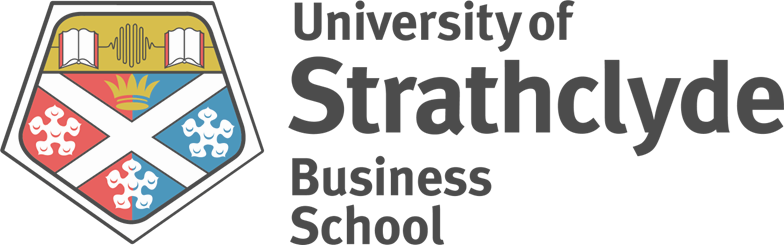
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TAX SYSTEM - NET TO GROSS (SCOTLAND AND REST OF UK)

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# Introduction

The main goal in this study was to comprehend how tax systems for various income groups are designed and implemented in Scotland and the UK as a whole. Two key datasets were created as the basis for our methodology: one with income tax percentages and the other with national insurance tax brackets. Making use of these tables, we set out to understand the strong connection between net and gross income.

# Methodology

The approach incorporated a real-world test dataset in the form of a CSV file, encompassing crucial information such as location, net monthly income, and annual gross income. A pivotal aspect of our methodology was to discern the intricate relationship between gross and net income from this test dataset.

Our method's creative feature was the gross-to-net computation's reverse engineering. First, using the provided test data, we calculated the net income. Equipped with precise net income numbers, we then devised a backward computation procedure. In addition to confirming our first calculations, this reverse engineering helped develop a crucial formula for estimating gross income from net income.

# Exploratory Data Analysis

The EDA code examines the salary dataset thoroughly, encompassing descriptive statistics, interesting visualizations, and insightful correlation analysis. The scatter plot, which seems to indicate a linear relationship, provides an instructive description of the link between monthly net income and annual gross sales. Accordingly, monthly net income grows at a steady rate in line with annual gross income. It is crucial to remember that the scatter plot only depicts a broad trend, and that the area surrounding the trend line is very variable. These findings not only give a thorough picture of income trends, but also lay the groundwork for following in-depth research. The specific insights are important for educated decision-making, enabling a greater awareness of income distributions and variances within diverse geographical places.

## 2.1 DATA INPUTS

We have been engaged with two datasets, one featuring columns like Monthly net and Gross income, and another containing details on tax brackets, NI (National Insurance) contributions, and Personal allowances. The first instance involved mapping actual net income, summing net and NI, and formulating equations based on tax brackets. Through the implementation of these functions on the salary dataset, then successfully derived the gross income from net. Then thoroughly examined tax brackets, recognised differences, and estimated mistake percentages, offering a comprehensive review of the dataset and aiding informed decision-making.

## 2.2 Calculations

Referring the tax brackets considering the gross threshold in each bracket, we came up with the corresponding net thresholds as follows:

**Rest of UK:**

Net Income Up to £11,904: For incomes at or below £11,904, the gross income remains the same as the net income. This bracket reflects situations where the net earnings align with the gross income without any deductions or additional taxes applied.

Net Income Between £11,905 and Threshold 1: In this range a National Insurance contribution is calculated. The gross income is determined by adding the calculated NI contribution to the net income.

ni=(1325\*(net-11905))/8675

gross\_income=net+gross\_income

Net Income Between Threshold 1 and Threshold 2:

gross\_income = (net-4091.41)/0.6675

Net Income Between Threshold 2 and Threshold 3:

gross\_income = (net-9118.47)/0.5675

Net Income Between Threshold 3 and Threshold 4: gross\_income=(net-19162.78)/0.4675

Net Income Above Threshold 4:

gross\_income=(net-12861.42)/0.5175

**Scotland**:

Net Income Up to £11,904: For incomes equal to or below £11,904, the gross income is set as the same figure as the net income.

Net Income Between £11,905 and £12,481.88: In this range, starting from £11,905 and extending to £12,481.88, a National Insurance (NI) contribution is computed based on a specified formula.

ni=(1325\*(net-11905))/8675

gross\_income=net+gross\_income

Net Income Between Threshold 1 and Threshold 2:

gross\_income = (net-3965.89)/0.6675

Net Income Between Threshold 2 and Threshold 3:

gross\_income = (net-4112.81)/0.6675

Net Income Between Threshold 3 and Threshold 4: In this bracket,

gross\_income = (net-4370.25)/0.6575

Net Income Between Threshold 4 and Threshold 5:

gross\_income = (net-13539.5)/0.4475

Net Income Between Threshold 5 and Threshold 6: Incomes that surpass 'net\_thres\_5' but do not reach 'net\_thres\_6' undergo a gross income calculation,

gross\_income = (net-8512.75)/0.5475

Net Income Above Threshold 6: For net incomes surpassing 'net\_thres\_6,'

gross\_income=(net-14769.81)/0.4975

# 3. Strengths, Limitations, and potential Improvements

Using Python for efficiency, our tax modeling project creatively links gross and net income. Reverse engineering the gross-to-net computation is a strength. Nevertheless, a mistake in percentage deviation was discovered. We want to improve forecasts, investigate machine learning, and consider more socioeconomic variables for a more complex model with more time and data. Iteratively depicting various tax scenarios would allow for continuous refinement and improvement of the model's accuracy and flexibility. The model might become more flexible and sensitive to changes in the actual world by modelling various tax laws and economic scenarios.

# 4. Conclusion

In conclusion, this study aimed to understand the relationship between net and gross income in the UK. Data sets were used to calculate net income and then reverse engineer the gross-to-net computation. The results showed that there was a strong correlation between net and gross income. The model showed promise, but limitations and potential improvements were identified. Future work could include improving the model's accuracy, investigating machine learning, and considering additional socioeconomic variables.