

Assignment 1

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Question 1

Before we start, we have to write three codes

```
library(tidyverse)
```

```
## -- Attaching packages ----- tidyverse 1.3.0 --
```

```
## v ggplot2 3.3.1    v purrr   0.3.3
## v tibble  3.0.0    v dplyr  0.8.5
## v tidyr   1.0.2    v stringr 1.4.0
## v readr   1.3.1    v forcats 0.5.0
```

```
## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()     masks stats::lag()
```

```
library(Ecdat)
```

```
## Loading required package: Ecfun
```

```
##
```

```
## Attaching package: 'Ecfun'
```

```
## The following object is masked from 'package:base':
```

```
##
```

```
##      sign
```

```
##
```

```
## Attaching package: 'Ecdat'
```

```
## The following object is masked from 'package:datasets':
```

```
##
```

```
##      Orange
```

```
data(Housing)
```

```
dim(Housing)
```

```
## [1] 546 12
```

There exist 546 rows and 12 columns.

To check whether there exist some missing values,

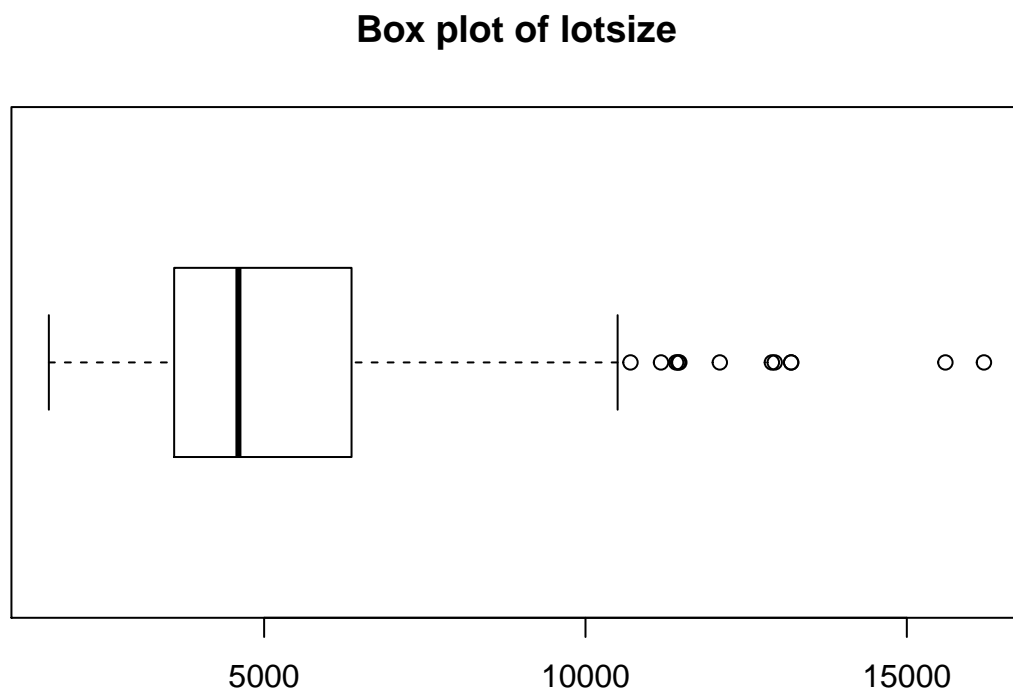
```
sum(is.na(Housing))
```

```
## [1] 0
```

Therefore, there are no missing values

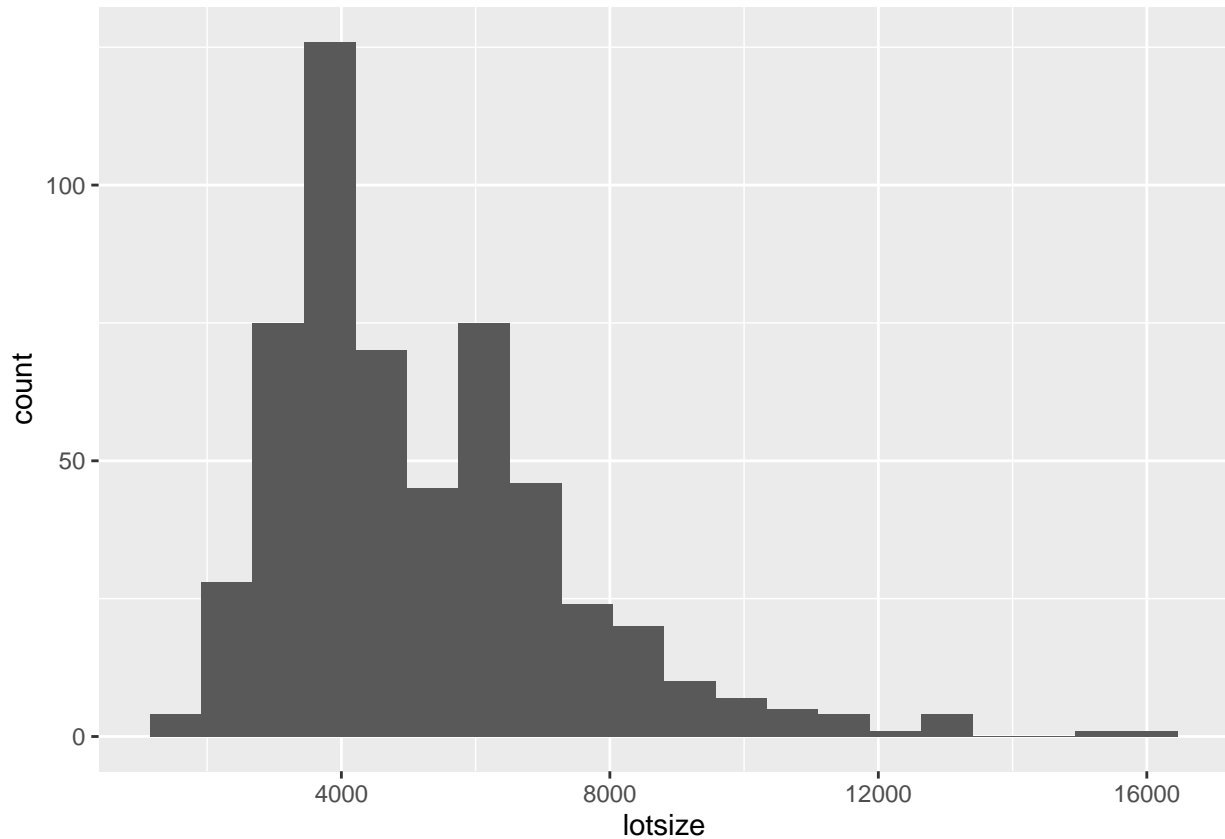
Question 2

```
boxplot(Housing$lotsize, main='Box plot of lotsize', horizontal=TRUE)
```



Here, we can find outliers on the right side of the box plot.

```
a=ggplot(data=Housing, mapping=aes(x=lotsize))
a+geom_histogram(bins=20)+xlab('lotsize')
```



Here, we can find outliers on approximately 16,000

Question 3

Question a

Z score method

```
Z_lotsize=(Housing$lotsize-mean(Housing$lotsize))/sd(Housing$lotsize)
```

By using Z-score, if Z score is bigger than 3 or smaller than -3, it is outlier!

```
filter(Housing, Z_lotsize>3| Z_lotsize< -3)
```

##	price	lotsize	bedrooms	bathrms	stories	driveway	recroom	fullbase	gashw	airco
## 1	97000	12090	4	2	2	yes	no	no	no	no
## 2	84900	15600	3	1	1	yes	no	no	no	yes
## 3	99000	13200	2	1	1	yes	no	yes	yes	no
## 4	145000	16200	5	3	2	yes	no	no	no	no
## 5	140000	13200	3	1	2	yes	no	yes	no	yes

```
## 6 50000 12944 3 1 1 yes no no no no
## 7 70000 12900 3 1 1 yes no no no no
## garagepl prefarea
## 1 2 yes
## 2 2 no
## 3 1 no
## 4 0 no
## 5 2 yes
## 6 0 no
## 7 2 no
```

Question b

IQR method

```
summary(Housing$lotsize)
```

```
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##      1650   3600   4600   5150   6360   16200
```

Here, we can find $Q1=3600$ and $Q3=6360$.

By using IQR method, if lotsize is smaller than $Q1 - (1.5 * IQR)$ or bigger than $Q3 + (1.5 * IQR)$, it is an outlier.

```
Q1=3600
Q3=6360
IQR=Q3-Q1
A=Q1-(1.5*IQR)
A
```

```
## [1] -540
```

```
B=Q3+(1.5*IQR)
B
```

```
## [1] 10500
```

```
filter(Housing,lotsize< -540 | lotsize>10500)
```

```
##      price lotsize bedrooms bathrms stories driveway recroom fullbase gashw
## 1  97000  12090      4        2        2      yes      no      no      no
## 2  72000  10700      3        1        2      yes      yes      yes      no
## 3  84900  15600      3        1        1      yes      no      no      no
## 4  99000  13200      2        1        1      yes      no      yes      yes
## 5 145000  16200      5        3        2      yes      no      no      no
## 6 140000  13200      3        1        2      yes      no      yes      no
## 7  83900  11460      3        1        3      yes      no      no      no
## 8 100000  11175      3        1        1      yes      no      yes      no
## 9  73000  11410      2        1        2      yes      no      no      no
## 10 104900 11440      4        1        2      yes      no      yes      no
```

```
## 11 50000 12944 3 1 1 yes no no no
## 12 70000 12900 3 1 1 yes no no no
## airco garagepl prefarea
## 1 no 2 yes
## 2 no 0 no
## 3 yes 2 no
## 4 no 1 no
## 5 no 0 no
## 6 yes 2 yes
## 7 no 2 yes
## 8 yes 1 yes
## 9 no 0 yes
## 10 no 1 yes
## 11 no 0 no
## 12 no 2 no
```

Question 4

Question a

```
summarise(Housing,
  mean_price=mean(price),
  median_price=median(price),
  sd_price=sd(price),
  mean_absolute_deviation_price=sum(abs(Housing$price-mean(Housing$price)))/nrow(Housing),
  IQR_price=quantile(Housing$price,0.75)-quantile(Housing$price,0.25),
  skewness_price=3*(mean(Housing$price)-median(Housing$price))/sd(Housing$price))
```

```
## mean_price median_price sd_price mean_absolute_deviation_price IQR_price
## 1 68121.6 62000 26702.67 20573.98 32875
## skewness_price
## 1 0.6877511
```

Question b

```
Z_price=(Housing$price-mean(Housing$price))/sd(Housing$price)
skewness_Z_price=3*(mean(Z_price)-median(Z_price))/(sd(Z_price))
skewness_price=3*(mean(Housing$price)-median(Housing$price))/(sd(Housing$price))
```

```
skewness_Z_price
```

```
## [1] 0.6877511
```

```
skewness_price
```

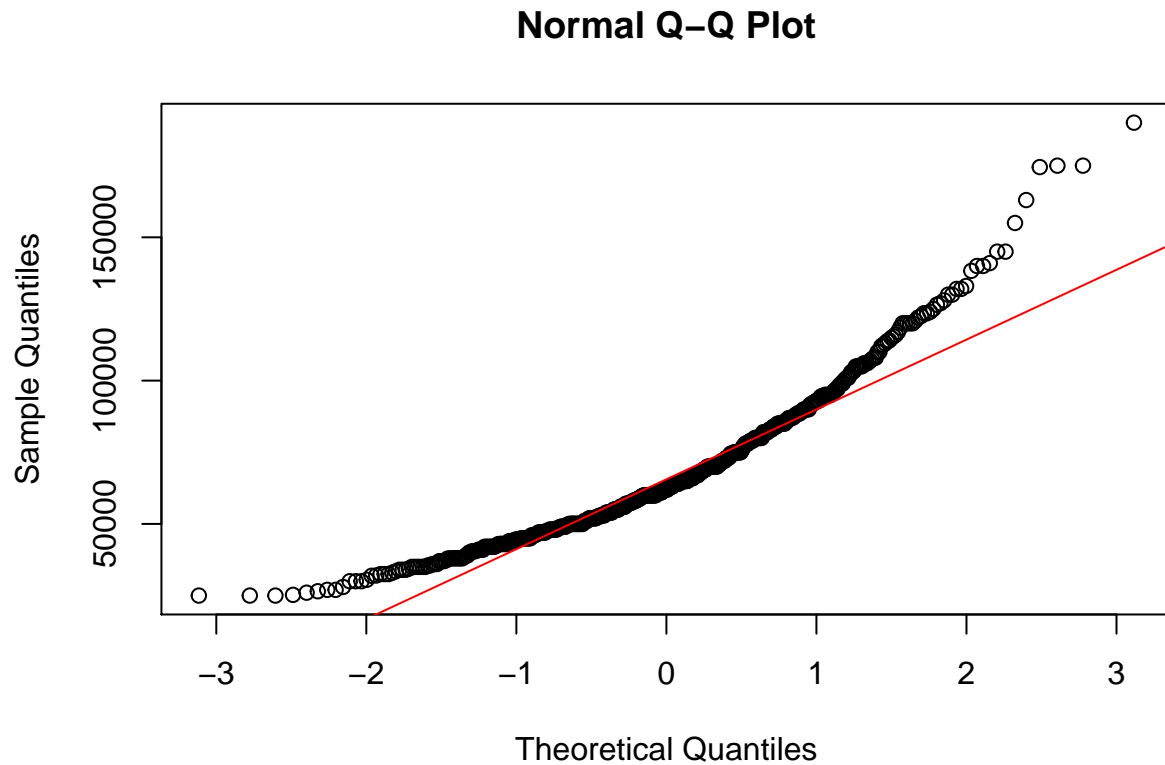
```
## [1] 0.6877511
```

The skewness of price and z scores are same. It implies that Z score does not change skewness.

Question 5

Question a

```
qqnorm(Housing$price)
qqline(Housing$price, col='red')
```



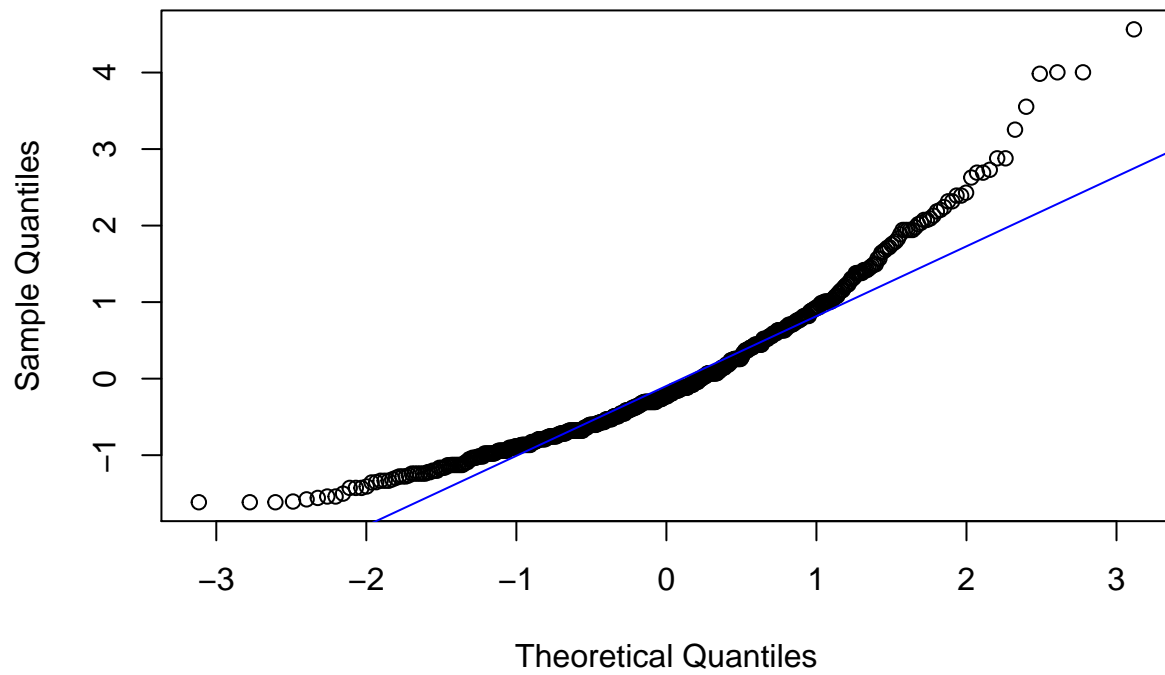
Question b

From 5-a, we found out that housing prices are not normally distributed using a normal Q-Q plot. In order to achieve normality, we tried

Z_score normalization

```
qqnorm(Z_price)
qqline(Z_price, col='blue')
```

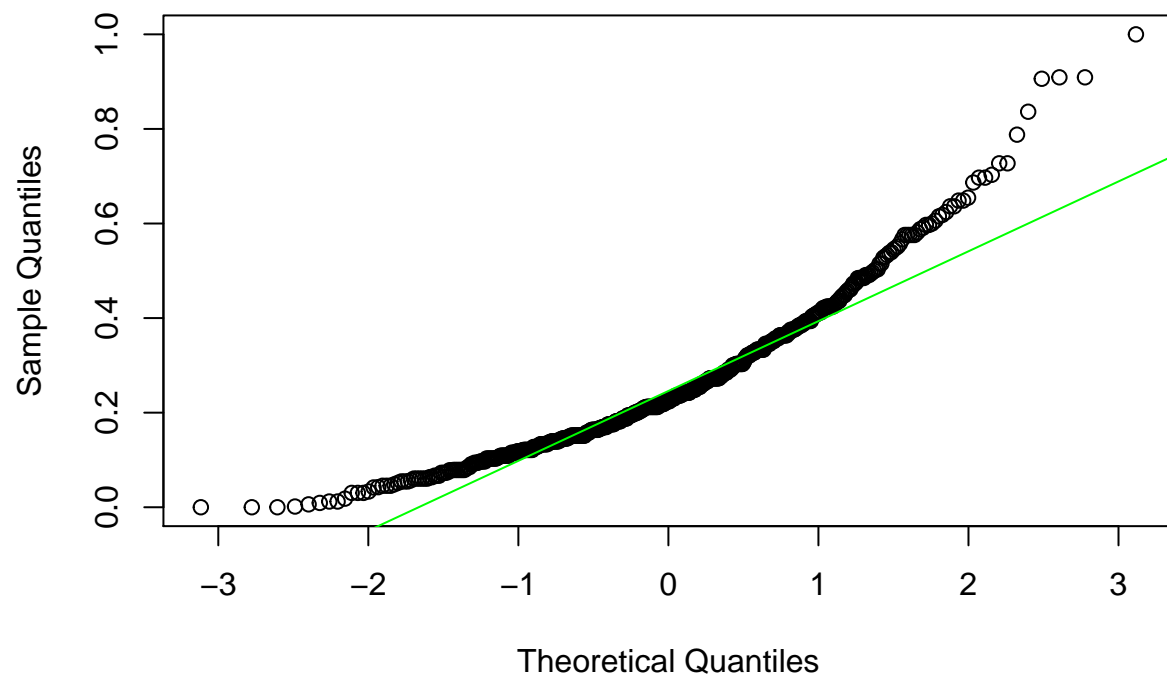
Normal Q-Q Plot



min-max normalization

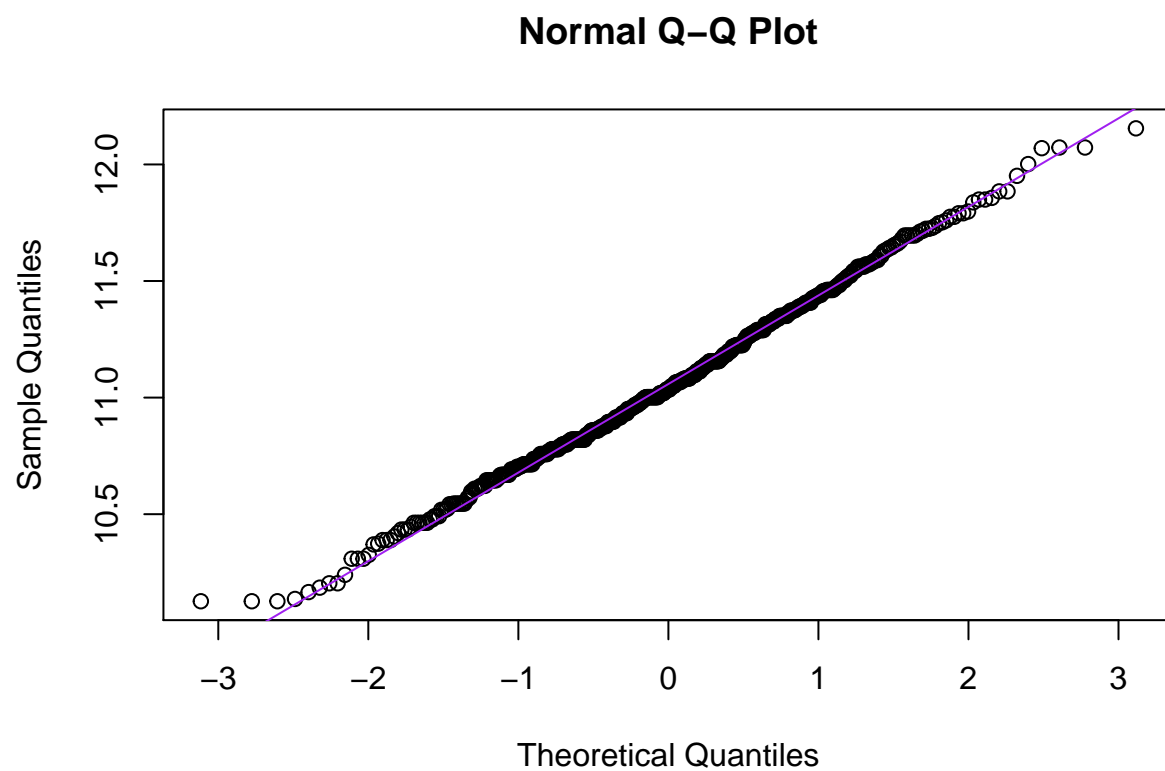
```
price_min_max=(Housing$price-min(Housing$price))/(max(Housing$price)-min(Housing$price))
qqnorm(price_min_max)
qqline(price_min_max, col='green')
```

Normal Q-Q Plot



log normalization

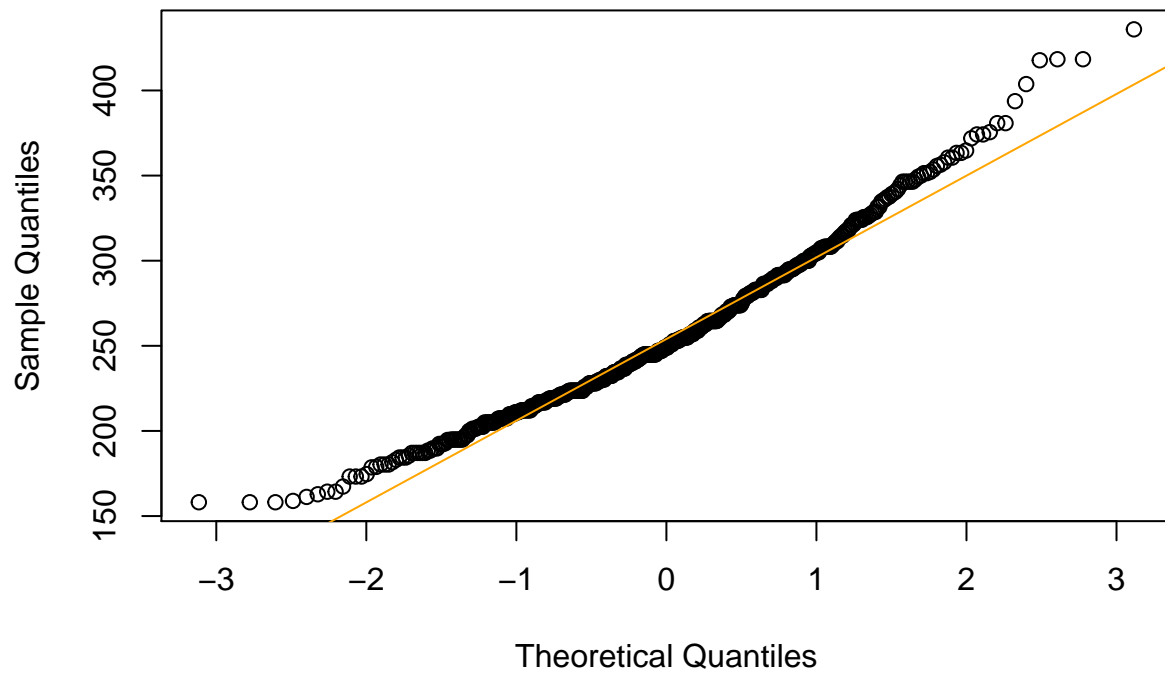
```
qqnorm(log(Housing$price))  
qqline(log(Housing$price),col='purple')
```

root X (\sqrt{X}) transformation method

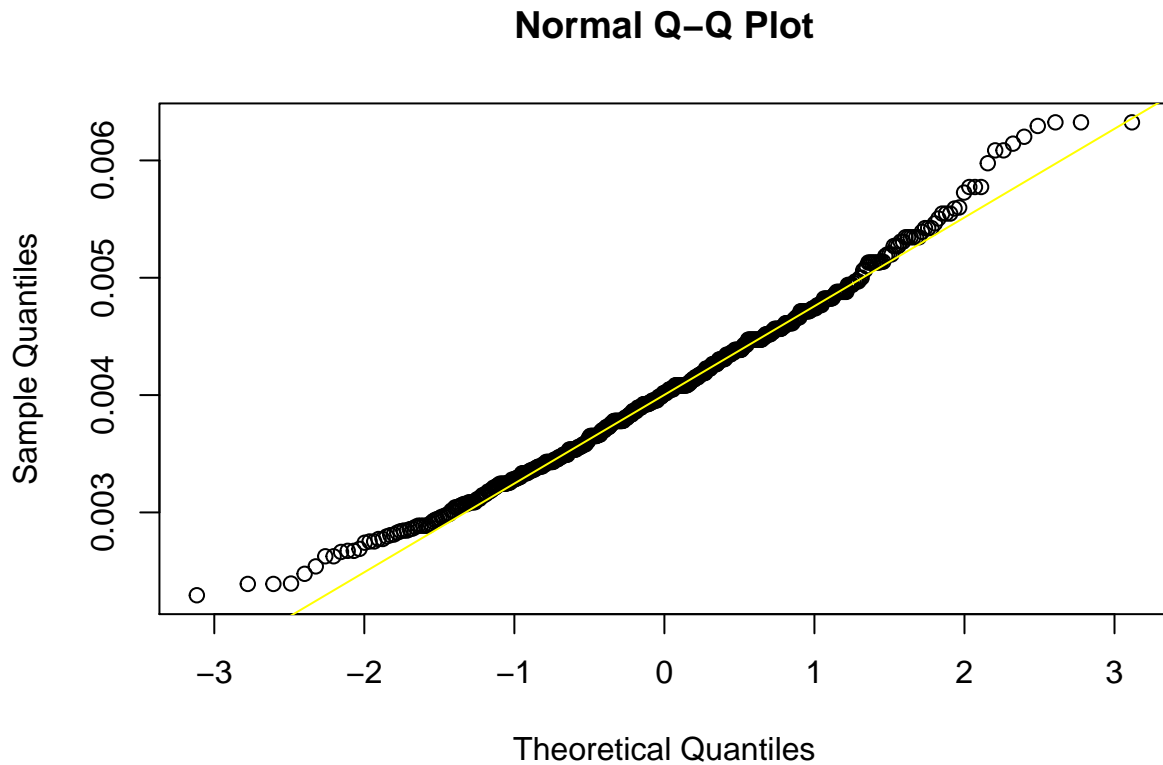
```
qqnorm(sqrt(Housing$price))  
qqline(sqrt(Housing$price),col='orange')
```

Normal Q-Q Plot



$\frac{1}{\sqrt{x}}$ transformation method

```
qqnorm(1/sqrt(Housing$price))  
qqline(1/sqrt(Housing$price),col='yellow')
```



As a result, we can analyze graphs by using QQ plot interpretation. Log normalization makes observations most likely fall onto a qqline, which means that the data comes from a normal population.

Question 6

Question a

```
Housing$bedrooms_dummy=1*(Housing$bedrooms>'3')
```

```
mutate(Housing,bedrooms_dummy)
```

##	price	lotsize	bedrooms	bathrms	stories	driveway	recroom	fullbase	gashw
## 1	42000	5850	3	1	2	yes	no	yes	no
## 2	38500	4000	2	1	1	yes	no	no	no
## 3	49500	3060	3	1	1	yes	no	no	no
## 4	60500	6650	3	1	2	yes	yes	no	no
## 5	61000	6360	2	1	1	yes	no	no	no
## 6	66000	4160	3	1	1	yes	yes	yes	no
## 7	66000	3880	3	2	2	yes	no	yes	no
## 8	69000	4160	3	1	3	yes	no	no	no
## 9	83800	4800	3	1	1	yes	yes	yes	no
## 10	88500	5500	3	2	4	yes	yes	no	no
## 11	90000	7200	3	2	1	yes	no	yes	no

## 12	30500	3000	2	1	1	no	no	no	no
## 13	27000	1700	3	1	2	yes	no	no	no
## 14	36000	2880	3	1	1	no	no	no	no
## 15	37000	3600	2	1	1	yes	no	no	no
## 16	37900	3185	2	1	1	yes	no	no	no
## 17	40500	3300	3	1	2	no	no	no	no
## 18	40750	5200	4	1	3	yes	no	no	no
## 19	45000	3450	1	1	1	yes	no	no	no
## 20	45000	3986	2	2	1	no	yes	yes	no
## 21	48500	4785	3	1	2	yes	yes	yes	no
## 22	65900	4510	4	2	2	yes	no	yes	no
## 23	37900	4000	3	1	2	yes	no	no	no
## 24	38000	3934	2	1	1	yes	no	no	no
## 25	42000	4960	2	1	1	yes	no	no	no
## 26	42300	3000	2	1	2	yes	no	no	no
## 27	43500	3800	2	1	1	yes	no	no	no
## 28	44000	4960	2	1	1	yes	no	yes	no
## 29	44500	3000	3	1	1	no	no	no	no
## 30	44900	4500	3	1	2	yes	no	no	no
## 31	45000	3500	2	1	1	no	no	yes	no
## 32	48000	3500	4	1	2	yes	no	no	no
## 33	49000	4000	2	1	1	yes	no	no	no
## 34	51500	4500	2	1	1	yes	no	no	no
## 35	61000	6360	2	1	2	yes	no	no	no
## 36	61000	4500	2	1	1	yes	no	no	no
## 37	61700	4032	2	1	1	yes	no	yes	no
## 38	67000	5170	3	1	4	yes	no	no	no
## 39	82000	5400	4	2	2	yes	no	no	no
## 40	54500	3150	2	2	1	no	no	yes	no
## 41	66500	3745	3	1	2	yes	no	yes	no
## 42	70000	4520	3	1	2	yes	no	yes	no
## 43	82000	4640	4	1	2	yes	no	no	no
## 44	92000	8580	5	3	2	yes	no	no	no
## 45	38000	2000	2	1	2	yes	no	no	no
## 46	44000	2160	3	1	2	no	no	yes	no
## 47	41000	3040	2	1	1	no	no	no	no
## 48	43000	3090	3	1	2	no	no	no	no
## 49	48000	4960	4	1	3	no	no	no	no
## 50	54800	3350	3	1	2	yes	no	no	no
## 51	55000	5300	5	2	2	yes	no	no	no
## 52	57000	4100	4	1	1	no	no	yes	no
## 53	68000	9166	2	1	1	yes	no	yes	no
## 54	95000	4040	3	1	2	yes	no	yes	yes
## 55	38000	3630	3	3	2	no	yes	no	no
## 56	25000	3620	2	1	1	yes	no	no	no
## 57	25245	2400	3	1	1	no	no	no	no
## 58	56000	7260	3	2	1	yes	yes	yes	no
## 59	35500	4400	3	1	2	yes	no	no	no
## 60	30000	2400	3	1	2	yes	no	no	no
## 61	48000	4120	2	1	2	yes	no	no	no
## 62	48000	4750	2	1	1	yes	no	no	no
## 63	52000	4280	2	1	1	yes	no	no	no
## 64	54000	4820	3	1	2	yes	no	no	no
## 65	56000	5500	4	1	2	yes	yes	yes	no

## 66	60000	5500	3	1	2	yes	no	no	no
## 67	60000	5040	3	1	2	yes	no	yes	no
## 68	67000	6000	2	1	1	yes	no	yes	no
## 69	47000	2500	2	1	1	no	no	no	no
## 70	70000	4095	3	1	2	no	yes	yes	no
## 71	45000	4095	2	1	1	yes	no	no	no
## 72	51000	3150	3	1	2	yes	no	yes	no
## 73	32500	1836	2	1	1	no	no	yes	no
## 74	34000	2475	3	1	2	yes	no	no	no
## 75	35000	3210	3	1	2	yes	no	yes	no
## 76	36000	3180	3	1	1	no	no	no	no
## 77	45000	1650	3	1	2	no	no	yes	no
## 78	47000	3180	4	1	2	yes	no	yes	no
## 79	55000	3180	2	2	1	yes	no	yes	no
## 80	63900	6360	2	1	1	yes	no	yes	no
## 81	50000	4240	3	1	2	yes	no	no	no
## 82	35000	3240	2	1	1	no	yes	no	no
## 83	50000	3650	3	1	2	yes	no	no	no
## 84	43000	3240	3	1	2	yes	no	no	no
## 85	55500	3780	2	1	2	yes	yes	yes	no
## 86	57000	6480	3	1	2	no	no	no	no
## 87	60000	5850	2	1	1	yes	yes	yes	no
## 88	78000	3150	3	2	1	yes	yes	yes	no
## 89	35000	3000	2	1	1	yes	no	no	no
## 90	44000	3090	2	1	1	yes	yes	yes	no
## 91	47000	6060	3	1	1	yes	yes	yes	no
## 92	58000	5900	4	2	2	no	no	yes	no
## 93	163000	7420	4	1	2	yes	yes	yes	no
## 94	128000	8500	3	2	4	yes	no	no	no
## 95	123500	8050	3	1	1	yes	yes	yes	no
## 96	39000	6800	2	1	1	yes	no	no	no
## 97	53900	8250	3	1	1	yes	no	no	no
## 98	59900	8250	3	1	1	yes	no	yes	no
## 99	35000	3500	2	1	1	yes	yes	no	no
## 100	43000	2835	2	1	1	yes	no	no	no
## 101	57000	4500	3	2	2	no	no	yes	no
## 102	79000	3300	3	3	2	yes	no	yes	no
## 103	125000	4320	3	1	2	yes	no	yes	yes
## 104	132000	3500	4	2	2	yes	no	no	yes
## 105	58000	4992	3	2	2	yes	no	no	no
## 106	43000	4600	2	1	1	yes	no	no	no
## 107	48000	3720	2	1	1	no	no	no	no
## 108	58500	3680	3	2	2	yes	no	no	no
## 109	73000	3000	3	2	2	yes	yes	yes	no
## 110	63500	3750	2	1	1	yes	yes	yes	no
## 111	43000	5076	3	1	1	no	no	no	no
## 112	46500	4500	2	1	1	no	no	no	no
## 113	92000	5000	3	1	2	yes	no	no	no
## 114	75000	4260	4	1	2	yes	no	yes	no
## 115	75000	6540	4	2	2	no	no	no	no
## 116	85000	3700	4	1	2	yes	yes	no	no
## 117	93000	3760	3	1	2	yes	no	no	yes
## 118	94500	4000	3	2	2	yes	no	yes	no
## 119	106500	4300	3	2	2	yes	no	yes	no

## 120	116000	6840	5	1	2	yes	yes	yes	no
## 121	61500	4400	2	1	1	yes	no	no	no
## 122	80000	10500	4	2	2	yes	no	no	no
## 123	37000	4400	2	1	1	yes	no	no	no
## 124	59500	4840	3	1	2	yes	no	no	no
## 125	70000	4120	2	1	1	yes	no	yes	no
## 126	95000	4260	4	2	2	yes	no	no	yes
## 127	117000	5960	3	3	2	yes	yes	yes	no
## 128	122500	8800	3	2	2	yes	no	no	no
## 129	123500	4560	3	2	2	yes	yes	yes	no
## 130	127000	4600	3	2	2	yes	yes	no	no
## 131	35000	4840	2	1	2	yes	no	no	no
## 132	44500	3850	3	1	2	yes	no	no	no
## 133	49900	4900	3	1	2	no	no	no	no
## 134	50500	3850	3	1	1	yes	no	no	no
## 135	65000	3760	3	1	1	yes	no	no	no
## 136	90000	6000	4	2	4	yes	no	no	no
## 137	46000	4370	3	1	2	yes	no	no	no
## 138	35000	7700	2	1	1	yes	no	no	no
## 139	26500	2990	2	1	1	no	no	no	no
## 140	43000	3750	3	1	2	yes	no	no	no
## 141	56000	3000	3	1	2	yes	no	no	no
## 142	40000	2650	3	1	2	yes	no	yes	no
## 143	51000	4500	4	2	2	yes	no	yes	no
## 144	51000	4500	2	1	1	no	no	no	no
## 145	57250	4500	3	1	2	no	no	yes	no
## 146	44000	4500	2	1	2	yes	no	no	yes
## 147	61000	2175	3	1	2	no	yes	yes	no
## 148	62000	4500	3	2	3	yes	no	no	yes
## 149	80000	4800	5	2	3	no	no	yes	yes
## 150	50000	4600	4	1	2	yes	no	no	no
## 151	59900	3450	3	1	2	yes	no	no	no
## 152	35500	3000	3	1	2	no	no	no	no
## 153	37000	3600	2	2	2	yes	no	yes	no
## 154	42000	3600	3	1	2	no	no	no	no
## 155	48000	3750	3	1	1	yes	no	no	no
## 156	60000	2610	4	3	2	no	no	no	no
## 157	60000	2953	3	1	2	yes	no	yes	no
## 158	60000	2747	4	2	2	no	no	no	no
## 159	62000	1905	5	1	2	no	no	yes	no
## 160	63000	3968	3	1	2	no	no	no	no
## 161	63900	3162	3	1	2	yes	no	no	no
## 162	130000	6000	4	1	2	yes	no	yes	no
## 163	25000	2910	3	1	1	no	no	no	no
## 164	50000	2135	3	2	2	no	no	no	no
## 165	52900	3120	3	1	2	no	no	yes	yes
## 166	62000	4075	3	1	1	yes	yes	yes	no
## 167	73500	3410	3	1	2	no	no	no	no
## 168	38000	2800	3	1	1	yes	no	no	no
## 169	46000	2684	2	1	1	yes	no	no	no
## 170	48000	3100	3	1	2	no	no	yes	no
## 171	52500	3630	2	1	1	yes	no	yes	no
## 172	32000	1950	3	1	1	no	no	no	yes
## 173	38000	2430	3	1	1	no	no	no	no

## 174	46000	4320	3	1	1	no	no	no	no
## 175	50000	3036	3	1	2	yes	no	yes	no
## 176	57500	3630	3	2	2	yes	no	no	yes
## 177	70000	5400	4	1	2	yes	no	no	no
## 178	69900	3420	4	2	2	yes	no	yes	no
## 179	74500	3180	3	2	2	yes	no	no	no
## 180	42000	3660	4	1	2	no	no	no	no
## 181	60000	4410	2	1	1	no	no	no	no
## 182	50000	3990	3	1	2	yes	no	no	no
## 183	58000	4340	3	1	1	yes	no	no	no
## 184	63900	3510	3	1	2	yes	no	no	no
## 185	28000	3420	5	1	2	no	no	no	no
## 186	54000	3420	2	1	2	yes	no	no	yes
## 187	44700	5495	3	1	1	yes	no	yes	no
## 188	47000	3480	4	1	2	no	no	no	no
## 189	50000	7424	3	1	1	no	no	no	no
## 190	57250	3460	4	1	2	yes	no	no	no
## 191	67000	3630	3	1	2	yes	no	no	no
## 192	52500	3630	2	1	1	yes	no	no	no
## 193	42000	3480	3	1	2	no	no	no	no
## 194	57500	3460	3	2	1	yes	no	yes	no
## 195	33000	3180	2	1	1	yes	no	no	no
## 196	34400	3635	2	1	1	no	no	no	no
## 197	40000	3960	3	1	1	yes	no	no	no
## 198	40500	4350	3	1	2	no	no	no	yes
## 199	46500	3930	2	1	1	no	no	no	no
## 200	52000	3570	3	1	2	yes	no	yes	no
## 201	53000	3600	3	1	1	yes	no	no	no
## 202	53900	2520	5	2	1	no	no	yes	no
## 203	50000	3480	3	1	1	no	no	no	no
## 204	55500	3180	4	2	2	yes	no	no	no
## 205	56000	3290	2	1	1	yes	no	no	yes
## 206	60000	4000	4	2	2	no	no	no	no
## 207	60000	2325	3	1	2	no	no	no	no
## 208	69500	4350	2	1	1	yes	no	yes	no
## 209	72000	3540	2	1	1	no	yes	yes	no
## 210	92500	3960	3	1	1	yes	no	yes	no
## 211	40500	2640	2	1	1	no	no	no	no
## 212	42000	2700	2	1	1	no	no	no	no
## 213	47900	2700	3	1	1	no	no	no	no
## 214	52000	3180	3	1	2	no	no	yes	no
## 215	62000	3500	4	1	2	yes	no	no	no
## 216	41000	3630	2	1	1	yes	no	no	no
## 217	138300	6000	4	3	2	yes	yes	yes	yes
## 218	42000	3150	3	1	2	no	no	no	no
## 219	47000	3792	4	1	2	yes	no	no	no
## 220	64500	3510	3	1	3	yes	no	no	no
## 221	46000	3120	3	1	2	no	no	no	no
## 222	58000	3000	4	1	3	yes	no	yes	no
## 223	70100	4200	3	1	2	yes	no	no	no
## 224	78500	2817	4	2	2	no	yes	yes	no
## 225	87250	3240	4	1	3	yes	no	no	no
## 226	70800	2800	3	2	2	no	no	yes	no
## 227	56000	3816	2	1	1	yes	no	yes	no

##	228	48000	3185	2	1	1	yes	no	yes	no
##	229	68000	6321	3	1	2	yes	no	yes	no
##	230	79000	3650	3	2	2	yes	no	no	no
##	231	80000	4700	4	1	2	yes	yes	yes	no
##	232	87000	6615	4	2	2	yes	yes	no	yes
##	233	25000	3850	3	1	2	yes	no	no	no
##	234	32500	3970	1	1	1	no	no	no	no
##	235	36000	3000	2	1	2	yes	no	no	no
##	236	42500	4352	4	1	2	no	no	no	no
##	237	43000	3630	4	1	2	yes	no	no	no
##	238	50000	3600	6	1	2	yes	no	no	no
##	239	26000	3000	2	1	1	yes	no	yes	no
##	240	30000	3000	4	1	2	yes	no	no	no
##	241	34000	2787	4	2	2	yes	no	no	no
##	242	52000	3000	2	1	2	yes	no	no	no
##	243	70000	4770	3	1	1	yes	yes	yes	no
##	244	27000	3649	2	1	1	yes	no	no	no
##	245	32500	3970	3	1	2	yes	no	yes	no
##	246	37200	2910	2	1	1	no	no	no	no
##	247	38000	3480	2	1	1	yes	no	no	no
##	248	42000	6615	3	1	2	yes	no	no	no
##	249	44500	3500	2	1	1	yes	no	no	no
##	250	45000	3450	3	1	2	yes	no	yes	no
##	251	48500	3450	3	1	1	yes	no	yes	no
##	252	52000	3520	2	2	1	yes	no	yes	no
##	253	53900	6930	4	1	2	no	no	no	no
##	254	60000	4600	3	2	2	yes	no	no	no
##	255	61000	4360	4	1	2	yes	no	no	no
##	256	64500	3450	3	1	2	yes	no	yes	no
##	257	71000	4410	4	3	2	yes	no	yes	no
##	258	75500	4600	2	2	1	yes	no	no	no
##	259	33500	3640	2	1	1	yes	no	no	no
##	260	41000	6000	2	1	1	yes	no	no	no
##	261	41000	5400	4	1	2	yes	no	no	no
##	262	46200	3640	4	1	2	yes	no	yes	no
##	263	48500	3640	2	1	1	yes	no	no	no
##	264	48900	4040	2	1	1	yes	no	no	no
##	265	50000	3640	2	1	1	yes	no	no	no
##	266	51000	3640	2	1	1	yes	no	no	no
##	267	52500	5640	2	1	1	no	no	no	no
##	268	52500	3600	2	1	1	yes	no	no	no
##	269	54000	3600	2	1	1	yes	no	no	no
##	270	59000	4632	4	1	2	yes	no	no	no
##	271	60000	3640	3	2	2	yes	no	yes	no
##	272	63000	4900	2	1	2	yes	no	yes	no
##	273	64000	4510	4	1	2	yes	no	no	no
##	274	64900	4100	2	2	1	yes	yes	yes	no
##	275	65000	3640	3	1	2	yes	no	no	no
##	276	66000	5680	3	1	2	yes	yes	no	no
##	277	70000	6300	3	1	1	yes	no	no	no
##	278	65500	4000	3	1	2	yes	no	no	no
##	279	57000	3960	3	1	2	yes	no	no	no
##	280	52000	5960	3	1	2	yes	yes	yes	no
##	281	54000	5830	2	1	1	yes	no	no	no

##	282	74500	4500	4	2	1	no	no	yes	no
##	283	90000	4100	3	2	3	yes	no	no	no
##	284	45000	6750	2	1	1	yes	no	no	no
##	285	45000	9000	3	1	2	yes	no	no	no
##	286	65000	2550	3	1	2	yes	no	yes	no
##	287	55000	7152	3	1	2	yes	no	no	no
##	288	62000	6450	4	1	2	yes	no	no	no
##	289	30000	3360	2	1	1	yes	no	no	no
##	290	34000	3264	2	1	1	yes	no	no	no
##	291	38000	4000	3	1	1	yes	no	no	no
##	292	39000	4000	3	1	2	yes	no	no	no
##	293	45000	3069	2	1	1	yes	no	no	no
##	294	47000	4040	2	1	1	yes	no	no	no
##	295	47500	4040	2	1	1	yes	no	no	no
##	296	49000	3185	2	1	1	yes	no	no	no
##	297	50000	5900	2	1	1	yes	no	no	no
##	298	50000	3120	3	1	2	yes	no	no	no
##	299	52900	5450	2	1	1	yes	no	no	no
##	300	53000	4040	2	1	1	yes	no	no	no
##	301	55000	4080	2	1	1	yes	no	no	no
##	302	56000	8080	3	1	1	yes	no	no	no
##	303	58500	4040	2	1	2	yes	no	no	no
##	304	59500	4080	3	1	2	yes	no	no	no
##	305	60000	5800	3	1	1	yes	no	no	yes
##	306	64000	5885	2	1	1	yes	no	no	no
##	307	67000	9667	4	2	2	yes	yes	yes	no
##	308	68100	3420	4	2	2	yes	no	no	no
##	309	70000	5800	2	1	1	yes	yes	yes	no
##	310	72000	7600	4	1	2	yes	no	no	no
##	311	57500	5400	3	1	1	yes	no	no	no
##	312	69900	4995	4	2	1	yes	no	yes	no
##	313	70000	3000	3	1	2	yes	no	yes	no
##	314	75000	5500	3	2	1	yes	no	yes	no
##	315	76900	6450	3	2	1	yes	yes	yes	yes
##	316	78000	6210	4	1	4	yes	yes	no	no
##	317	80000	5000	3	1	4	yes	no	no	no
##	318	82000	5000	3	1	3	yes	no	no	no
##	319	83000	5828	4	1	4	yes	yes	no	no
##	320	83000	5200	3	1	3	yes	no	no	no
##	321	83900	5500	3	1	3	yes	yes	no	no
##	322	88500	6350	3	2	3	yes	yes	no	no
##	323	93000	8250	3	2	3	yes	no	no	no
##	324	98000	6000	3	1	1	yes	no	no	no
##	325	98500	7700	3	2	1	yes	no	no	no
##	326	99000	8880	3	2	2	yes	no	yes	no
##	327	101000	8880	2	1	1	yes	no	no	no
##	328	110000	6480	3	2	4	yes	no	no	no
##	329	115442	7000	3	2	4	yes	no	no	no
##	330	120000	8875	3	1	1	yes	no	no	no
##	331	124000	7155	3	2	1	yes	yes	yes	no
##	332	175000	8960	4	4	4	yes	no	no	no
##	333	50000	7350	2	1	1	yes	no	no	no
##	334	55000	3850	2	1	1	yes	no	no	no
##	335	60000	7000	3	1	1	yes	no	no	no

##	336	61000	7770	2	1	1	yes	no	no	no
##	337	106000	7440	3	2	1	yes	yes	yes	no
##	338	155000	7500	3	3	1	yes	no	yes	no
##	339	141000	8100	4	1	2	yes	yes	yes	no
##	340	62500	3900	3	1	2	yes	no	no	no
##	341	70000	2970	3	1	3	yes	no	no	no
##	342	73000	3000	3	1	2	yes	no	yes	no
##	343	80000	10500	2	1	1	yes	no	no	no
##	344	80000	5500	3	2	2	yes	no	no	no
##	345	88000	4500	3	1	4	yes	no	no	no
##	346	49000	3850	3	1	1	yes	no	no	no
##	347	52000	4130	3	2	2	yes	no	no	no
##	348	59500	4046	3	1	2	yes	no	yes	no
##	349	60000	4079	3	1	3	yes	no	no	no
##	350	64000	4000	3	1	2	yes	no	no	no
##	351	64500	9860	3	1	1	yes	no	no	no
##	352	68500	7000	3	1	2	yes	no	yes	no
##	353	78500	7980	3	1	1	yes	no	no	no
##	354	86000	6800	2	1	1	yes	yes	yes	no
##	355	86900	4300	6	2	2	yes	no	no	no
##	356	75000	10269	3	1	1	yes	no	no	no
##	357	78000	6100	3	1	3	yes	yes	no	no
##	358	95000	6420	3	2	3	yes	no	no	no
##	359	97000	12090	4	2	2	yes	no	no	no
##	360	107000	6600	3	1	4	yes	no	no	no
##	361	130000	6600	4	2	2	yes	yes	yes	no
##	362	145000	8580	4	3	4	yes	no	no	no
##	363	175000	9960	3	2	2	yes	no	yes	no
##	364	72000	10700	3	1	2	yes	yes	yes	no
##	365	84900	15600	3	1	1	yes	no	no	no
##	366	99000	13200	2	1	1	yes	no	yes	yes
##	367	114000	9000	4	2	4	yes	no	no	no
##	368	120000	7950	5	2	2	yes	no	yes	yes
##	369	145000	16200	5	3	2	yes	no	no	no
##	370	79000	6100	3	2	1	yes	no	yes	no
##	371	82000	6360	3	1	1	yes	yes	yes	no
##	372	85000	6420	3	1	1	yes	no	yes	no
##	373	100500	6360	4	2	3	yes	no	no	no
##	374	122000	6540	4	2	2	yes	yes	yes	no
##	375	126500	6420	3	2	2	yes	no	no	no
##	376	133000	6550	4	2	2	yes	no	no	no
##	377	140000	5750	3	2	4	yes	yes	no	no
##	378	190000	7420	4	2	3	yes	no	no	no
##	379	84000	7160	3	1	1	yes	no	yes	no
##	380	97000	4000	3	2	2	yes	no	yes	no
##	381	103500	9000	4	2	4	yes	yes	no	no
##	382	112500	6550	3	1	2	yes	no	yes	no
##	383	140000	13200	3	1	2	yes	no	yes	no
##	384	74700	7085	3	1	1	yes	yes	yes	no
##	385	78000	6600	4	2	2	yes	yes	yes	no
##	386	78900	6900	3	1	1	yes	yes	yes	no
##	387	83900	11460	3	1	3	yes	no	no	no
##	388	85000	7020	3	1	1	yes	no	yes	no
##	389	85000	6540	3	1	1	yes	yes	yes	no

##	390	86000	8000	3	1	1	yes	yes	yes	no
##	391	86900	9620	3	1	1	yes	no	yes	no
##	392	94500	10500	3	2	1	yes	no	yes	no
##	393	96000	5020	3	1	4	yes	no	no	no
##	394	106000	7440	3	2	4	yes	no	no	no
##	395	72000	6600	3	1	1	yes	yes	yes	no
##	396	74500	7200	3	1	2	yes	yes	yes	no
##	397	77000	6710	3	2	2	yes	yes	yes	no
##	398	80750	6660	4	2	2	yes	yes	yes	no
##	399	82900	7000	3	1	1	yes	no	yes	no
##	400	85000	7231	3	1	2	yes	yes	yes	no
##	401	92500	7410	3	1	1	yes	yes	yes	no
##	402	76000	7800	3	1	1	yes	no	yes	no
##	403	77500	6825	3	1	1	yes	yes	yes	no
##	404	80000	6360	3	1	3	yes	no	no	no
##	405	80000	6600	4	2	1	yes	no	yes	no
##	406	86000	6900	3	2	1	yes	yes	yes	no
##	407	87000	6600	3	1	1	yes	yes	yes	no
##	408	87500	6420	3	1	3	yes	no	yes	no
##	409	89000	6600	3	2	1	yes	no	yes	no
##	410	89900	6600	3	2	3	yes	no	no	no
##	411	90000	9000	3	1	1	yes	no	yes	no
##	412	95000	6500	3	2	3	yes	no	no	no
##	413	112000	6360	3	2	4	yes	no	no	no
##	414	31900	5300	3	1	1	no	no	no	no
##	415	52000	2850	3	2	2	no	no	yes	no
##	416	90000	6400	3	1	1	yes	yes	yes	no
##	417	100000	11175	3	1	1	yes	no	yes	no
##	418	91700	6750	2	1	1	yes	yes	yes	no
##	419	174500	7500	4	2	2	yes	no	yes	no
##	420	94700	6000	3	1	2	yes	no	no	yes
##	421	68000	10240	2	1	1	yes	no	no	no
##	422	80000	5136	3	1	2	yes	yes	yes	no
##	423	61100	3400	3	1	2	yes	no	yes	no
##	424	62900	2880	3	1	2	yes	no	no	no
##	425	65500	3840	3	1	2	yes	no	no	no
##	426	66000	2870	2	1	2	yes	yes	yes	no
##	427	49500	5320	2	1	1	yes	no	no	no
##	428	50000	3512	2	1	1	yes	no	no	no
##	429	53500	3480	2	1	1	yes	no	no	no
##	430	58550	3600	3	1	1	yes	no	yes	no
##	431	64500	3520	2	1	2	yes	no	no	no
##	432	65000	5320	3	1	2	yes	yes	yes	no
##	433	69000	6040	3	1	1	yes	no	no	no
##	434	73000	11410	2	1	2	yes	no	no	no
##	435	75000	8400	3	1	2	yes	yes	yes	no
##	436	75000	5300	4	2	1	yes	no	no	no
##	437	132000	7800	3	2	2	yes	no	no	no
##	438	60000	3520	3	1	2	yes	no	no	no
##	439	65000	5360	3	1	2	yes	no	no	no
##	440	69000	6862	3	1	2	yes	no	no	no
##	441	51900	3520	3	1	1	yes	no	no	no
##	442	57000	4050	2	1	2	yes	yes	yes	no
##	443	65000	3520	3	1	1	yes	no	no	no

## 444	79500	4400	4	1	2	yes	no	no	no
## 445	72500	5720	2	1	2	yes	no	no	no
## 446	104900	11440	4	1	2	yes	no	yes	no
## 447	114900	7482	3	2	3	yes	no	no	yes
## 448	120000	5500	4	2	2	yes	no	yes	no
## 449	58000	4320	3	1	2	yes	no	no	no
## 450	67000	5400	2	1	2	yes	no	no	no
## 451	67000	4320	3	1	1	yes	no	no	no
## 452	69000	4815	2	1	1	yes	no	no	no
## 453	73000	6100	3	1	1	yes	no	yes	no
## 454	73500	7980	3	1	1	yes	no	no	no
## 455	74900	6050	3	1	1	yes	no	yes	no
## 456	75000	3800	3	1	2	yes	yes	yes	no
## 457	79500	5400	5	1	2	yes	yes	yes	no
## 458	120900	6000	3	2	4	yes	yes	yes	no
## 459	44555	2398	3	1	1	yes	no	no	no
## 460	47000	2145	3	1	2	yes	no	yes	no
## 461	47600	2145	3	1	2	yes	no	yes	no
## 462	49000	2145	3	1	3	yes	no	no	no
## 463	49000	2610	3	1	2	yes	no	yes	no
## 464	49000	1950	3	2	2	yes	no	yes	no
## 465	49500	2145	3	1	3	yes	no	no	no
## 466	52000	2275	3	1	3	yes	no	no	yes
## 467	54000	2856	3	1	3	yes	no	no	no
## 468	55000	2015	3	1	2	yes	no	yes	no
## 469	55000	2176	2	1	2	yes	yes	no	no
## 470	56000	2145	4	2	1	yes	no	yes	no
## 471	60000	2145	3	1	3	yes	no	no	no
## 472	60500	2787	3	1	1	yes	no	yes	no
## 473	50000	9500	3	1	2	yes	no	no	no
## 474	64900	4990	4	2	2	yes	yes	yes	no
## 475	93000	6670	3	1	3	yes	no	yes	no
## 476	85000	6254	4	2	1	yes	no	yes	no
## 477	61500	10360	2	1	1	yes	no	no	no
## 478	88500	5500	3	2	1	yes	yes	yes	no
## 479	88000	5450	4	2	1	yes	no	yes	no
## 480	89000	5500	3	1	3	yes	no	no	no
## 481	89500	6000	4	1	3	yes	yes	yes	no
## 482	95000	5700	3	1	1	yes	yes	yes	no
## 483	95500	6600	2	2	4	yes	no	yes	no
## 484	51500	4000	2	1	1	yes	no	no	no
## 485	62900	4880	3	1	1	yes	no	no	no
## 486	118500	4880	4	2	2	yes	no	no	no
## 487	42900	8050	2	1	1	yes	no	no	no
## 488	44100	8100	2	1	1	yes	no	no	no
## 489	47000	5880	3	1	1	yes	no	no	no
## 490	50000	5880	2	1	1	yes	no	no	no
## 491	50000	12944	3	1	1	yes	no	no	no
## 492	53000	6020	3	1	1	yes	no	no	no
## 493	53000	4050	2	1	1	yes	no	no	no
## 494	54000	8400	2	1	1	yes	no	no	no
## 495	58500	5600	2	1	1	yes	no	no	no
## 496	59000	5985	3	1	1	yes	no	yes	no
## 497	60000	4500	3	1	1	yes	no	yes	no

##	498	62900	4920	3	1	2	yes	no	no	no
##	499	64000	8250	3	1	1	yes	no	no	no
##	500	65000	8400	4	1	4	yes	no	no	no
##	501	67900	6440	2	1	1	yes	no	no	no
##	502	68500	8100	4	1	4	yes	no	yes	no
##	503	70000	6720	3	1	1	yes	no	no	no
##	504	70500	5948	3	1	2	yes	no	no	no
##	505	71500	8150	3	2	1	yes	yes	yes	no
##	506	71900	4800	2	1	1	yes	yes	yes	no
##	507	75000	9800	4	2	2	yes	yes	no	no
##	508	75000	8520	3	1	1	yes	no	no	no
##	509	87000	8372	3	1	3	yes	no	no	no
##	510	64000	4040	3	1	2	yes	no	no	no
##	511	70000	4646	3	1	2	yes	yes	yes	no
##	512	47500	4775	4	1	2	yes	no	no	no
##	513	62600	4950	4	1	2	yes	no	no	no
##	514	66000	5010	3	1	2	yes	no	yes	no
##	515	58900	6060	2	1	1	yes	no	yes	no
##	516	53000	3584	2	1	1	yes	no	no	yes
##	517	95000	6000	3	2	3	yes	yes	no	no
##	518	96500	6000	4	2	4	yes	no	no	no
##	519	101000	6240	4	2	2	yes	no	no	no
##	520	102000	6000	3	2	2	yes	yes	no	no
##	521	103000	7680	4	2	4	yes	yes	no	no
##	522	105000	6000	4	2	4	yes	yes	no	no
##	523	108000	6000	4	2	4	yes	no	no	no
##	524	110000	6000	4	2	4	yes	no	no	no
##	525	113000	6000	4	2	4	yes	no	no	no
##	526	120000	7475	3	2	4	yes	no	no	no
##	527	105000	5150	3	2	4	yes	no	no	no
##	528	106000	6325	3	1	4	yes	no	no	no
##	529	107500	6000	3	2	4	yes	no	no	no
##	530	108000	6000	3	2	3	yes	no	no	no
##	531	113750	6000	3	1	4	yes	yes	no	no
##	532	120000	7000	3	1	4	yes	no	no	no
##	533	70000	12900	3	1	1	yes	no	no	no
##	534	71000	7686	3	1	1	yes	yes	yes	yes
##	535	82000	5000	3	1	3	yes	no	no	no
##	536	82000	5800	3	2	4	yes	no	no	no
##	537	82500	6000	3	2	4	yes	no	no	no
##	538	83000	4800	3	1	3	yes	no	no	no
##	539	84000	6500	3	2	3	yes	no	no	no
##	540	85000	7320	4	2	2	yes	no	no	no
##	541	85000	6525	3	2	4	yes	no	no	no
##	542	91500	4800	3	2	4	yes	yes	no	no
##	543	94000	6000	3	2	4	yes	no	no	no
##	544	103000	6000	3	2	4	yes	yes	no	no
##	545	105000	6000	3	2	2	yes	yes	no	no
##	546	105000	6000	3	1	2	yes	no	no	no
##	airco garagepl prefarea bedrooms_dummy									
##	1	no	1	no		0				
##	2	no	0	no		0				
##	3	no	0	no		0				
##	4	no	0	no		0				

## 5	no	0	no	0
## 6	yes	0	no	0
## 7	no	2	no	0
## 8	no	0	no	0
## 9	no	0	no	0
## 10	yes	1	no	0
## 11	yes	3	no	0
## 12	no	0	no	0
## 13	no	0	no	0
## 14	no	0	no	0
## 15	no	0	no	0
## 16	yes	0	no	0
## 17	no	1	no	0
## 18	no	0	no	1
## 19	no	0	no	0
## 20	no	1	no	0
## 21	yes	1	no	0
## 22	no	0	no	1
## 23	yes	0	no	0
## 24	no	0	no	0
## 25	no	0	no	0
## 26	no	0	no	0
## 27	no	0	no	0
## 28	yes	0	no	0
## 29	yes	0	no	0
## 30	yes	0	no	0
## 31	no	0	no	0
## 32	yes	2	no	1
## 33	no	0	no	0
## 34	no	0	no	0
## 35	no	0	no	0
## 36	yes	2	no	0
## 37	no	0	no	0
## 38	yes	0	no	0
## 39	yes	2	no	1
## 40	no	0	no	0
## 41	no	0	no	0
## 42	yes	0	no	0
## 43	no	1	no	1
## 44	no	2	no	1
## 45	no	0	no	0
## 46	no	0	no	0
## 47	no	0	no	0
## 48	no	0	no	0
## 49	no	0	no	1
## 50	no	0	no	0
## 51	no	0	no	1
## 52	no	0	no	1
## 53	yes	2	no	0
## 54	no	1	no	0
## 55	no	0	no	0
## 56	no	0	no	0
## 57	no	0	no	0
## 58	no	3	no	0

## 59	no	0	no	0
## 60	no	0	no	0
## 61	no	0	no	0
## 62	no	0	no	0
## 63	yes	2	no	0
## 64	no	0	no	0
## 65	no	0	no	1
## 66	yes	0	no	0
## 67	yes	0	no	0
## 68	yes	1	no	0
## 69	yes	0	no	0
## 70	yes	0	no	0
## 71	no	2	no	0
## 72	no	0	no	0
## 73	no	0	no	0
## 74	no	0	no	0
## 75	no	0	no	0
## 76	no	0	no	0
## 77	no	0	no	0
## 78	yes	0	no	1
## 79	no	2	no	0
## 80	yes	1	no	0
## 81	yes	0	no	0
## 82	no	1	no	0
## 83	no	0	no	0
## 84	no	2	no	0
## 85	no	0	no	0
## 86	yes	1	no	0
## 87	no	2	no	0
## 88	yes	0	no	0
## 89	no	1	no	0
## 90	no	0	no	0
## 91	no	0	no	0
## 92	no	1	no	1
## 93	yes	2	no	1
## 94	yes	2	no	0
## 95	yes	1	no	0
## 96	no	0	no	0
## 97	no	2	no	0
## 98	no	3	no	0
## 99	no	0	no	0
## 100	no	0	no	0
## 101	yes	0	no	0
## 102	no	0	no	0
## 103	no	2	no	0
## 104	no	2	no	1
## 105	no	2	no	0
## 106	no	0	no	0
## 107	yes	0	no	0
## 108	no	0	no	0
## 109	no	0	no	0
## 110	no	0	no	0
## 111	no	0	no	0
## 112	no	0	no	0

## 113	yes	0	no	0
## 114	yes	0	no	1
## 115	yes	0	no	1
## 116	yes	0	no	1
## 117	no	2	no	0
## 118	yes	1	no	0
## 119	no	1	no	0
## 120	yes	1	no	1
## 121	no	1	no	0
## 122	no	1	no	1
## 123	no	0	no	0
## 124	no	1	no	0
## 125	no	1	no	0
## 126	no	0	no	1
## 127	no	1	no	0
## 128	yes	2	no	0
## 129	yes	1	no	0
## 130	yes	2	no	0
## 131	no	0	no	0
## 132	no	0	no	0
## 133	no	0	no	0
## 134	no	2	no	0
## 135	no	2	no	0
## 136	no	1	no	1
## 137	no	0	no	0
## 138	no	0	no	0
## 139	no	1	no	0
## 140	no	0	no	0
## 141	no	0	no	0
## 142	no	1	no	0
## 143	no	2	no	1
## 144	no	0	no	0
## 145	yes	0	no	0
## 146	no	1	no	0
## 147	yes	0	no	0
## 148	no	1	no	0
## 149	no	0	no	1
## 150	no	0	no	1
## 151	no	1	no	0
## 152	no	0	no	0
## 153	no	1	no	0
## 154	no	1	no	0
## 155	no	0	no	0
## 156	no	0	no	1
## 157	yes	0	no	0
## 158	no	0	no	1
## 159	no	0	no	1
## 160	no	0	no	0
## 161	yes	1	no	0
## 162	no	2	no	1
## 163	no	0	no	0
## 164	no	0	no	0
## 165	no	0	no	0
## 166	no	2	no	0

## 167	yes	0	no	0
## 168	no	0	no	0
## 169	yes	1	no	0
## 170	no	0	no	0
## 171	no	0	no	0
## 172	no	0	no	0
## 173	no	0	no	0
## 174	no	1	no	0
## 175	no	0	no	0
## 176	no	2	no	0
## 177	no	0	no	1
## 178	yes	2	no	1
## 179	no	2	no	0
## 180	no	0	no	1
## 181	no	1	no	0
## 182	no	0	no	0
## 183	no	0	no	0
## 184	no	0	no	0
## 185	no	0	no	1
## 186	no	1	no	0
## 187	no	0	no	0
## 188	no	1	no	1
## 189	no	0	no	0
## 190	yes	0	no	1
## 191	no	2	no	0
## 192	yes	0	no	0
## 193	no	1	no	0
## 194	yes	1	no	0
## 195	no	0	no	0
## 196	no	0	no	0
## 197	no	0	no	0
## 198	no	1	no	0
## 199	no	0	no	0
## 200	no	0	no	0
## 201	no	1	no	0
## 202	yes	1	no	1
## 203	yes	0	no	0
## 204	no	0	no	1
## 205	no	1	no	0
## 206	no	0	no	1
## 207	no	0	no	0
## 208	no	0	no	0
## 209	no	0	no	0
## 210	no	2	no	0
## 211	no	1	no	0
## 212	no	0	no	0
## 213	no	0	no	0
## 214	no	0	no	0
## 215	no	2	no	1
## 216	no	0	no	0
## 217	no	2	no	1
## 218	no	0	no	0
## 219	no	0	no	1
## 220	no	0	no	0

## 221	no	0	no	0
## 222	yes	2	no	1
## 223	no	1	no	0
## 224	no	1	no	1
## 225	no	1	no	1
## 226	yes	1	no	0
## 227	yes	2	no	0
## 228	no	2	no	0
## 229	yes	1	no	0
## 230	no	2	no	0
## 231	yes	1	no	1
## 232	no	1	no	1
## 233	no	0	no	0
## 234	no	0	no	0
## 235	no	0	no	0
## 236	no	1	no	1
## 237	no	3	no	1
## 238	no	1	no	1
## 239	no	2	no	0
## 240	no	0	no	1
## 241	no	0	no	1
## 242	yes	0	no	0
## 243	no	0	no	0
## 244	no	0	no	0
## 245	no	0	no	0
## 246	no	0	no	0
## 247	no	1	no	0
## 248	no	0	no	0
## 249	no	0	no	0
## 250	no	0	no	0
## 251	no	2	no	0
## 252	no	0	no	0
## 253	no	1	no	1
## 254	yes	1	no	0
## 255	no	0	no	1
## 256	no	1	no	0
## 257	no	2	no	1
## 258	yes	2	no	0
## 259	no	0	no	0
## 260	no	0	no	0
## 261	no	0	no	1
## 262	no	0	no	1
## 263	no	0	no	0
## 264	no	0	no	0
## 265	no	1	no	0
## 266	no	0	no	0
## 267	no	0	no	0
## 268	no	0	no	0
## 269	no	0	no	0
## 270	yes	0	no	1
## 271	no	0	no	0
## 272	no	0	no	0
## 273	yes	2	no	1
## 274	no	0	no	0

## 275	yes	0	no	0
## 276	yes	1	no	0
## 277	yes	2	no	0
## 278	no	1	no	0
## 279	no	0	no	0
## 280	no	0	no	0
## 281	no	2	no	0
## 282	yes	2	no	1
## 283	yes	2	no	0
## 284	no	0	no	0
## 285	no	2	no	0
## 286	no	0	no	0
## 287	yes	0	no	0
## 288	no	0	no	1
## 289	no	1	no	0
## 290	no	0	no	0
## 291	no	0	no	0
## 292	no	1	no	0
## 293	no	1	no	0
## 294	no	0	no	0
## 295	no	1	no	0
## 296	no	2	no	0
## 297	no	1	no	0
## 298	no	1	no	0
## 299	no	0	no	0
## 300	no	0	no	0
## 301	no	0	no	0
## 302	yes	2	no	0
## 303	no	1	no	0
## 304	no	2	no	0
## 305	no	2	no	0
## 306	yes	1	no	0
## 307	no	1	no	1
## 308	no	0	no	1
## 309	yes	0	no	0
## 310	yes	2	no	1
## 311	no	3	no	0
## 312	no	0	no	1
## 313	yes	0	no	0
## 314	no	0	no	0
## 315	no	0	no	0
## 316	yes	0	no	1
## 317	no	0	no	0
## 318	yes	0	no	0
## 319	no	0	no	1
## 320	yes	0	no	0
## 321	yes	1	no	0
## 322	yes	0	no	0
## 323	yes	0	no	0
## 324	yes	1	no	0
## 325	no	2	no	0
## 326	yes	1	no	0
## 327	yes	1	no	0
## 328	yes	2	no	0

## 329	yes	2	no	0
## 330	no	1	no	0
## 331	yes	2	no	0
## 332	yes	3	no	1
## 333	no	1	no	0
## 334	no	0	no	0
## 335	no	3	no	0
## 336	no	1	no	0
## 337	yes	0	yes	0
## 338	yes	2	yes	0
## 339	yes	2	yes	1
## 340	no	0	no	0
## 341	no	0	no	0
## 342	no	0	no	0
## 343	no	1	no	0
## 344	no	1	no	0
## 345	yes	0	no	0
## 346	no	0	no	0
## 347	no	2	no	0
## 348	no	1	no	0
## 349	no	0	no	0
## 350	no	2	no	0
## 351	no	0	no	0
## 352	no	0	no	0
## 353	no	2	no	0
## 354	no	2	no	0
## 355	no	0	no	1
## 356	no	1	yes	0
## 357	yes	0	yes	0
## 358	yes	0	yes	0
## 359	no	2	yes	1
## 360	yes	3	yes	0
## 361	yes	1	yes	1
## 362	yes	2	yes	1
## 363	no	2	yes	0
## 364	no	0	no	0
## 365	yes	2	no	0
## 366	no	1	no	0
## 367	yes	2	no	1
## 368	no	2	no	1
## 369	no	0	no	1
## 370	no	2	yes	0
## 371	yes	2	yes	0
## 372	yes	0	yes	0
## 373	yes	2	yes	1
## 374	yes	2	yes	1
## 375	yes	1	yes	0
## 376	yes	1	yes	1
## 377	yes	1	yes	0
## 378	yes	2	yes	1
## 379	no	2	yes	0
## 380	yes	0	yes	0
## 381	yes	1	yes	1
## 382	yes	0	yes	0

## 383	yes	2	yes	0
## 384	no	2	yes	0
## 385	no	0	yes	1
## 386	no	0	yes	0
## 387	no	2	yes	0
## 388	yes	2	yes	0
## 389	no	2	yes	0
## 390	yes	2	yes	0
## 391	no	2	yes	0
## 392	yes	1	yes	0
## 393	yes	0	yes	0
## 394	no	1	yes	0
## 395	no	0	yes	0
## 396	no	1	yes	0
## 397	no	1	yes	0
## 398	no	1	yes	1
## 399	no	2	yes	0
## 400	yes	0	yes	0
## 401	yes	2	yes	0
## 402	yes	2	yes	0
## 403	yes	0	yes	0
## 404	no	0	yes	0
## 405	no	0	yes	1
## 406	no	0	yes	0
## 407	no	2	yes	0
## 408	no	0	yes	0
## 409	yes	0	yes	0
## 410	yes	0	yes	0
## 411	no	1	yes	0
## 412	yes	0	yes	0
## 413	yes	0	yes	0
## 414	yes	0	yes	0
## 415	no	0	yes	0
## 416	yes	1	yes	0
## 417	yes	1	yes	0
## 418	no	2	yes	0
## 419	yes	3	yes	1
## 420	no	1	yes	0
## 421	yes	2	yes	0
## 422	yes	0	yes	0
## 423	no	2	yes	0
## 424	no	0	yes	0
## 425	no	1	yes	0
## 426	no	0	yes	0
## 427	no	1	yes	0
## 428	no	1	yes	0
## 429	no	0	yes	0
## 430	yes	0	yes	0
## 431	no	0	yes	0
## 432	no	0	yes	0
## 433	no	2	yes	0
## 434	no	0	yes	0
## 435	yes	2	yes	0
## 436	yes	0	yes	1

## 437	no	0	yes	0
## 438	no	0	yes	0
## 439	no	2	yes	0
## 440	yes	2	yes	0
## 441	no	2	yes	0
## 442	no	0	yes	0
## 443	no	0	yes	0
## 444	yes	2	yes	1
## 445	yes	0	yes	0
## 446	no	1	yes	1
## 447	no	1	yes	0
## 448	yes	1	yes	1
## 449	no	2	yes	0
## 450	no	0	yes	0
## 451	no	0	yes	0
## 452	yes	0	yes	0
## 453	yes	0	yes	0
## 454	no	1	yes	0
## 455	no	0	yes	0
## 456	no	1	yes	0
## 457	yes	0	yes	1
## 458	yes	0	yes	0
## 459	no	0	yes	0
## 460	no	0	yes	0
## 461	no	0	yes	0
## 462	no	0	yes	0
## 463	no	0	yes	0
## 464	no	0	yes	0
## 465	no	0	yes	0
## 466	yes	0	yes	0
## 467	no	0	yes	0
## 468	no	0	yes	0
## 469	no	0	yes	0
## 470	no	0	yes	1
## 471	no	1	yes	0
## 472	no	0	yes	0
## 473	no	3	yes	0
## 474	no	0	yes	1
## 475	no	0	yes	0
## 476	no	1	yes	1
## 477	no	1	yes	0
## 478	no	2	yes	0
## 479	yes	0	yes	1
## 480	no	1	yes	0
## 481	no	0	yes	1
## 482	yes	2	yes	0
## 483	no	0	yes	0
## 484	no	0	yes	0
## 485	no	2	yes	0
## 486	yes	1	yes	1
## 487	no	0	no	0
## 488	no	1	no	0
## 489	no	1	no	0
## 490	no	0	no	0

## 491	no	0	no	0
## 492	no	0	no	0
## 493	no	0	no	0
## 494	no	1	no	0
## 495	yes	0	no	0
## 496	no	0	no	0
## 497	no	0	no	0
## 498	no	1	no	0
## 499	no	0	no	0
## 500	no	3	no	1
## 501	yes	3	no	0
## 502	yes	2	no	1
## 503	no	0	no	0
## 504	yes	0	no	0
## 505	no	0	no	0
## 506	no	0	no	0
## 507	no	2	no	1
## 508	yes	2	no	0
## 509	yes	2	no	0
## 510	no	1	no	0
## 511	no	2	no	0
## 512	no	0	no	1
## 513	yes	0	no	1
## 514	no	0	no	0
## 515	no	1	no	0
## 516	no	0	no	0
## 517	yes	0	no	0
## 518	yes	0	no	1
## 519	yes	1	no	1
## 520	no	1	no	0
## 521	yes	1	no	1
## 522	yes	1	no	1
## 523	yes	1	no	1
## 524	no	2	no	1
## 525	yes	1	no	1
## 526	yes	2	no	0
## 527	yes	2	no	0
## 528	yes	1	no	0
## 529	yes	1	no	0
## 530	yes	0	no	0
## 531	yes	2	no	0
## 532	yes	2	no	0
## 533	no	2	no	0
## 534	no	0	no	0
## 535	yes	0	no	0
## 536	yes	0	no	0
## 537	yes	0	no	0
## 538	yes	0	no	0
## 539	yes	0	no	0
## 540	no	0	no	1
## 541	no	1	no	0
## 542	yes	0	no	0
## 543	yes	0	no	0
## 544	yes	1	no	0

```
## 545  yes      1      no      0
## 546  yes      1      no      0
```

Question b

```
filter(Housing,bedrooms_dummy==1, prefarea=='yes' )
```

```
##      price lotsize bedrooms bathrms stories driveway recroom fullbase gashw
## 1  141000   8100         4         1         2       yes     yes     yes    no
## 2   97000  12090         4         2         2       yes     no      no    no
## 3  130000   6600         4         2         2       yes     yes     yes    no
## 4  145000   8580         4         3         4       yes     no      no    no
## 5  100500   6360         4         2         3       yes     no      no    no
## 6  122000   6540         4         2         2       yes     yes     yes    no
## 7  133000   6550         4         2         2       yes     no      no    no
## 8  190000   7420         4         2         3       yes     no      no    no
## 9  103500   9000         4         2         4       yes     yes     no    no
## 10 78000    6600         4         2         2       yes     yes     yes    no
## 11 80750    6660         4         2         2       yes     yes     yes    no
## 12 80000    6600         4         2         1       yes     no      yes    no
## 13 174500   7500         4         2         2       yes     no      yes    no
## 14 75000    5300         4         2         1       yes     no      no    no
## 15 79500    4400         4         1         2       yes     no      no    no
## 16 104900  11440         4         1         2       yes     no      yes    no
## 17 120000   5500         4         2         2       yes     no      yes    no
## 18 79500    5400         5         1         2       yes     yes     yes    no
## 19 56000    2145         4         2         1       yes     no      yes    no
## 20 64900    4990         4         2         2       yes     yes     yes    no
## 21 85000    6254         4         2         1       yes     no      yes    no
## 22 88000    5450         4         2         1       yes     no      yes    no
## 23 89500    6000         4         1         3       yes     yes     yes    no
## 24 118500   4880         4         2         2       yes     no      no    no
##      airco garagepl prefarea bedrooms_dummy
## 1    yes          2      yes              1
## 2    no          2      yes              1
## 3    yes          1      yes              1
## 4    yes          2      yes              1
## 5    yes          2      yes              1
## 6    yes          2      yes              1
## 7    yes          1      yes              1
## 8    yes          2      yes              1
## 9    yes          1      yes              1
## 10   no          0      yes              1
## 11   no          1      yes              1
## 12   no          0      yes              1
## 13   yes          3      yes              1
## 14   yes          0      yes              1
## 15   yes          2      yes              1
## 16   no          1      yes              1
## 17   yes          1      yes              1
## 18   yes          0      yes              1
## 19   no          0      yes              1
```



```
## 20    no      0    yes      1
## 21    no      1    yes      1
## 22   yes      0    yes      1
## 23    no      0    yes      1
## 24   yes      1    yes      1
```

Question c

```
mean_average_price=mean(Housing$price)
mean_price_dummy1_prefareaYes=mean(filter(Housing,bedrooms_dummy==1, prefarea=='yes' )$price)
mean_average_price
```

```
## [1] 68121.6
```

```
mean_price_dummy1_prefareaYes
```

```
## [1] 105668.8
```

Average price of housing with more than 3 bedrooms and located in the preferred neighborhood of the city are much more expensive than average houses.

Question 7

Question a

```
(max(Housing$lotsize)-min(Housing$lotsize))/3
```

```
## [1] 4850
```

```
Housing$lotsize_bin_equal_width=cut_width(Housing$lotsize, width=4850)
head(Housing$lotsize_bin_equal_width)
```

```
## [1] (2.42e+03,7.28e+03] (2.42e+03,7.28e+03] (2.42e+03,7.28e+03]
## [4] (2.42e+03,7.28e+03] (2.42e+03,7.28e+03] (2.42e+03,7.28e+03]
## 4 Levels: [-2.42e+03,2.42e+03] (2.42e+03,7.28e+03] ... (1.21e+04,1.7e+04]
```

```
table(Housing$lotsize_bin_equal_width)
```

```
##
## [-2.42e+03,2.42e+03] (2.42e+03,7.28e+03] (7.28e+03,1.21e+04]
##                23                446                71
## (1.21e+04,1.7e+04]
##                6
```

Question b

```
Housing$lotsize_bin_equal_freq=cut_number(Housing$lotsize,n=4)
table(Housing$lotsize_bin_equal_freq)
```

```
##
##  [1.65e+03,3.6e+03]  (3.6e+03,4.6e+03]  (4.6e+03,6.36e+03]  (6.36e+03,1.62e+04]
##                    144                    133                    134                    135
```