of indices indicating the position in a sorted list of each value

```
[3, 1, 2, 5, 4]  =>  [1, 2, 0, 4, 3]
```

In [6]:
```python
# values sorted for each row
row_sorted = np.sort(dataset)
row_sorted
```

Out[6]:
```
array([[ 96.81964892,  97.85230675,  98.56783189,  98.74986914,
         98.80833412,  99.14931546, 101.34745901, 104.03852715,
        107.43534677],
       [ 92.02628776,  92.65657752,  92.9267508 ,  93.87155456,
         97.10439252,  97.24584816,  99.32066924, 101.23162942,
        105.7197853 ],
       [ 90.93318132,  95.17750125,  95.66253664,  98.37481387,
         98.80084371, 105.95297652, 106.54654286, 107.22482426,
        110.18889465],
       [ 91.37294597,  91.6604946 ,  95.08715803, 100.40118279,
        100.96781394, 103.40412146, 105.48508838, 106.1472841 ,
        113.42090475],
       [ 93.37126331,  94.20019732,  96.10020311, 100.28690912,
        100.79478953, 101.20862522, 103.5730309 , 105.85269352,
        108.57980357],
```

jupyter Velasquez_Exercise1.03 (autosaved)

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In [7]:
```python
# values sorted for each column
col_sorted = np.sort(dataset, axis=0)
col_sorted
```

Out[7]:
```
array([[ 91.37294597,  88.80221141,  90.93318132,  93.18884302,
         85.98839623,  91.6604946 ,  91.32093303,  92.5748759 ,
         91.37294597],
       [ 92.02628776,  91.6779221 ,  93.24376389,  94.59300658,
         89.03452725,  92.65657752,  93.04610867,  94.20019732,
         91.37294597],
       [ 94.11176915,  92.0108226 ,  93.83969256,  96.74630281,
         92.75048583,  95.19184343,  94.35373179,  94.76253572,
         93.87155456],
       [ 95.65982034,  92.87730812,  94.5081787 ,  97.24130034,
         92.9267508 ,  95.46493436,  96.50342927,  95.08715803,
         93.97853495],
       [ 95.66253664,  93.87155456,  97.75887636,  97.24584816,
         93.37126331,  95.62359311,  96.81964892,  95.85284217,
         95.19184343],
       [ 96.02548256,  94.57421727,  98.45723272,  97.62787811,
         93.97853495,  96.2832753 ,  96.89244283,  97.59572169,
         96.10020311],
       [ 96.10020311,  95.17750125,  99.32066924,  97.65393524,
         95.93799169,  96.34622848,  96.96851209,  98.00253006,
         97.10439252],
       [ 96.76814836,  96.59385486,  99.57859892,  97.85230675,
         98.29243952,  96.5937781 ,  97.57544275,  98.07122664,
         97.24130034],
       [ 96.78266211,  97.10439252, 100.28690912,  99.4889538 ,
         98.61325194,  98.65912661,  97.94046856,  98.56783189,
         97.62787811],
       [ 97.21315663,  98.29687616, 100.40118279,  99.95827854,
```

jupyter Velasquez_Exercise1.03 (autosaved)

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```
        110.44484313]])
```

In [8]:
```
# sorted indices of positions for first row
index_sorted = np.argsort(dataset[0])
dataset[0][index_sorted]
```

Out[8]:
```
array([ 96.81964892,  97.85230675,  98.56783189,  98.74986914,
        98.80833412,  99.14931546, 101.34745901, 104.03852715,
       107.43534677])
```

Combining

After finishing their visualization and doing ask you to deliver a way they can incrementally add the split parts of the dataset to make sure it works with every subset, too.
Create a combined dataset by:

- adding the second half of the first column
- adding the second column
- adding the third and last separate column

In [9]:
```
# split up dataset from exercise02
thirds = np.hsplit(dataset, (3))
halfed_first = np.vsplit(thirds[0], (2))

# this is the part we've sent the client in exercise02
halfed_first[0]
```

jupyter Velasquez_Exercise1.03 (autosaved)

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In [9]:
# split up dataset from exercise02
thirds = np.hsplit(dataset, (3))
halfed_first = np.vsplit(thirds[0], (2))
# this is the part we've sent the client in exercise02
halfed_first[0]

Out[9]:
```
array([[ 99.14931546, 104.03852715, 107.43534677],
       [ 92.02628776,  97.10439252,  99.32066924],
       [ 95.66253664,  95.17750125,  90.93318132],
       [ 91.37294597, 100.96781394, 100.40118279],
       [101.20862522, 103.5730309 , 100.28690912],
       [102.80387079,  98.29687616,  93.24376389],
       [106.71751618, 102.97585605,  98.45723272],
       [ 96.02548256, 102.82360856, 106.47551845],
       [105.30350449,  92.87730812, 103.19258339],
       [110.44484313,  93.87155456, 101.5363647 ],
       [101.3514185 , 100.37372248, 106.6471081 ],
       [ 97.21315663, 107.02874163, 102.17642112]])
```

In [10]:
```
# adding the second half of the first column to the data
first_col = np.vstack([halfed_first[0], halfed_first[1]])
first_col
```

Out[10]:
```
array([[ 99.14931546, 104.03852715, 107.43534677],
       [ 92.02628776,  97.10439252,  99.32066924],
       [ 95.66253664,  95.17750125,  90.93318132],
       [ 91.37294597, 100.96781394, 100.40118279],
       [101.20862522, 103.5730309 , 100.28690912],
       [102.80387079,  98.29687616,  93.24376389],
       [106.71751618, 102.97585605,  98.45723272],
       [ 96.02548256, 102.82360856, 106.47551845],
```

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```
       [106.89005002, 106.57364584, 102.26648279],
       [ 99.80873105, 101.63973121, 106.46476468],
       [ 96.10020311,  94.57421727, 100.80409326],
       [ 94.11176915,  99.62387832, 104.51786419]])
```

In [11]:
```
# adding the second column to our combined dataset
first_second_col = np.hstack([first_col, thirds[1]])
first_second_col
```

Out[11]:
```
array([[ 99.14931546, 104.03852715, 107.43534677,  97.85230675,
         98.74986914,  98.80833412],
       [ 92.02628776,  97.10439252,  99.32066924,  97.24584816,
         92.9267508 ,  92.65657752],
       [ 95.66253664,  95.17750125,  90.93318132, 110.18889465,
         98.80084371, 105.95297652],
       [ 91.37294597, 100.96781394, 100.40118279, 113.42090475,
        105.48508838,  91.6604946 ],
       [101.20862522, 103.5730309 , 100.28690912, 105.85269352,
         93.37126331, 108.57980357],
       [102.80387079,  98.29687616,  93.24376389,  97.24130034,
         89.03452725,  96.2832753 ],
       [106.71751618, 102.97585605,  98.45723272, 100.72418901,
        106.39798503,  95.46493436],
       [ 96.02548256, 102.82360856, 106.47551845, 101.34745901,
        102.45651798,  98.74767493],
       [105.30350449,  92.87730812, 103.19258339, 104.40518318,
        101.29326772, 100.85447132],
       [110.44484313,  93.87155456, 101.5363647 ,  97.65393524,
         92.75048583, 101.72074646],
       [101.3514185 , 100.37372248, 106.6471081 , 100.61742813,
        105.0320535 ,  99.35999981],
       [ 97.21315663, 107.02874163, 102.17642112,  96.74630281,
         95.93799169, 102.62384733],
```

jupyter Velasquez_Exercise1.03 (autosaved)

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```
       [ 96.10020311,  94.57421727, 100.80409326, 105.02389857,
         98.61325194,  95.62359311],
       [ 94.11176915,  99.62387832, 104.51786419,  97.62787811,
         93.97853495,  98.75108352]])
```

In [12]:
```python
# adding the third column to our combined dataset
full_data = np.hstack([first_second_col, thirds[2]])
full_data
```

Out[12]:
```
array([[ 99.14931546, 104.03852715, 107.43534677,  97.85230675,
         98.74986914,  98.80833412,  96.81964892,  98.56783189,
        101.34745901],
       [ 92.02628776,  97.10439252,  99.32066924,  97.24584816,
         92.9267508 ,  92.65657752, 105.7197853 , 101.23162942,
         93.87155456],
       [ 95.66253664,  95.17750125,  90.93318132, 110.18889465,
         98.80084371, 105.95297652,  98.37481387, 106.54654286,
        107.22482426],
       [ 91.37294597, 100.96781394, 100.40118279, 113.42090475,
        105.48508838,  91.6604946 , 106.1472841 ,  95.08715803,
        103.40412146],
       [101.20862522, 103.5730309 , 100.28690912, 105.85269352,
         93.37126331, 108.57980357, 100.79478953,  94.20019732,
         96.10020311],
       [102.80387079,  98.29687616,  93.24376389,  97.24130034,
         89.03452725,  96.2832753 , 104.60344836, 101.13442416,
         97.62787811],
       [106.71751618, 102.97585605,  98.45723272, 100.72418901,
        106.39798503,  95.46493436,  94.35373179, 106.83273763,
        100.07721494],
       [ 96.02548256, 102.82360856, 106.47551845, 101.34745901,
        102.45651798,  98.74767493,  97.57544275,  92.5748759 ,
         91.37294597],
       [105.30350449,  92.87730812, 103.19258339, 104.40518318,
```

jupyter Velasquez_Exercise1.03 (autosaved)

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Reshaping

For their internal AI algorithms, they need the dataset in a reshaped manner that reduces the number of columns.
They asked us to deliver the whole dataset in the following shapes. Create new datasets that are:

- reshaped in a one-dimensional list with all values
- reshaped in a matrix with only 2 columns

In [13]:
```python
# reshaping to a list of values
single_list = np.reshape(dataset, (1, -1))
single_list
```

Out[13]:
```
array([[ 99.14931546, 104.03852715, 107.43534677,  97.85230675,
         98.74986914,  98.80833412,  96.81964892,  98.56783189,
        101.34745901,  92.02628776,  97.10439252,  99.32066924,
         97.24584816,  92.9267508 ,  92.65657752, 105.7197853 ,
        101.23162942,  93.87155456,  95.66253664,  95.17750125,
         90.93318132, 110.18889465,  98.80084371, 105.95297652,
         98.37481387, 106.54654286, 107.22482426,  91.37294597,
        100.96781394, 100.40118279, 113.42090475, 105.48508838,
         91.6604946 , 106.1472841 ,  95.08715803, 103.40412146,
        101.20862522, 103.5730309 , 100.28690912, 105.85269352,
         93.37126331, 108.57980357, 100.79478953,  94.20019732,
         96.10020311, 102.80387079,  98.29687616,  93.24376389,
         97.24130034,  89.03452725,  96.2832753 , 104.60344836,
        101.13442416,  97.62787811, 106.71751618, 102.97585605,
         98.45723272, 100.72418901, 106.39798503,  95.46493436,
         94.35373179, 106.83273763, 100.07721494,  96.02548256,
        102.82360856, 106.47551845, 101.34745901, 102.45651798,
         98.74767493,  97.57544275,  92.5748759 ,  91.37294597,
```

jupyter Velasquez_Exercise1.03 (autosaved)

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```
         99.62387832, 104.51786419,  97.62787811,  93.97853495,
         98.75108352, 106.05042487, 100.07721494, 106.89005002]])
```

In [14]:
```python
# reshaping to a matrix with two columns
two_col_dataset = dataset.reshape(-1, 2)
two_col_dataset
```

```
       [102.20618501,  91.37294597],
       [106.89005002, 106.57364584],
       [102.26648279, 107.40064604],
       [ 99.94318168, 103.40412146],
       [106.38276709,  98.00253006],
       [ 97.10439252,  99.80873105],
       [101.63973121, 106.46476468],
       [110.43976681, 100.69156231],
       [ 99.99579473, 101.32113654],
       [ 94.76253572,  97.24130034],
       [ 96.10020311,  94.57421727],
       [100.80409326, 105.02389857],
       [ 98.61325194,  95.62359311],
       [ 97.99762409, 103.83852459],
       [101.2226037 ,  94.11176915],
       [ 99.62387832, 104.51786419],
       [ 97.62787811,  93.97853495],
       [ 98.75108352, 106.05042487],
       [100.07721494, 106.89005002]])
```

Note:
-1 in the dimension definition means that it figures out the other dimension on its own

Exercise 1.04: Loading a Sample Dataset and Calculating the Mean

jupyter Velasquez_Exercise1.04 (autosaved)

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In [3]:
```python
# looking at the dataset
dataset.head()
```

Out[3]:

Country Name	Country Code	Indicator Name	Indicator Code	1960	1961	1962	1963	1964	1965	1966	...	2007	2008	
Aruba	ABW	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	307.972222	312.366667	314.983333	316.827778	318.666667	320.622222	...	562.322222	563.011111	563
Andorra	AND	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	30.587234	32.714894	34.914894	37.170213	39.470213	41.800000	...	180.591489	182.161702	181
Afghanistan	AFG	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	14.038148	14.312061	14.599692	14.901579	15.218206	15.545203	...	39.637202	40.634655	41
Angola	AGO	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	4.305195	4.384299	4.464433	4.544558	4.624228	4.703271	...	15.387749	15.915819	16
Albania	ALB	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	60.576642	62.456898	64.329234	66.209307	68.058066	69.874927	...	108.394781	107.566204	106

5 rows × 60 columns

jupyter Velasquez_Exercise1.04 (autosaved)

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In [4]:
```python
# printing the shape of our dataset
dataset.shape
```

Out[4]: (264, 60)

In [5]:
```python
# calculating the mean for 1961 column
dataset["1961"].mean()
```

Out[5]: 176.91514132840555

In [6]:
```python
# calculating the mean for 2015 column
dataset["2015"].mean()
```

Out[6]: 368.70660104001837

Note:
Only by comaparing the overall mean of the two years, 1961 and 2015, we can already see that the mean population density **more than doubled** in this time range.

In [10]:
```python
# Assuming 'dataset' is your DataFrame, select only valid numeric columns
numeric_columns = dataset.select_dtypes(include='number')

# Calculate the mean of selected numeric columns
mean_values = numeric_columns.mean(axis=1)

# Display the mean values for the first 10 rows
print(mean_values.head(10))
```

```
Country Name
```

jupyter Velasquez_Exercise1.04 (autosaved)

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In [10]:
```python
# Assuming 'dataset' is your DataFrame, select only valid numeric columns
numeric_columns = dataset.select_dtypes(include='number')

# Calculate the mean of selected numeric columns
mean_values = numeric_columns.mean(axis=1)

# Display the mean values for the first 10 rows
print(mean_values.head(10))
```

```
Country Name
Aruba                   413.944949
Andorra                 106.838839
Afghanistan              25.373379
Angola                    9.649583
Albania                  99.159197
Arab World               16.118586
United Arab Emirates     31.321721
Argentina                11.634028
Armenia                 103.415539
American Samoa          211.855636
dtype: float64
```

In [7]:
```python
# mean for each country (row)
dataset.mean(axis=1).head(10)
```

```
C:\Users\user\AppData\Local\Temp\ipykernel_2920\51040833.py:2: FutureWarning: Dropping of nuisance columns in DataFrame reducti
ons (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError.  Select only valid columns before
calling the reduction.
  dataset.mean(axis=1).head(10)
```

Out[7]:
```
Country Name
Aruba                   413.944949
```

jupyter Velasquez_Exercise1.04 (autosaved)

Logout

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Run Code

In [13]:
```python
# Assuming 'dataset' is your DataFrame, select only valid numeric columns
numeric_columns = dataset.select_dtypes(include='number')

# Calculate the mean of selected numeric columns
mean_values = numeric_columns.mean(axis=0)

# Display the mean values for the first 10 rows
print(mean_values.tail(10))
```

```
2007    331.995474
2008    338.688417
2009    343.649206
2010    347.967029
2011    351.942027
2012    357.787305
2013    360.985726
2014    364.849194
2015    368.706601
2016           NaN
dtype: float64
```

In [8]:
```python
# mean for each feature (col)
dataset.mean(axis=0).tail(10)
```

```
C:\Users\user\AppData\Local\Temp\ipykernel_2920\2830591496.py:2: FutureWarning: The default value of numeric_only in DataFrame.mean is deprecated. In a future version, it will default to False. In addition, specifying 'numeric_only=None' is deprecated. Select only valid columns or specify the value of numeric_only to silence this warning.
  dataset.mean(axis=0).tail(10)
```

Out[8]:
```
2007    331.995474
2008    338.688417
2009    343.649206
```

jupyter Velasquez_Exercise1.04 (autosaved)

Logout

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Run Code

The axis parameter is again needed to control the aggregation now.

In [14]:
```python
# Assuming 'dataset' is your DataFrame, calculate the mean for all numeric columns
mean_values = dataset.mean(numeric_only=True)

# Display the mean values for each numeric column
print(mean_values)
```

```
1960           NaN
1961    176.915141
1962    180.703231
1963    184.572413
1964    188.461797
1965    192.412363
1966    196.145042
1967    200.118063
1968    203.879464
1969    207.336102
1970    210.607871
1971    213.489694
1972    215.998475
1973    218.438708
1974    220.621210
1975    223.046375
1976    224.960258
1977    227.006734
1978    229.187306
1979    232.510772
1980    236.185357
1981    240.789508
1982    246.175178
1983    251.342389
1984    256.647822
```

jupyter Velasquez_Exercise1.04 (autosaved)

Logout

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Run Code

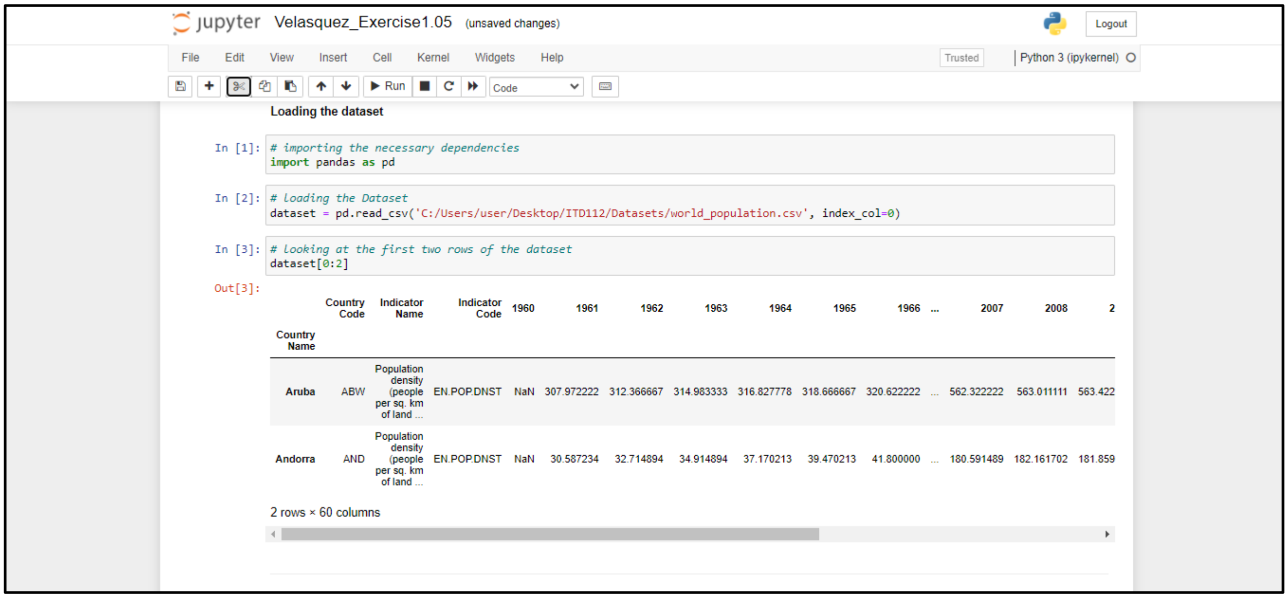
```
2016           NaN
dtype: float64
```

In [9]:
```python
# calculating the mean for the whole matrix
dataset.mean()
```

```
C:\Users\user\AppData\Local\Temp\ipykernel_2920\2681821768.py:2: FutureWarning: The default value of numeric_only in DataFrame.mean is deprecated. In a future version, it will default to False. In addition, specifying 'numeric_only=None' is deprecated. Select only valid columns or specify the value of numeric_only to silence this warning.
  dataset.mean()
```

Out[9]:
```
1960           NaN
1961    176.915141
1962    180.703231
1963    184.572413
1964    188.461797
1965    192.412363
1966    196.145042
1967    200.118063
1968    203.879464
1969    207.336102
1970    210.607871
1971    213.489694
1972    215.998475
1973    218.438708
1974    220.621210
1975    223.046375
1976    224.960258
1977    227.006734
1978    229.187306
1979    232.510772
1980    236.185357
1981    240.789508
1982    246.175178
```

Exercise 1.05: Using pandas to Compute the Mean, Median, and Variance of a Dataset



jupyter Velasquez_Exercise1.05 (unsaved changes) Logout

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Loading the dataset

In [1]:
```
# importing the necessary dependencies
import pandas as pd
```

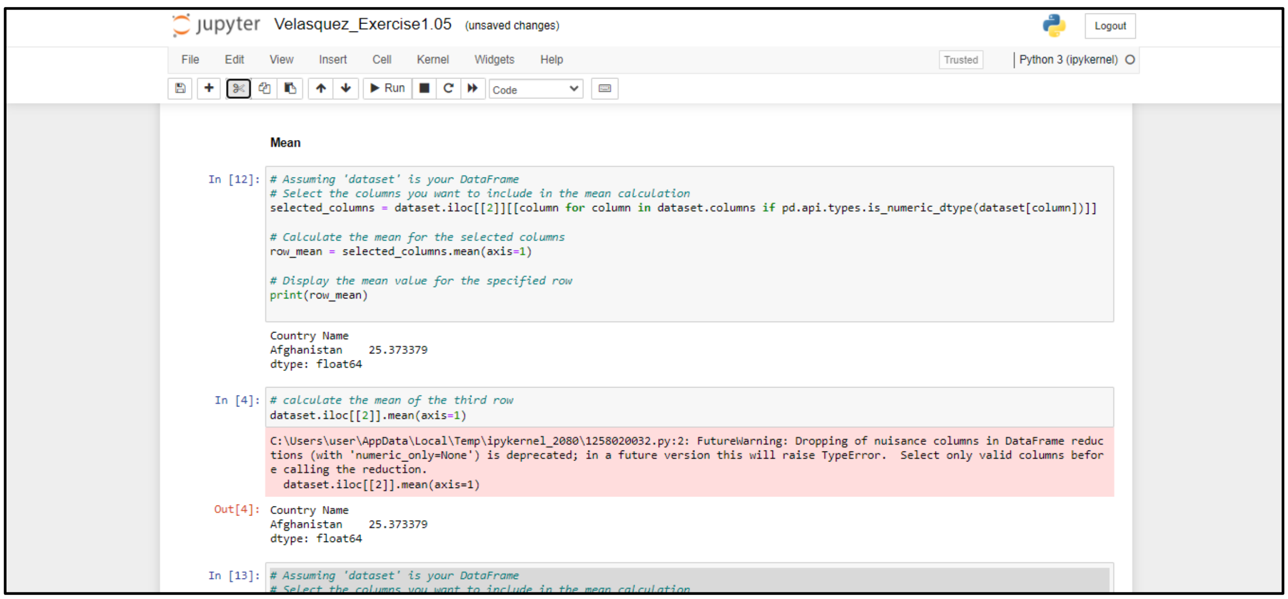
In [2]:
```
# loading the Dataset
dataset = pd.read_csv('C:/Users/user/Desktop/ITD112/Datasets/world_population.csv', index_col=0)
```

In [3]:
```
# looking at the first two rows of the dataset
dataset[0:2]
```

Out[3]:

	Country Code	Indicator Name	Indicator Code	1960	1961	1962	1963	1964	1965	1966	...	2007	2008	2
Country Name														
Aruba	ABW	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	307.972222	312.366667	314.983333	316.827778	318.666667	320.622222	...	562.322222	563.011111	563.422
Andorra	AND	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	30.587234	32.714894	34.914894	37.170213	39.470213	41.800000	...	180.591489	182.161702	181.859

2 rows × 60 columns



jupyter Velasquez_Exercise1.05 (unsaved changes) Logout

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Mean

In [12]:
```
# Assuming 'dataset' is your DataFrame
# Select the columns you want to include in the mean calculation
selected_columns = dataset.iloc[[2]][[column for column in dataset.columns if pd.api.types.is_numeric_dtype(dataset[column])]]

# Calculate the mean for the selected columns
row_mean = selected_columns.mean(axis=1)

# Display the mean value for the specified row
print(row_mean)
```

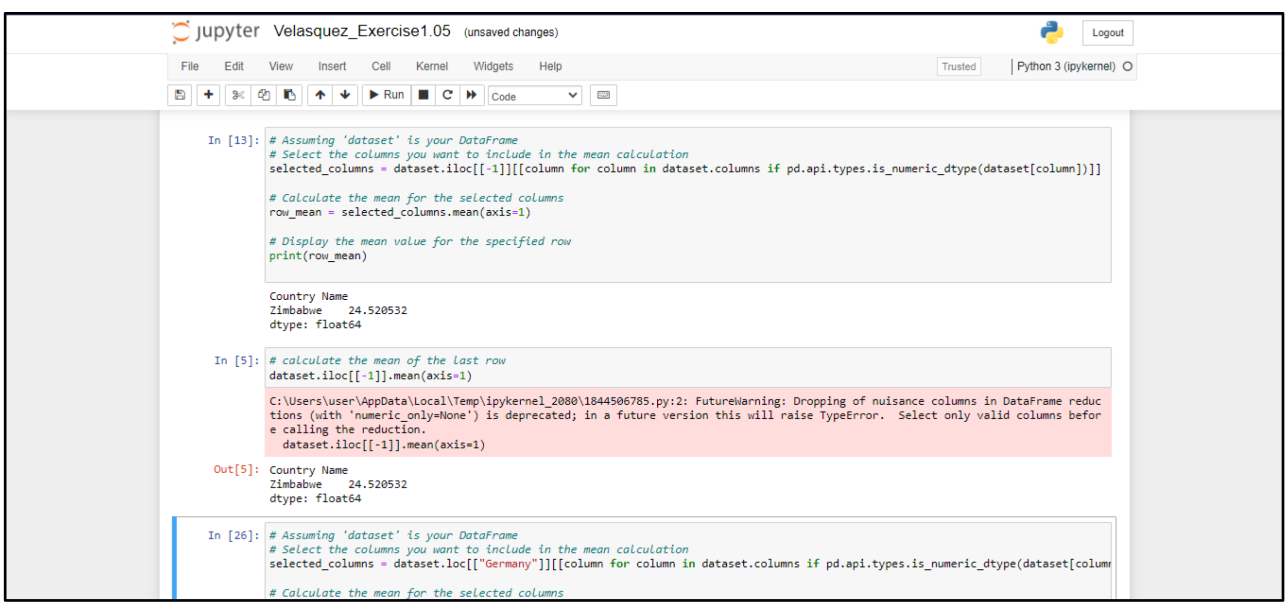
```
Country Name
Afghanistan    25.373379
dtype: float64
```

In [4]:
```
# calculate the mean of the third row
dataset.iloc[[2]].mean(axis=1)
```

```
C:\Users\user\AppData\Local\Temp\ipykernel_2080\1258020032.py:2: FutureWarning: Dropping of nuisance columns in DataFrame reduc
tions (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError.  Select only valid columns befor
e calling the reduction.
  dataset.iloc[[2]].mean(axis=1)
```

Out[4]:
```
Country Name
Afghanistan    25.373379
dtype: float64
```

In [13]:
```
# Assuming 'dataset' is your DataFrame
# Select the columns you want to include in the mean calculation
```



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In [13]:
```
# Assuming 'dataset' is your DataFrame
# Select the columns you want to include in the mean calculation
selected_columns = dataset.iloc[[-1]][[column for column in dataset.columns if pd.api.types.is_numeric_dtype(dataset[column])]]

# Calculate the mean for the selected columns
row_mean = selected_columns.mean(axis=1)

# Display the mean value for the specified row
print(row_mean)
```

```
Country Name
Zimbabwe    24.520532
dtype: float64
```

In [5]:
```
# calculate the mean of the last row
dataset.iloc[[-1]].mean(axis=1)
```

```
C:\Users\user\AppData\Local\Temp\ipykernel_2080\1844506785.py:2: FutureWarning: Dropping of nuisance columns in DataFrame reduc
tions (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError.  Select only valid columns befor
e calling the reduction.
  dataset.iloc[[-1]].mean(axis=1)
```

Out[5]:
```
Country Name
Zimbabwe    24.520532
dtype: float64
```

In [26]:
```
# Assuming 'dataset' is your DataFrame
# Select the columns you want to include in the mean calculation
selected_columns = dataset.loc[["Germany"]][[column for column in dataset.columns if pd.api.types.is_numeric_dtype(dataset[colum

# Calculate the mean for the selected columns
```

jupyter Velasquez_Exercise1.05 (unsaved changes)

```
dtype: float64
```

In [26]:

```python
# Assuming 'dataset' is your DataFrame
# Select the columns you want to include in the mean calculation
selected_columns = dataset.loc[["Germany"]][[column for column in dataset.columns if pd.api.types.is_numeric_dtype(dataset[colum

# Calculate the mean for the selected columns
row_mean = selected_columns.mean(axis=1)

# Display the mean value for the specified row
print(row_mean)
```

```
Country Name
Germany     227.773688
dtype: float64
```

In [6]:

```python
# calculate the mean of the country Germany
dataset.loc[["Germany"]].mean(axis=1)
```

```
C:\Users\user\AppData\Local\Temp\ipykernel_2080\2599282623.py:2: FutureWarning: Dropping of nuisance columns in DataFrame reduc
tions (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError.  Select only valid columns befor
e calling the reduction.
  dataset.loc[["Germany"]].mean(axis=1)
```

Out[6]:

```
Country Name
Germany     227.773688
dtype: float64
```

Note:

`.iloc()` and `.loc()` are two important methods when indexing with Pandas. They allow to make precise selections of data based on either the integer value index (`.iloc`) or the index column (`.loc`), which in our case is the country name column.

jupyter Velasquez_Exercise1.05 (autosaved)

Median

In [29]:

```python
# Assuming 'dataset' is your DataFrame
# Select the columns you want to include in the mean calculation
selected_columns = dataset.iloc[[-1]][[column for column in dataset.columns if pd.api.types.is_numeric_dtype(dataset[column])]]

# Calculate the mean for the selected columns
row_median = selected_columns.median(axis=1)

# Display the mean value for the specified row
print(row_median)
```

```
Country Name
Zimbabwe    25.505431
dtype: float64
```

In [7]:

```python
# calculate the median of the last row
dataset.iloc[[-1]].median(axis=1)
```

```
C:\Users\user\AppData\Local\Temp\ipykernel_2080\1533885436.py:2: FutureWarning: Dropping of nuisance columns in DataFrame reduc
tions (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError.  Select only valid columns befor
e calling the reduction.
  dataset.iloc[[-1]].median(axis=1)
```

Out[7]:

```
Country Name
Zimbabwe    25.505431
dtype: float64
```

In [31]:

```python
# Select the rows you want (last 3 rows)
last_3_rows = dataset.iloc[-3:]
```

jupyter Velasquez_Exercise1.05 (autosaved)

In [31]:

```python
# Select the rows you want (last 3 rows)
last_3_rows = dataset.iloc[-3:]

# Select the columns you want to include in the median calculation
selected_columns = last_3_rows.select_dtypes(include=['number'])

# Calculate the median for each row along columns (axis=1)
row_medians = selected_columns.median(axis=1)

# Display the medians for the last 3 rows
print(row_medians)
```

```
Country Name
Congo, Dem. Rep.    14.419050
Zambia              10.352668
Zimbabwe            25.505431
dtype: float64
```

In [8]:

```python
# calculate the median of the last 3 rows
dataset[-3:].median(axis=1)
```

```
C:\Users\user\AppData\Local\Temp\ipykernel_2080\1139480153.py:2: FutureWarning: Dropping of nuisance columns in DataFrame reduc
tions (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError.  Select only valid columns befor
e calling the reduction.
  dataset[-3:].median(axis=1)
```

Out[8]:

```
Country Name
Congo, Dem. Rep.    14.419050
Zambia              10.352668
Zimbabwe            25.505431
dtype: float64
```

Note:

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Run Code

In [32]:
```python
# Select the columns you want to include in the median calculation
selected_columns = dataset.head(10).select_dtypes(include=['number'])

# Calculate the median for each row along columns (axis=1)
row_medians = selected_columns.median(axis=1)

# Display the medians for the first 10 rows
print(row_medians)
```

```
Country Name
Aruba                   348.022222
Andorra                 107.300000
Afghanistan              19.998926
Angola                    8.458253
Albania                 106.001058
Arab World               15.307283
United Arab Emirates     19.305072
Argentina                11.618238
Armenia                 105.898033
American Samoa          220.245000
dtype: float64
```

In [9]:
```python
# calculate the median of the first 10 countries
dataset.head(10).median(axis=1)
```

```
C:\Users\user\AppData\Local\Temp\ipykernel_2080\2702851610.py:2: FutureWarning: Dropping of nuisance columns in DataFrame reduc
tions (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError.  Select only valid columns befor
e calling the reduction.
  dataset.head(10).median(axis=1)
```

Out[9]:
```
Country Name
Aruba                   348.022222
Andorra                 107.300000
```

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Run Code

```
American Samoa          220.245000
dtype: float64
```

In [9]:
```python
# calculate the median of the first 10 countries
dataset.head(10).median(axis=1)
```

```
C:\Users\user\AppData\Local\Temp\ipykernel_2080\2702851610.py:2: FutureWarning: Dropping of nuisance columns in DataFrame reduc
tions (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError.  Select only valid columns befor
e calling the reduction.
  dataset.head(10).median(axis=1)
```

Out[9]:
```
Country Name
Aruba                   348.022222
Andorra                 107.300000
Afghanistan              19.998926
Angola                    8.458253
Albania                 106.001058
Arab World               15.307283
United Arab Emirates     19.305072
Argentina                11.618238
Armenia                 105.898033
American Samoa          220.245000
dtype: float64
```

Note:
When handling larger datasets, the order in which methods get executed definitely matters.
Think about what `.head(10)` does for a moment, it simply takes your dataset and returns the first 10 rows of it, cutting down your input to the `.mean()` method drastically.
This will definitely have an impact when using more memory intensive calculations, so keep an eye on the order.

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Run Code

Variance

In [33]:
```python
# Calculate the variance for columns with numeric data only
variance = dataset.var(numeric_only=True).tail()

# Display the variance for the selected columns
print(variance)
```

```
2012    3.063475e+06
2013    3.094597e+06
2014    3.157111e+06
2015    3.220634e+06
2016             NaN
dtype: float64
```

In [10]:
```python
# calculate the variance of the last 5 columns
dataset.var().tail()
```

```
C:\Users\user\AppData\Local\Temp\ipykernel_2080\3575222615.py:2: FutureWarning: The default value of numeric_only in DataFrame.
var is deprecated. In a future version, it will default to False. In addition, specifying 'numeric_only=None' is deprecated. Se
lect only valid columns or specify the value of numeric_only to silence this warning.
  dataset.var().tail()
```

Out[10]:
```
2012    3.063475e+06
2013    3.094597e+06
2014    3.157111e+06
2015    3.220634e+06
2016             NaN
dtype: float64
```

jupyter Velasquez_Exercise1.05 (autosaved)

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```
lect only valid columns or specify the value of numeric_only to silence this warning.
  dataset.var().tail()
```

Out[10]:

```
2012    3.063475e+06
2013    3.094597e+06
2014    3.157111e+06
2015    3.220634e+06
2016             NaN
dtype: float64
```

As mentioned in the introduction of Pandas, it's interoperable with several of NumPy's features.
Here's an example of how to use NumPy's `mean` method with a Pandas dataFrame.

In [11]:

```python
# NumPy Pandas interoperability
import numpy as np

print("Pandas", dataset["2015"].mean())
print("NumPy", np.mean(dataset["2015"]))
```

```
Pandas 368.70660104001837
NumPy 368.70660104001837
```

Exercise 1.06: Indexing, Slicing, and Iterating Using pandas

jupyter Velasquez_Exercise1.06 (autosaved)

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Loading the dataset

In [1]:

```python
# importing the necessary dependencies
import pandas as pd
```

In [2]:

```python
# Loading the Dataset
dataset = pd.read_csv('C:/Users/user/Desktop/ITD112/Datasets/world_population.csv', index_col=0)
```

In [3]:

```python
# looking at the first 2 elements of the dataset
dataset.head(2)
```

Out[3]:

Country Name	Country Code	Indicator Name	Indicator Code	1960	1961	1962	1963	1964	1965	1966	...	2007	2008	2
Aruba	ABW	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	307.972222	312.366667	314.983333	316.827778	318.666667	320.622222	...	562.322222	563.011111	563.422
Andorra	AND	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	30.587234	32.714894	34.914894	37.170213	39.470213	41.800000	...	180.591489	182.161702	181.859

2 rows × 60 columns

jupyter Velasquez_Exercise1.06 (autosaved)

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Indexing

Since we need several rows and columns of our dataset to complete the given task, we have to use indexing to get the right rows and columns.
Use indexing to get:

- the row of the USA
- the second to last row
- the column of year 2000 as Series
- the population density for India in 2000

In [4]:

```python
# indexing the USA row
dataset.loc[["United States"]].head()
```

Out[4]:

Country Name	Country Code	Indicator Name	Indicator Code	1960	1961	1962	1963	1964	1965	1966	...	2007	2008	2009	2
United States	USA	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	20.05588	20.366723	20.661953	20.950959	21.214527	21.460952	...	32.878611	33.243687	33.536399	33.817

1 rows × 60 columns

jupyter Velasquez_Exercise1.06 (autosaved)

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In [5]:
```python
# indexing the last second to last row by index
dataset.iloc[[-2]]
```

Out[5]:

Country Name	Country Code	Indicator Name	Indicator Code	1960	1961	1962	1963	1964	1965	1966	...	2007	2008	2009	2010
Zambia	ZMB	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	4.227724	4.359305	4.496824	4.639914	4.788452	4.942343	...	17.135926	17.641587	18.170609	18.721585

1 rows × 60 columns

In [6]:
```python
# indexing the column of 2000 as a Series
dataset["2000"].head()
```

Out[6]:
```
Country Name
Aruba          504.766667
Andorra        139.146809
Afghanistan     30.177894
Angola          12.078798
Albania        112.738212
Name: 2000, dtype: float64
```

In [7]:
```python
# indexing the population density of India in 2000 (Dataframe)
dataset[["2000"]].loc[["India"]]
```

jupyter Velasquez_Exercise1.06 (autosaved)

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In [7]:
```python
# indexing the population density of India in 2000 (Dataframe)
dataset[["2000"]].loc[["India"]]
```


Out[7]:

Country Name	2000
India	354.326858

Note:
Using sinlge brackets to index columns (like with NumPy) we will get a pandas Series object.
When using double brackets to do indexing, a DataFrame will be returned. This way we can also index several elements with one query.

When comparing the output of the DataFrame query to the Series query, we can see the difference between Series and DataFrames

In [8]:
```python
# indexing the population density of India in 2000 (Series)
dataset["2000"].loc["India"]
```

Out[8]: 354.326858357522

Slicing

Other than the single rows and columns and we also need to get some Subsets of the dataset.
Use slicing for:

- the countries in row 2 to 5

jupyter Velasquez_Exercise1.06 (autosaved)

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- Germany, Singapore, United States, and India with their population density of years 1970, 1990, 2010

In [9]:
```python
# slicing countries of rows 2 to 5
dataset.iloc[1:5]
```

Out[9]:

Country Name	Country Code	Indicator Name	Indicator Code	1960	1961	1962	1963	1964	1965	1966	...	2007	2008	2009
Andorra	AND	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	30.587234	32.714894	34.914894	37.170213	39.470213	41.800000	...	180.591489	182.161702	181.859574
Afghanistan	AFG	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	14.038148	14.312061	14.599692	14.901579	15.218206	15.545203	...	39.637202	40.634655	41.674005
Angola	AGO	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	4.305195	4.384299	4.464433	4.544558	4.624228	4.703271	...	15.387749	15.915819	16.459536
Albania	ALB	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	60.576642	62.456898	64.329234	66.209307	68.058066	69.874927	...	108.394781	107.566204	106.843759

4 rows × 60 columns

jupyter Velasquez_Exercise1.06 (autosaved)

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Run Markdown

In [10]:
```python
# slicing rows Germany, Singapore, United States, and India
dataset.loc[["Germany", "Singapore", "United States", "India"]]
```

Out[10]:

Country Name	Country Code	Indicator Name	Indicator Code	1960	1961	1962	1963	1964	1965	1966	...	2007	200
Germany	DEU	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	210.172807	212.029284	214.001527	215.731495	217.579970	219.403406	...	235.943362	235.5221
Singapore	SGP	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	2540.895522	2612.238806	2679.104478	2748.656716	2816.268657	2887.164179	...	6602.300719	6913.4228
United States	USA	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	20.055880	20.366723	20.661953	20.950959	21.214527	21.460952	...	32.878611	33.2436
India	IND	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	154.275864	157.424902	160.679256	164.029246	167.470047	170.995768	...	396.774384	402.6214

4 rows × 60 columns

jupyter Velasquez_Exercise1.06 (autosaved)

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Trusted | Python 3 (ipykernel)

Run Markdown

In [11]:
```python
# slicing a subset of Germany, Singapore, United States, and India
# for years 1970, 1990, 2010 <
country_list = ["Germany", "Singapore", "United States", "India"]

dataset.loc[country_list][["1970", "1990", "2010"]]
```

Out[11]:

Country Name	1970	1990	2010
Germany	223.897371	227.517054	234.606908
Singapore	3096.268657	4547.958209	7231.811966
United States	22.388131	27.254514	33.817936
India	186.312757	292.817404	414.028200

Iterating

As the last task of this exercise, we want to iterate over the first three countries of our dataset and print:

- name
- country code
- years 1970, 1990, 2010

jupyter Velasquez_Exercise1.06 (autosaved)

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Run Markdown

- years 1970, 1990, 2010

In [12]:
```python
# iterating over the first three countries (row by row)
for index, row in dataset.iterrows():
    # only printing the rows until Angola
    if index == 'Angola':
        break

    print(index, '\n', row[["Country Code", "1970", "1990", "2010"]], '\n')
```

```
Aruba
 Country Code         ABW
1970           328.138889
1990           345.266667
2010           564.427778
Name: Aruba, dtype: object

Andorra
 Country Code         AND
1970            51.657447
1990           115.980851
2010           179.614894
Name: Andorra, dtype: object

Afghanistan
 Country Code        AFG
1970           17.034429
1990           18.484162
2010           42.830327
Name: Afghanistan, dtype: object
```

Exercise 1.07: Filtering, Sorting, and Reshaping

jupyter Velasquez_Exercise1.07 (autosaved)

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Loading the dataset

In [1]:
```python
# importing the necessary dependencies
import pandas as pd
```

In [2]:
```python
# Loading the Dataset
dataset = pd.read_csv('C:/Users/user/Desktop/ITD112/Datasets/world_population.csv', index_col=0)
```

In [3]:
```python
# looking at the data
dataset[:2]
```

Out[3]:

Country Name	Country Code	Indicator Name	Indicator Code	1960	1961	1962	1963	1964	1965	1966	...	2007	2008	2
Aruba	ABW	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	307.972222	312.366667	314.983333	316.827778	318.666667	320.622222	...	562.322222	563.011111	563.422
Andorra	AND	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	30.587234	32.714894	34.914894	37.170213	39.470213	41.800000	...	180.591489	182.161702	181.859

2 rows × 60 columns

jupyter Velasquez_Exercise1.07 (autosaved)

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In [4]:
```python
# filtering columns 1961, 2000, and 2015
dataset.filter(items=["1961", "2000", "2015"]).head()
```

Out[4]:

Country Name	1961	2000	2015
Aruba	307.972222	504.766667	577.161111
Andorra	30.587234	139.146809	149.942553
Afghanistan	14.038148	30.177894	49.821649
Angola	4.305195	12.078798	20.070565
Albania	60.576642	112.738212	105.444051

In [5]:
```python
# filtering countries that had a greater population density than 500 in 2000
dataset[(dataset["2000"] > 500)][["2000"]]
```

Out[5]:

Country Name	2000
Aruba	504.766667
Bangladesh	1008.532988
Bahrain	939.232394
Bermuda	1236.660000
Barbados	627.530233
Channel Islands	766.623711
Gibraltar	2735.100000

jupyter Velasquez_Exercise1.07 (autosaved)

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Sint Maarten (Dutch part)	897.617647

In [6]:
```python
# filtering for years 2000 and later
dataset.filter(regex="^2", axis=1).head()
```

Out[6]:

Country Name	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Aruba	504.766667	516.077778	527.750000	538.972222	548.566667	555.727778	560.166667	562.322222	563.011111	563.422222	564.427778	566.311111
Andorra	139.146809	144.191489	151.161702	159.112766	166.674468	172.814894	177.389362	180.591489	182.161702	181.859574	179.614894	175.161702
Afghanistan	30.177894	31.448029	32.912231	34.475030	35.995236	37.373936	38.574296	39.637202	40.634655	41.674005	42.830327	44.127634
Angola	12.078798	12.483188	12.921871	13.388462	13.873025	14.368286	14.872437	15.387749	15.915819	16.459536	17.020898	17.600302
Albania	112.738212	111.685146	111.350730	110.934891	110.472226	109.908285	109.217044	108.394781	107.566204	106.843759	106.314635	106.013869

In [7]:
```python
# # filtering countries that start with A
dataset.filter(regex="^A", axis=0).head()
```

Out[7]:

Country Name	Country Code	Indicator Name	Indicator Code	1960	1961	1962	1963	1964	1965	1966	...	2007	2008	
Aruba	ABW	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	307.972222	312.366667	314.983333	316.827778	318.666667	320.622222	...	562.322222	563.011111	563
		Population												

jupyter Velasquez_Exercise1.07 (autosaved)

Logout

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Trusted | Python 3 (ipykernel)

Run Code

In [8]:
```
# filtering countries that contain the word land
dataset.filter(like="land", axis=0).head()
```

Out[8]:

Country Name	Country Code	Indicator Name	Indicator Code	1960	1961	1962	1963	1964	1965	1966	...	2007	2008	
Switzerland	CHE	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	137.479609	141.009285	144.056036	146.458915	148.160089	149.716707	...	191.090115	193.533632	195.
Channel Islands	CHI	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	569.067010	574.551546	580.386598	586.484536	592.742268	599.103093	...	806.783505	812.304124	817.
Cayman Islands	CYM	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	33.441667	33.925000	34.283333	34.579167	34.879167	35.175000	...	214.500000	220.520833	226.
Finland	FIN	Population density (people per sq. km of land ...	EN.POP.DNST	NaN	14.645934	14.745865	14.850484	14.933330	14.983197	15.039460	...	17.391956	17.484038	17.
Faroe Islands	FRO	Population density (people per sq. km of land	EN.POP.DNST	NaN	24.878223	25.181232	25.465616	25.749284	26.047994	26.363897	...	34.813037	34.834527	34.

jupyter Velasquez_Exercise1.07 (autosaved)

Logout

File Edit View Insert Cell Kernel Widgets Help

Trusted | Python 3 (ipykernel)

Run Code

- values sorted in ascending order by 1961
- values sorted in ascending order by 2015
- values sorted in descending order by 2015

In [9]:
```
# values sorted by column 1961
dataset.sort_values(by=["1961"])[["1961"]].head(10)
```

Out[9]:

Country Name	1961
Greenland	0.098625
Mongolia	0.632212
Namibia	0.749775
Libya	0.843320
Mauritania	0.856916
Botswana	0.946793
United Arab Emirates	1.207955
Australia	1.364565
Iceland	1.785825
Oman	1.825186

In [10]:
```
# values sorted by column 2015
dataset.sort_values(by=["2015"])[["2015"]].head(10)
```

Out[10]:

2015

jupyter Velasquez_Exercise1.07 (autosaved)

Logout

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Trusted | Python 3 (ipykernel)

Run Code

In [10]:
```
# values sorted by column 2015
dataset.sort_values(by=["2015"])[["2015"]].head(10)
```

Out[10]:

Country Name	2015
Greenland	0.136713
Mongolia	1.904744
Namibia	2.986590
Australia	3.095579
Iceland	3.299980
Suriname	3.480609
Libya	3.568227
Guyana	3.896800
Canada	3.942567
Mauritania	3.946409

Note:
Comparisons like this are very valuable to get a good understanding not only of your dataset but also the underlying data itself.
For example, here we can see that the ranking of the lowest densely populated countries changed.

In [11]:
```
# values sorted by column 2015 in descending order
dataset.sort_values(by=["2015"], ascending=False)[["2015"]].head(10)
```

Out[11]:

jupyter Velasquez_Exercise1.07 (autosaved)

Logout

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Run Code

Note:
Comparisons like this are very valuable to get a good understanding not only of your dataset but also the underlying data itself.
For example, here we can see that the ranking of the lowest densely populated countries changed.

In [11]:
```
# values sorted by column 2015 in descending order
dataset.sort_values(by=["2015"], ascending=False)[["2015"]].head(10)
```

Out[11]:

	2015
Country Name	
Macao SAR, China	19392.937294
Monaco	18865.500000
Singapore	7828.857143
Hong Kong SAR, China	6957.809524
Gibraltar	3221.700000
Bahrain	1788.619481
Maldives	1363.876667
Malta	1347.915625
Bermuda	1304.700000
Bangladesh	1236.810648

Reshaping

jupyter Velasquez_Exercise1.07 (unsaved changes)

Logout

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Run Code

Reshaping

In order to create a visualization that focuses on 2015, they ask you to create a subset of your DataFrame which only contains one row that which holds all the values for the year 2015 mapped to the country codes as columns.

They've sent you this scribble:

```
Country Code   ABW   AFG   AGO   ...
---------------------------------------
        2015   577    49    20   ...
```

> They were lazy so they didn't write the digits after the comma. Make sure to keep the original values

In [12]:
```
# reshaping to 2015 as row and country codes as columns
dataset_2015 = dataset[["Country Code", "2015"]]

dataset_2015.pivot(index=["2015"] * len(dataset_2015), columns="Country Code", values="2015")
```

Out[12]:

2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
0.136713	0.136713	0.136713	0.136713	0.136713	0.136713	0.136713	0.136713	0.136713	0.136713	0.136713
1.904744	1.904744	1.904744	1.904744	1.904744	1.904744	1.904744	1.904744	1.904744	1.904744	1.904744
2.986590	2.986590	2.986590	2.986590	2.986590	2.986590	2.986590	2.986590	2.986590	2.986590	2.986590
3.095579	3.095579	3.095579	3.095579	3.095579	3.095579	3.095579	3.095579	3.095579	3.095579	3.095579