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Homework 2

This homework assignment aims to build a linear model to describe the trend of height increase for the United Kingdom between 1900 and 1980.

Please complete this notebook and submit it to Blackboard as a PDF file before Wednesday, March 2nd at 11:59PM.

1. Extract the average height values for **United Kingdom** between 1900 and 1980 from the dataset used in Week 2 notebook.

```
import pandas as pd

raw_data = pd.read_csv("average-height-of-men-for-selected-countries.csv", sep=',')
raw_data
```

```
           Entity  Code  Year  Human Height (University of Tuebingen (2015))
   0  Afghanistan   AFG  1870                                          168.4
   1  Afghanistan   AFG  1880                                          165.7
   2  Afghanistan   AFG  1930                                          166.8
   3      Albania   ALB  1880                                          170.1
   4      Albania   ALB  1890                                          169.8
 ...          ...   ...   ...                                            ...
1245     Zimbabwe   ZWE  1900                                          167.6
1246     Zimbabwe   ZWE  1950                                          171.0
1247     Zimbabwe   ZWE  1960                                          171.1
1248     Zimbabwe   ZWE  1970                                          171.3
1249     Zimbabwe   ZWE  1980                                          171.0

1250 rows × 4 columns
```

```
raw_UK = raw_data[raw_data.Entity == 'United Kingdom']
raw_UK
```

```
          Entity  Code  Year  Human Height (University of Tuebingen (2015))
```

1176	United Kingdom	GBR	1810	169.7
1177	United Kingdom	GBR	1820	169.1
1178	United Kingdom	GBR	1830	166.7
1179	United Kingdom	GBR	1840	166.5
1180	United Kingdom	GBR	1850	165.6
1181	United Kingdom	GBR	1860	166.6
1182	United Kingdom	GBR	1870	167.2
1183	United Kingdom	GBR	1880	168.0
1184	United Kingdom	GBR	1890	167.4
1185	United Kingdom	GBR	1900	169.4
1186	United Kingdom	GBR	1910	170.9
1187	United Kingdom	GBR	1920	171.0
1188	United Kingdom	GBR	1930	173.9
1189	United Kingdom	GBR	1940	174.9
1190	United Kingdom	GBR	1950	176.0
1191	United Kingdom	GBR	1960	176.9
1192	United Kingdom	GBR	1970	177.1
1193	United Kingdom	GBR	1980	176.8

```
UK_1900 = raw_UK[raw_UK.Year >= 1900]
UK_1900
```

	Entity	Code	Year	Human Height (University of Tuebingen (2015))
1185	United Kingdom	GBR	1900	169.4

```
AVG_UK = UK_1900['Human Height (University of Tuebingen (2015))'].mean()
AVG_UK
```

```
174.1
```

1189 United Kingdom GBR 1940 174.9

2. Find a linear model (height = m * year + b) that can describe the trend of height increase.

   - The value of `m` should be close to the average height increase
   - The value of `b` should make the line close to the data points.

1193 United Kingdom GBR 1980 176.8

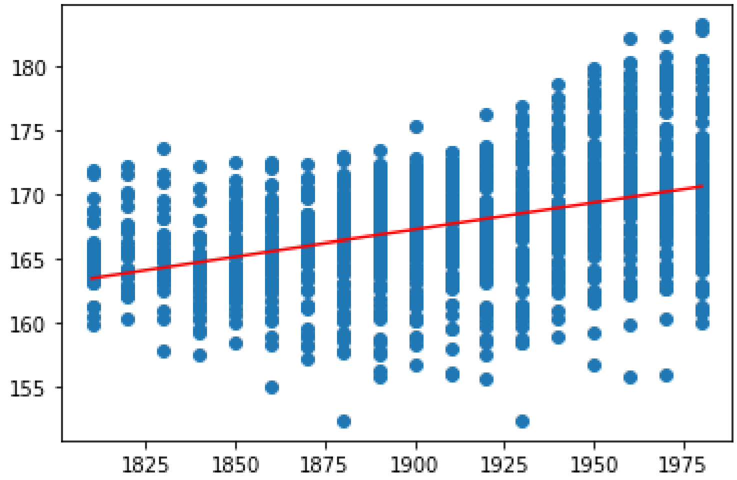
```
from sklearn.linear_model import LinearRegression
from matplotlib import pyplot as plt
import numpy as np

model = LinearRegression()
model.fit(raw_data[['Year']], raw_data[['Human Height (University of Tuebingen (2015))']
m = model.coef_[0,0]
b = model.intercept_[0]
x = np.array([raw_data.Year.min(), raw_data.Year.max()])
height = m * x + b
height
```

```
array([163.47798227, 170.57544096])
```

3. Display the model line together with the data points.

```
plt.scatter(raw_data['Year'], raw_data['Human Height (University of Tuebingen (2015))'])
plt.plot(x, height, 'r-')
plt.show()
```



4. Compute the mean square error of this model.

```
total_err = 0
for x in raw_data.index:
    year = raw_data.loc[x, 'Year']
    err = (m * year + b - raw_data.loc[x, 'Human Height (University of Tuebingen (2015))'
    total_err += err
print('MSE:', total_err / len(raw_data))
```

```
MSE: 17.643093595105366
```