Project Write-Up: Census Data Analysis of Town B

Introduction

Town B is a moderate sized town in-between two cities connected by motorways. The town does not have a university, but some students live in the town and go to the cities where the schools are. As a member of the local government team saddled with the responsibility of making decisions on the social amenity to be built on the unoccupied piece of land in the town and what sort of investment would fit the needs of the community, I have taken up the task to clean the data, analyse it and based on the analysis make recommendations to the team.

Data Cleaning

The first step I took was to use various exploratory data analysis methods to understand the data. From the data exploration, I was able to note that some columns need to be cleaned before I start the analysis. Details of the cleaning step are highlighted below:

Age Column: The age column is in the float type. Age should be a whole number ideally. So, I converted the age column to integer. I also created another column to put the ages into groups for further analysis (Age Pyramid, etc)

Religion Column: I noticed 2,489 blank entries. When I dug further, I discovered that all in the population with age below 18 (2,431) have blank entries. These were left as they were, but the remaining 58 entries were changed to the unknown.
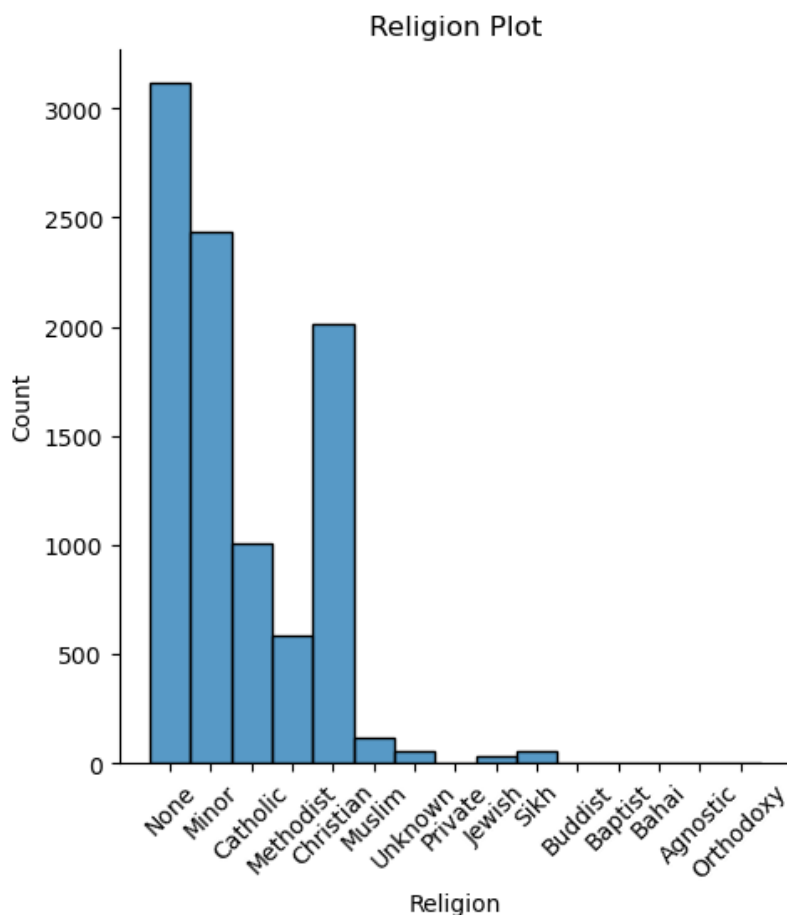
Someone's religion was entered as empty string. I checked the other members of his household just to see what I can infer from them but only his wife is a Christian his children are still minors, so it is difficult to use that in generalizing for the family, so I change the empty string to unknown also.

Another person entered her religion as 'Sith'. I initially thought this was misspelt but upon checking I noticed it's a form of Jediism, which was not considered a religion in the UK (Diaz, 2017). I changed this to None.

Figure 1: The Plot of All Religions in Town B

Another entry in the religion column is 'nope' which I also changed to None as nope is an informal way of saying No (Cambridge Dictionary, 2023)

Marital Status Column: As with the religion column, all minors have their entries as blank, so I changed it to Single (Minor) to differentiate it from the single adults.

There was an empty string entry, for this I checked the other members of his household then discovered that he is married to the head of the house and has 2 children, so I changed the entry to married. Some entries who just turned 18 and are university students are married or divorced. It is very uncommon to be divorced or even married at that age especially when you are a university student. I changed these entries to 'Single'.
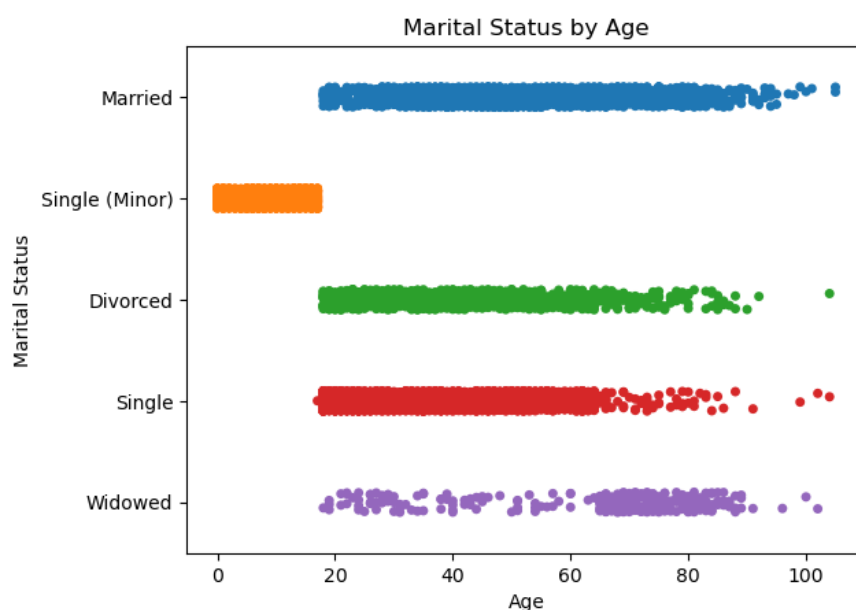
I noticed some outliers but I decided to keep them. For example, there are some old people (Age above 80) who are single, I checked to ensure its not a mix up and discovered most of them are the only ones living in their household except a woman who has two sons living in her household. I decided to leave it as it were as it is not uncommon to have children as a single.

Figure 2: A Plot of Cleaned Marital Status

Occupation Column: The occupation column came to me as being tricky as there are 1,080 entries. It was difficult to work with it. I noticed an empty string, the person is a 9 year old and it is fitting to change the entry to 'Student' which is the entry for 5 to 9 years. I changed all students below 18 years to 'Student(Minor)' to differentiate them from the other students (university students and PhD students).

I then created another column to categorize the occupation column so it will be easy to carry out further analysis. The categories created are:

- Student (Minor): All entries that contain the word 'student' and are below 18 years
- Child: Those entered as child from the onset
- Student: All students above 18 years including university and PhD students
- Retired: Any entry that contains the word 'Retired'
- Unemployed: Those entered as unemployed from the onset
- Employed: Every other entry

Infirmity Column

The infirmity column contains some empty strings which I changed to "unknown" as there was no information to guide me in replacing them.

Analysis

Population Pyramid

The plot of population pyramid reveals that there is a concentration of the population in the school age bands and the middle age bands. This suggests that the birth rate is lower than it is in previous periods and that there may be migration of people into the town especially between 35 - 39 years
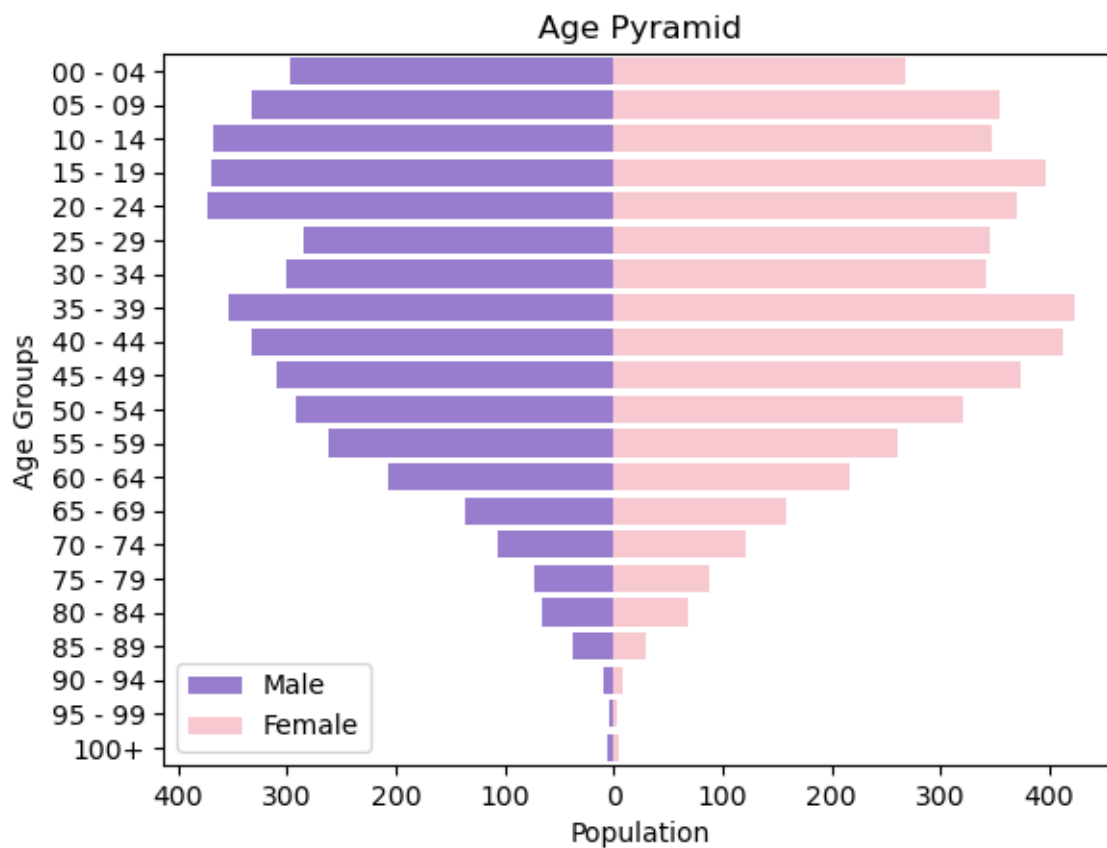

Figure 3: Population Pyramid

Birth Rate and Death Rate

The birth rate was computed by using the methodology in ONS (2023) as seen in the figure below.

$$(B/P) \times 1,000$$

where B equals total live births in the year, and

P equals mid − year population

Figure 4: Crude Birth Rate Formula (ONS, 2023)

The current crude birth rate is 11 births per thousand. I also calculated for the last 5 and 10 years using the estimated population and it was 15 and 17 respectively corroborating the evidence from the age pyramid that the birth rate for the town is declining.

The death rate was tricky to calculate since the data does not contain record of deaths. I will infer this by summing up the difference between the population in the different age band (the older ones, above 65 years as this difference is most likely as a result of death than migration). The death rate is estimated at 9 deaths per 1,000. This is lower than the birth rate, suggesting that there is a natural increase in population. However, we need to also consider other factors such as migration in population increase.

Household Occupancy

There are a total of 3,048 households in the town and the average household occupancy is 3. The average household size in the UK is currently at 2.4 while the areas with the highest rate have 3 as their size (ONS, 2022).

587 houses are over occupied in the town with 5 or more people living in each household accounting for **3,863** people accounting for 41% of the total population. If we are to ensure that no house is over-occupied, (except for large families who still have minors living them) there is need for additional **255** houses. This was derived by dividing the number of people in over-occupied houses by the average occupancy rate of the town, then subtracting the answer from the number of houses already over occupied
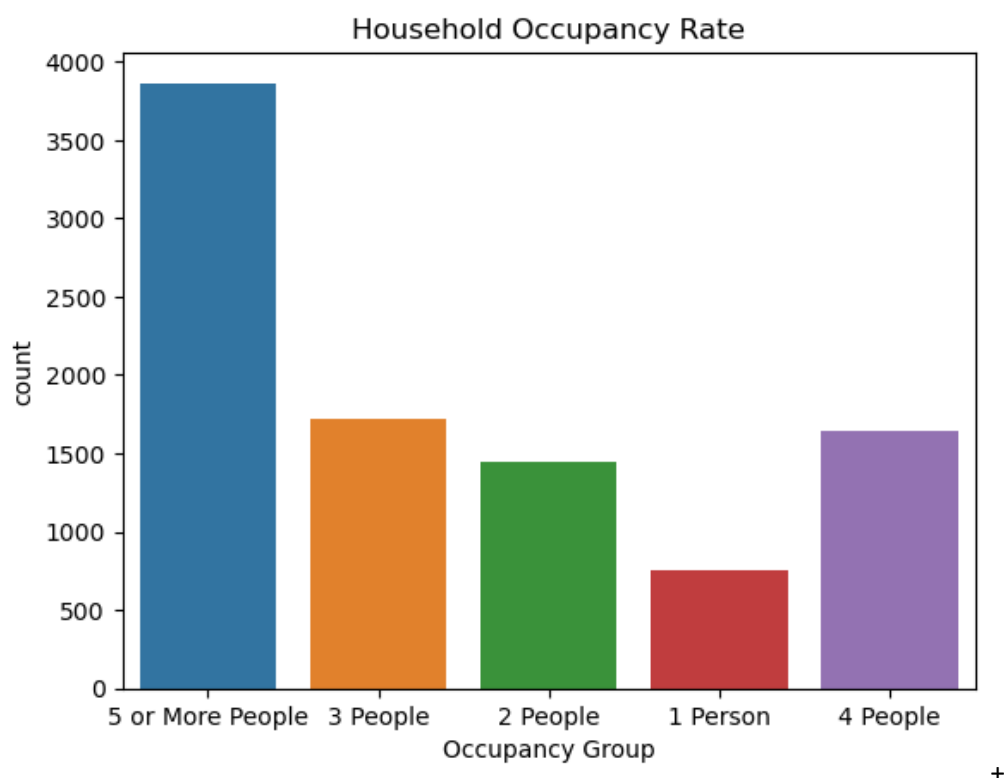

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Figure 5: Household Occupancy Rate

Street Housing

There are **105** streets in the town. The average number of households per street is **29** and there are **34** streets with more than 29 households each. Meaning that only **32%** of the streets are relatively densely populated. The plot below shows that the very densely populated streets in terms of households also have the highest occupancy rates, especially Love Avenue, Virgofix Crescent and Corporation Road. However, the city is generally sparsely populated, hence any need for housing should align with this notion.
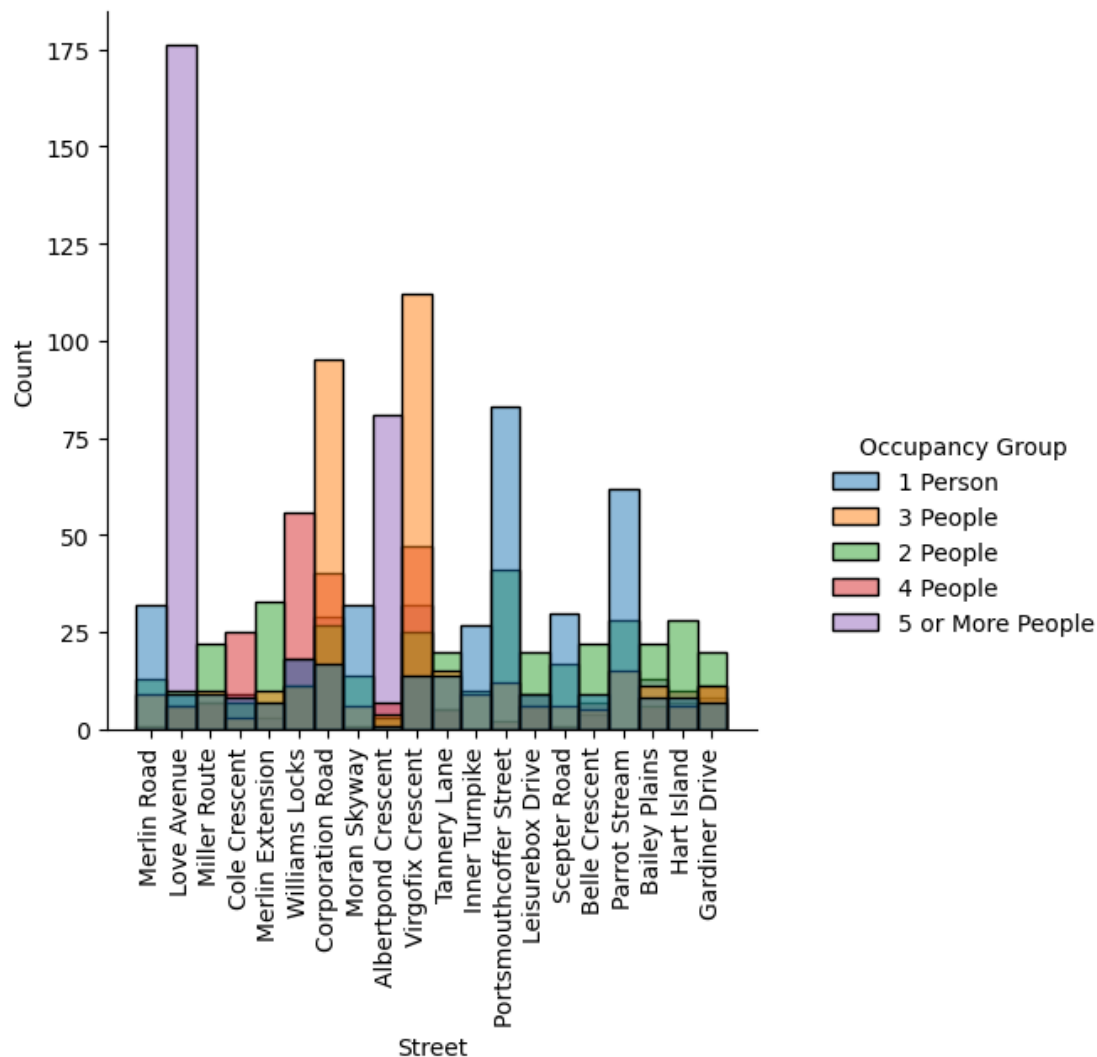

Figure 6: Top 20 Streets Based on Number of Houses

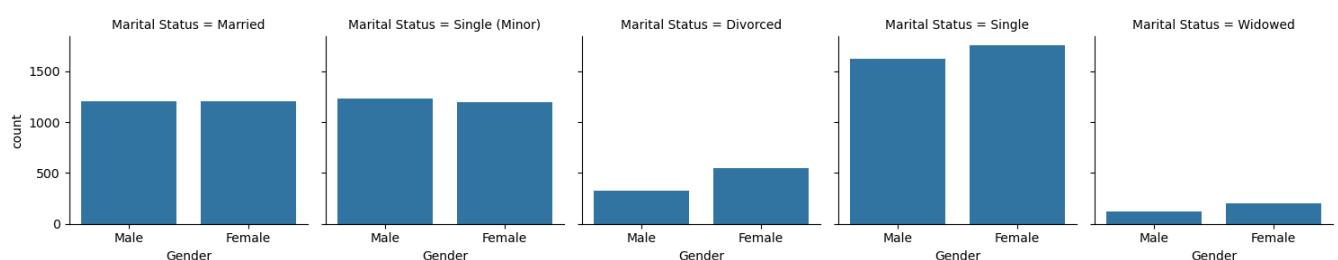**Marriage and Divorce Rate**

Figure 7: Marital Status by Gender

From the plot above, I can see that there is almost equality in the number of married male and female suggesting that the married couples stay together and a decline in the number of male divorcees compared to females, which suggests that some male partners move out of the town after getting divorced. I will use this in calculating my emigration rate later in the analysis.

The crude rates are calculated as seen in the table below:

Table 1: Divorce and Marriage Rates

Rate	Method	Result
Crude Divorce Rate	Number of divorced females by total population * 1,000	58
Crude Marriage Rate	Half number of married people by total population * 1,000	127
Divorce to Marriage Ratio	Number of divorced females by half number of married	0.45

Migration Rate

I had to make a lot of assumptions here, as the data does not contain explicit information on migration. I will consider potential marital migration, student migration and temporary (lodgers and visitors).

Marital Migration: As seen earlier in figure 6, there is a difference in the number of female and male divorcees in the town, which suggests that male divorcees tend to move out of the town. I computed this difference as the **potential marital emigration**. From the population pyramid in figure 3, it is noteworthy that there is a sharp increase as we move from age band 30 – 34 to 35 – 39. I checked this difference (+133) and compared it with the relationship with head of house column. I noticed the sum of those who are husbands and wives to the head of house is 132. It might suggest that these 133 people moved in to the town when they got married. So, I took it as **potential marital immigration.**

Student Migration: Also from the population pyramid, it is obvious that there is a sharp decrease as we move from age band 20– 24 to 25 to 29 (being the age range for student graduation). I computed this as the **student emigration rate**.

Lodgers and Visitors Migration: 10% of the lodgers are students, so I assume they will move in and stay at least till they graduate. I also assumed that 10% more of the lodgers will move in more permanently to the town, making 20%. I then used this to compute the migration rate.

The total potential migration rate is computed as follows:

Potential Emigration = Potential Marital Emigration Rate + Potential Student Emigration Rate

Potential Immigration = Potential Marital Immigration Rate + Lodgers and Visitors Migration Rate

Potential Migration Rate = Potential Immigration – Potential Emigration

The potential migration rate is -**13**, which suggests that more people are leaving the town than moving in to the town.

To calculate total population change in the town, I used the method below:

Potential Population Change = Birth Rate – (Death Rate + Potential Migration Rate)

The potential population change is **-11 per 1000** suggesting that the population is a slightly shrinking population.

Employment Rate

There are **579** unemployed population in the town which is **6%** of the total population and **8%** of the employable population (Above 18 years). The unemployment rate is very high compared to UK's current unemployment rate of **3.7%** (ONS, 2023).

I reviewed the age groups of unemployed people and I saw that its more concentrated in the middle aged band. Which means these people can still work if we provide appropriate training for them. I used the minimum age of the retired people in the town as a benchmark to determine those who are still able to work. Any one who has not gotten to the retirement age should be able to work if trained
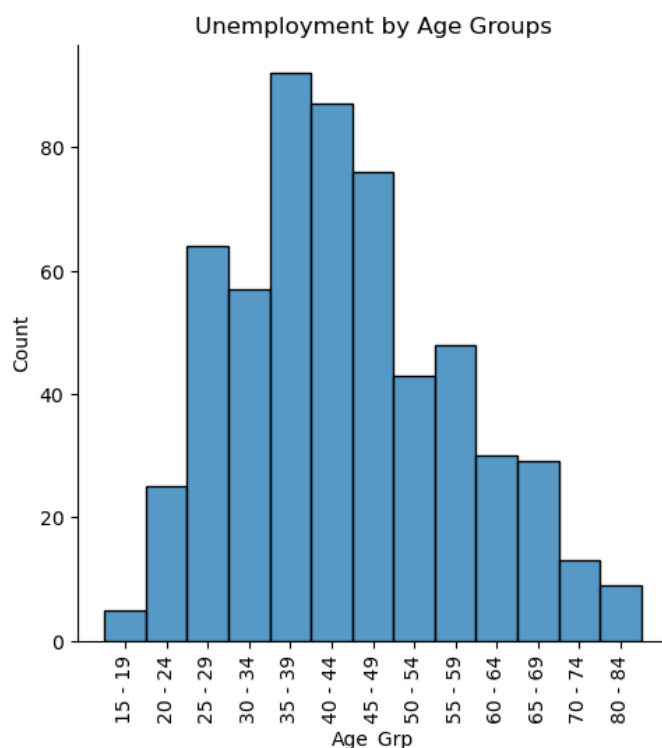
There are **545** people in this category which makes up **94%** of the unemployed population.

Let's see how this can impact the unemployment rate. Assuming **100%** (although this is almost impossible) of the trainable people become employed afterwards, it will reduce the unemployment rate to **0.5%.** Worst case scenario, if **60%** of the trainable people become employed, it reduces unemployment rate to **3.6%** which is just below the current UK rate.

Figure 8: Unemployment by Age Groups

Commuters

The data does not provide direct information about who might be a commuter. The only clear information we have about this is that there are university students living in the town but there is no university in the town. This means that these students commute to their school. I also considered the staff of the university, though it was not stated explicitly in the data. I searched for some keywords such as 'Professor', 'Lecturer', 'Higher Education' and 'Research'. These are words common to a university. Using this method only, there are **622** people who regularly commute, and they make up 9% of the population.

Infirmity

Infirmity makes up only 0.7% of the population. The average disability rate in UK is 22% (House of Commons, 2022). This is too minute to impact any decision.

Religion

45% of the population are not religiously inclined. Christians are the next largest religion. However, building a church is not ideal as they have many different branches within it (BBC, n.d.). The Catholics are next in number, and they already have a church. I considered the methodists who have the next highest members. Their average age is 45 years and median age is 43. Which shows that it has a possibility of growing in future. Also, there are quite a number of family-oriented people either married or divorced who are also still in the child bearing / rearing age, it is possible as their children mature, they take on their religion. However, it is difficult to ascertain this as there are no religion entries for minors.
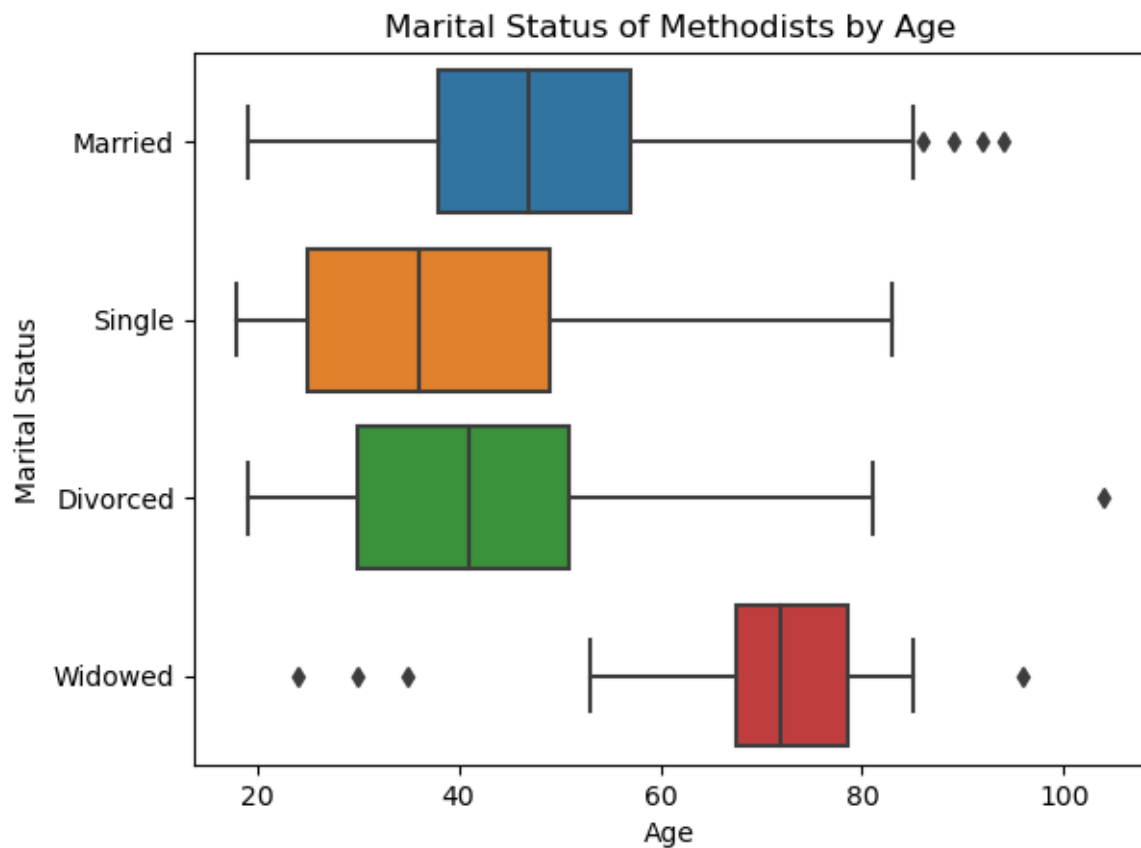

Figure 9: Marital Status of Methodist Religion Members Compared with Age

Summary

Based on the data provided and the analysis carried out:

- The population is a slightly shrinking one at **-11 persons per 1,000 annual population change** when I compared the death and birth rate to the migration rate.
- There is housing deficit in the town as **41%** of the population live in over occupied houses.
- Only **32%** of the streets are densely populated with number of houses higher than the town's street average.
- The unemployment rate is currently at **8%** but can be reduced to **3.6%** by providing adequate training to those unemployed who are still below the minimum retirement age.
- **9%** of the population regularly commute. There might be others but its difficult to identify them.
- **45%** of the population are not religiously inclined. It is difficult to identify growing religion or infer transferability since all minors do not have entries for religion.

Recommendation

The following recommendations are made:

- It is important to invest in housing as deficit is an obvious problem of the town. The structure of the town shows that low density housing is more common since most of the streets are within the average number of houses per street. Hence it is advisable to invest in low density housing to provide houses for the **255** households.
- The unemployment rate in the town is high compared to the UK average and **94%** of these are still under the retirement age. Hence it is important to invest in training to enable them take up employment, reduce the unemployment rate and increase the economic growth of the town (Pettinger, 2018). It will also attract new immigrants and commuters to the town, thereby increasing the need for housing in future and possibly a train station.

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