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# MATH1005 Project 2

Code

## Housing arrangements - Homes owned with a mortgage in Local Government Areas.

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University of Sydney | MATH1005| Friday/2:00pm/Lab Class 03

# 1 Executive Summary

The purpose of this report is to analyse two research question that "Whether the total proportion of home ownership was greater than 67% in 2011?" and "Were there any variations in median monthly mortgage repayments between local government areas in different states?" based on 2011 census data in Australia.

This report discovered that the home ownership wasn't greater than 67 percent in Australia in 2011. Additionally, I also observed that the maximum value of median monthly mortgage repayments for LGA in New South Wales and Western Australia were higher than that in other states, as shown by comparative boxplot graphs.

# 2 Full Report

## 2.1 Initial Data Analysis (IDA)

2.1.1 IDA source

This data comes from the Australian Bureau of Statistics' (ABS) online data site (abs.gov.au) on patterns of housing arrangements as recorded in the 2011 census and released in 2013. All the following research question data are from this data set and are strictly based on the original data, no changes will be made.

It is a large data set from a credible and reliable source (Australian Bureau of Statistics). Furthermore, the data was collected in an ethically acceptable manner, as participation in the census is voluntary. However, this tends to put it at risk of excluding some data sources due to volunteer bias. In addition, it only considers homes that were occupied on the night of the census and occupied in a classifiable manner. Due to the grouping of the data by local government areas (LGAs), potential information from unincorporated areas and the Australian Capital Territory was excluded. As a result, this data may not accurately reflect the total number of dwellings in Australia in 2011.

This data pertains to home ownership and rental statistics for all local government areas in 2011. Potential stakeholders include the Australian government, Australian property developers and renters.

2.1.2 IDA Variables

The classification the data variables are as shown:

Code

```
## 'data.frame':    559 obs. of  14 variables:
##  $ Local.Government.Area                                  : chr  "LGA10050 Albury (C)" "LGA10110 Armida
le Dumaresq (A)" "LGA10150 Ashfield (A)" "LGA10200 Auburn (C)" ...
##  $ Owned...outright                                       : int  5440 2888 4408 5505 6274 327 19468 447
2 5610 2236 ...
##  $ Owned...with.a.mortgage                                : int  6403 2322 4240 7104 4169 216 18982 469
2 3586 1316 ...
##  $ Rented...Real.estate.agent                             : int  3783 1803 4624 5824 2415 44 7236 2385
1462 572 ...
##  $ Rented...State.or.territory.housing.authority          : int  827 451 231 836 602 21 5296 556 348 10
0 ...
##  $ Rented...Person.not.in.same.household                  : int  1067 519 972 1432 1065 86 2736 840 851
460 ...
##  $ Rented...Housing.co.operative..community.or.church.group: int  144 103 158 130 135 20 469 72 102 31 .
..
##  $ Rented...Other.landlord.type                           : int  170 123 93 236 241 47 508 106 149 70 .
..
##  $ Rented...Landlord.type.not.stated                      : int  88 76 62 128 93 23 305 99 111 53 ...
##  $ Other.tenure.type                                      : int  149 71 125 135 199 11 394 71 114 52 ..
.
##  $ Tenure.type.not.stated                                 : int  545 233 384 751 404 32 1842 362 343 12
0 ...
##  $ Total                                                  : int  18616 8589 15297 22081 15597 827 57236
13655 12676 5010 ...
##  $ Median.mortgage.repayment....monthly.                  : int  1450 1430 2167 2000 1733 867 2000 1625
1300 1300 ...
##  $ State                                                  : chr  "New South Wales" "New South Wales" "N
ew South Wales" "New South Wales" ...
```

There are 559 rows in the data, and each row represents one of the 559 local government area. There are 14 columns in the data, and each column represents a tested dependent variable.

The key variables used for this report are:

Owned…outright:is an integer represents the number of dwellings were owned outright

Owned…with.a.mortgage: is an integer represents the number of dwellings were owned with a mortgage

Total: is an integer represents the total number of dwellings in 2011 census in Australia.

Median.mortgage.repayment….monthly：is an integer represents the median mortgage repayment for each LGA.

State: is a string represents different states in Australia.

# 2.2 Research Question 1: In research question 1, I would like to use a one-sided hypothesis test (Z-test) to determine whether the total proportion of home ownership in Australia was greater than 67% in 2011.

2.2.1 Set up hypothesis

To begin, I will set up a null hypothesis H0 and an alternative hypothesis H1, and test them in the following steps. In addition, the significant level in this research question is 0.05 by convention.

H0: 67% of dwellings were owned (with or without a mortgage) in Australia in 2011.

H1: More than 67% of dwellings were owned (with or without a mortgage) in Australia in 2011.

2.2.2 Weigh up evidence

Code

```
## [1] 7626147
```

Assumptions: The observations are independent of each other, which is reasonable because one dwelling's ownership would not affect the other dwellings. In addition, the population size is 7626147 which is quite large, so I can safely assume the Central Limit Theorem will hold. Thus, the population mean and population sum will be approximately normal.

Code

```
## [1] 0.6700000 0.4702127
```

Code

```
## [1] 5109518.490    1298.515
```

Code

```
## [1] 0.6700000000 0.0001702714
```

Code

```
## [1] -0.3777315
```

Code

```
## [1] -0.3777315
```

Code

```
## [1] 0.647185
```

As shown in the coding above, the mean of the test statistic value is equal to sum of that, which is near to -0.378. Therefore, the observed value is -0.378 standard errors away from the expected value.After that, I used this value to calculate the p-value in a standard normal curve, which is near to 0.647.The p-value of 0.647 means that I can expect to observe a test statistic of size -0.378 or greater approximately 64.7% of times. As the p-value (0.647) is significantly larger than the significant level(0.05), so I do not reject the null hypothesis that "67% of dwellings were owned in Australia in 2011".

2.2.3 Conclusion

In conclusion, a Z-test consist of three main steps including setting up a research question and hypothesis, weighting up evidence and making a conclusion. In this research question, since our p-value is higher than the significance level, I do not reject the null hypothesis and conclude that the data does not provide strong evidence that the home ownership was greater than 67 percent in Australia in 2011.

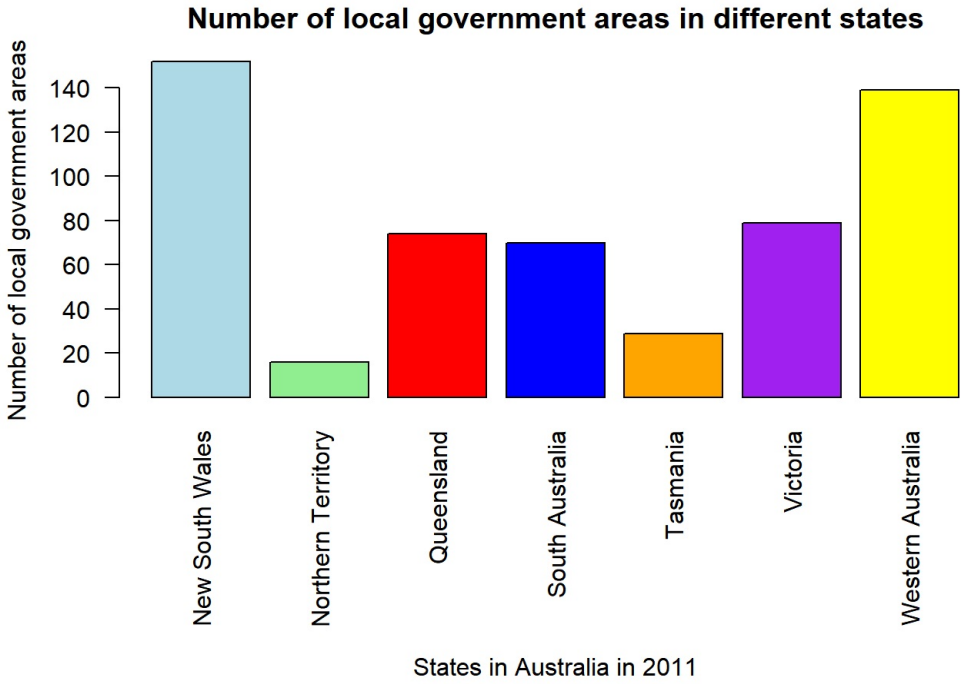
2.2.4 Further research

Our result align with the report presented by Australian Bureau of Statistics (2013). This report reviewed the data from census 2006 to 2011. It was concluded that despite the number of dwellings in Australia was increasing from 2006 to 2011, the overall home ownership rate was continuous decreasing. In 2011, the overall home ownership rate was only 67%.One possible explanation was fewer mainstream employment opportunities and associated low incomes from 2006 to 2011, which may have made home ownership unaffordable. However, a limitation is that as the data was divided by Local Government Areas (LGAs), potential information from unincorporated areas and the Australian Capital Territory was excluded in 2011 census. As a result, the proportion of home ownership in Australia in 2011 may not be accurately represented in this report and also in our data.

# 2.3 Research Question 2: In research question 2, I would like to determine whether there were any significant differences in median monthly mortgage repayments between local government areas in different states in 2011 in Australia.

2.3.1 Distribution of local government areas in different states

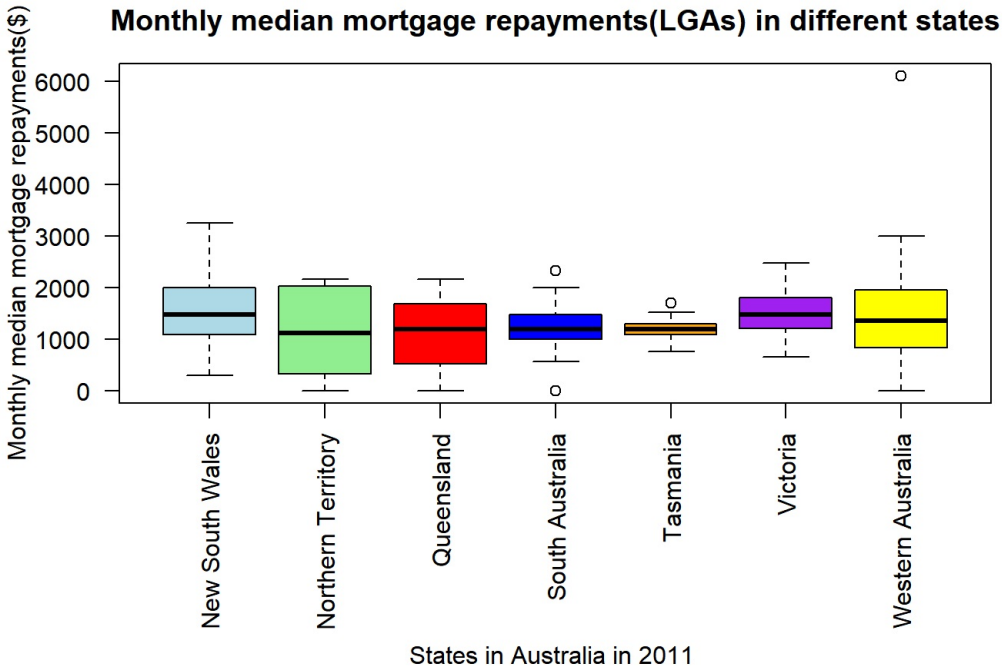
Code




As shown in the bar plot above, New South Wales had the most number of local government areas in 2011 in Australia, with more than 140. On the other hand, the northern territory had the smallest number of local government areas, which was less than 20.

2.3.2 Comparing median monthly mortgage repayments between local government areas in different states

Code




As illustrated by the boxplot above, there was little variance among the median of median monthly mortgage repayments between LGAs in each state. However, the maximum values of median monthly mortgage repayments between LGAs in New South Wales and Western Australia appeared to be higher than that in other states in 2011, at more than 3000$ per month (excluding outliers). On the other hand, local government areas that intersect the boundaries of greater capital city statistical areas were excluded in this data. As a result, the data may not accurately represent median monthly mortgage repayments between local government areas in different states in Australia in 2011.

A report presented by Australian Bureau of Statistics (2013) also indicated that median monthly mortgage repayments in some LGAs in New South Wales and Western Australia were higher than that in other states. The rapid development of these states' economies from 2006 to 2012 was one reason for this. For instance, between 2006 and 2011, some LGAs in Western Australia experienced a rapid economic boost as a result of the rapid growth in tourism. However, a limitation is that this report didn't explain in detail why monthly median mortgage repayments in some LGAs in NSW were higher than that in other states. Hence, I cannot completely relate the findings in this report to our data.

To summarize, the maximum value of monthly median mortgage repayments in local government areas in New South Wales and Western Australia were higher than that in other states in 2011 in Australia. This result was also reinforced by the external source, meaning our data can be considered as valid.

# 3 References (APA 7th edition)

Australian Bureau of Statistics. (2013). Tenure and Landlord Type and Median Mortgage Repayments in Local Government Areas, 2006-2011. [Data set]. https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1380.0.55.0122011?OpenDocument (https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1380.0.55.0122011?OpenDocument).

Australian Bureau of Statistics. (2013). 1380.0.55.012 - Perspectives on Regional Australia, Housing Arrangements - Homes Owned with a Mortgage in Local Government Areas, 2011. Abs.gov.au. Retrieved 13 October 2022, from https://www.abs.gov.au/AUSSTATS/abs@.nsf/0/FE397F0E85A8BA4ECA257C27000E9A40?Opendocument (https://www.abs.gov.au/AUSSTATS/abs@.nsf/0/FE397F0E85A8BA4ECA257C27000E9A40?Opendocument).

Australian Bureau of Statistics. (2013). 1380.0.55.010 - Perspectives on Regional Australia: Housing Arrangements - Home Ownership in Local Government Areas, 2011. Abs.gov.au. Retrieved 13 October 2022, from https://www.abs.gov.au/ausstats/abs@.nsf/mf/1380.0.55.010 (https://www.abs.gov.au/ausstats/abs@.nsf/mf/1380.0.55.010).