

ESE527-practice2

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Solution of Problem 2:

First we install and read three packages related to outlier detection mentioned in Practice 2.

```
library(OutlierDetection)
library(Outliers03)
```

```
## Registered S3 method overwritten by 'GGally':
##   method from
##   +.gg      ggplot2
```

```
library(outliers)
```

The data set we use in our project is called "Credit Card Approval". Here we only extract six features and the first 10,000 rows of the first table "application_record.csv" from the original data set.

The features are: gender, number of children, annual income, education level, marital status and ways of living. We choose to ignore the ID of clients and replace this column with indices.

In the following part we show the first six rows of the new table "application1.csv".

```
library(readr)
library(knitr)
options(encoding = "UTF-8")

application1 <- read_csv("E:/MS-WUSTL/SP2022/ESE 527/practice2/application1.csv", show_col_types = FALSE)
head(application1)
```

IN...	CODE_GEN...	CNT_CHILD...	AMT_INCOME_TO...	NAME_EDUCATION_TYPE
<dbl>	<chr>	<dbl>	<dbl>	<chr>
1	M	0	427500	Higher education
2	M	0	427500	Higher education
3	M	0	112500	Secondary / secondary special
4	F	0	270000	Secondary / secondary special
5	F	0	270000	Secondary / secondary special
6	F	0	270000	Secondary / secondary special

6 rows | 1-5 of 7 columns

Considering that some of the features in the table "application1.csv" are demonstrated by words instead of numbers, we change these columns with scalar numbers.

The features that need changes are: gender, education level, marital status and ways of living.

First we find out how many different values each feature has.

```
gender_val<-unique(application1[,2])
education_val<-unique(application1[,5])
marital_val<-unique(application1[,6])
housing_val<-unique(application1[,7])

library("plyr")
list1<-list()
list1[[1]]<-data.frame(t(gender_val))
list1[[2]]<-data.frame(t(education_val))
list1[[3]]<-data.frame(t(marital_val))
list1[[4]]<-data.frame(t(housing_val))
values<-rbind.fill(list1)
t(values)
```

```
##      [,1] [,2]                [,3]
## X1 "M"   "Higher education"    "Civil marriage"
## X2 "F"   "Secondary / secondary special" "Married"
## X3 NA    "Incomplete higher"     "Single / not married"
## X4 NA    "Lower secondary"       "Separated"
## X5 NA    "Academic degree"       "Widow"
## X6 NA    NA                     NA
##      [,4]
## X1 "Rented apartment"
## X2 "House / apartment"
## X3 "Municipal apartment"
## X4 "With parents"
## X5 "Co-op apartment"
## X6 "Office apartment"
```

Then we substitute these words with numbers.

For the feature gender, we set 0 for "F" and 1 for "M".

For the education level, we set 1 for "Academic degree", 2 for "Lower secondary", 3 for "Incomplete higher", 4 for "Secondary / secondary special" and 5 for "Higher education".

For the marital status, we set 1 for "Civil marriage", 2 for "Married", 3 for "Single / not married", 4 for "Separated" and 5 for "Widow".

For the ways of living, we set 1 for "Rented apartment", 2 for "House / apartment", 3 for "Municipal apartment", 4 for "With parents", 5 for "Co-op apartment" and 6 for "Office apartment".

```

a<-sub("M", "0", application1$CODE_GENDER)
b<-sub("F", "1", a)
gender<-as.numeric(b)

a<-sub("Academic degree", "1", application1$NAME_EDUCATION_TYPE)
b<-sub("Lower secondary", "2", a)
c<-sub("Incomplete higher", "3", b)
d<-sub("Secondary / secondary special", "4", c)
e<-sub("Higher education", "5", d)
education<-as.numeric(e)

a<-sub("Civil marriage", "1", application1$NAME_FAMILY_STATUS)
b<-sub("Married", "2", a)
c<-sub("Single / not married", "3", b)
d<-sub("Separated", "4", c)
e<-sub("Widow", "5", d)
marital<-as.numeric(e)

a<-sub("Rented apartment", "1", application1$NAME_HOUSING_TYPE)
b<-sub("House / apartment", "2", a)
c<-sub("Municipal apartment", "3", b)
d<-sub("With parents", "4", c)
e<-sub("Co-op apartment", "5", d)
f<-sub("Office apartment", "6", e)
housing<-as.numeric(f)

index<-application1$INDEX
num_child<-application1$CNT_CHILDREN
ann_income<-application1$AMT_INCOME_TOTAL

newdata<-data.frame(index, gender, num_child, ann_income, education, marital, housing)
head(newdata)

```

	index <dbl>	gender <dbl>	num_child <dbl>	ann_income <dbl>	education <dbl>	marital <dbl>	housing <dbl>
1	1	0	0	427500	5	1	1
2	2	0	0	427500	5	1	1
3	3	0	0	112500	4	2	2
4	4	1	0	270000	4	3	2
5	5	1	0	270000	4	3	2
6	6	1	0	270000	4	3	2
6 rows							

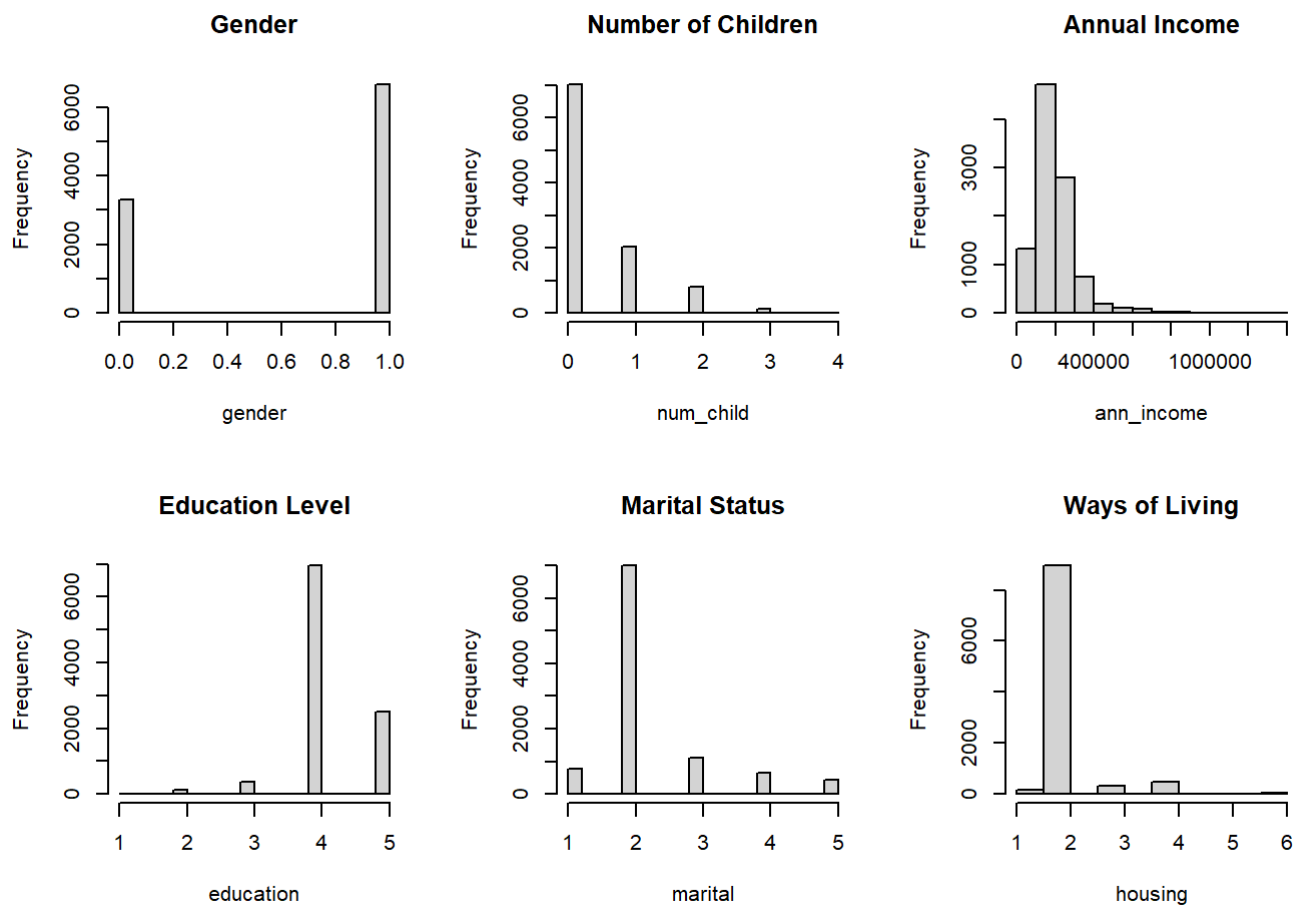
Then we construct the summary of "application1.csv" with the summary function.

```
summary(newdata)
```

```
##      index      gender      num_child      ann_income
##  Min.   : 1      Min.   :0.0000      Min.   :0.0000      Min.   : 33300
## 1st Qu.: 2501    1st Qu.:0.0000    1st Qu.:0.0000    1st Qu.: 121500
## Median : 5000    Median :1.0000    Median :0.0000    Median : 171000
## Mean   : 5000    Mean   :0.6682    Mean   :0.4053    Mean   : 192739
## 3rd Qu.: 7500    3rd Qu.:1.0000    3rd Qu.:1.0000    3rd Qu.: 225000
## Max.   :10000    Max.   :1.0000    Max.   :4.0000    Max.   :1350000
##  education      marital      housing
##  Min.   :1.000      Min.   :1.000      Min.   :1.000
## 1st Qu.:4.000      1st Qu.:2.000      1st Qu.:2.000
## Median :4.000      Median :2.000      Median :2.000
## Mean   :4.184      Mean   :2.296      Mean   :2.133
## 3rd Qu.:5.000      3rd Qu.:2.000      3rd Qu.:2.000
## Max.   :5.000      Max.   :5.000      Max.   :6.000
```

The histograms of all feature are hence drawn below.

```
par(mfrow=c(2, 3))
hist(gender, main="Gender")
hist(num_child, main="Number of Children")
hist(ann_income, main="Annual Income")
hist(education, main="Education Level")
hist(marital, main="Marital Status")
hist(housing, main="Ways of Living")
```



```
par( )
```

```
## $xlog
## [1] FALSE
##
## $ylog
## [1] FALSE
##
## $adj
## [1] 0.5
##
## $ann
## [1] TRUE
##
## $ask
## [1] FALSE
##
## $bg
## [1] "white"
##
## $bty
## [1] "o"
##
## $cex
## [1] 0.66
##
## $cex.axis
## [1] 1
##
## $cex.lab
## [1] 1
##
## $cex.main
## [1] 1.2
##
## $cex.sub
## [1] 1
##
## $cin
## [1] 0.15 0.20
##
## $col
## [1] "black"
##
## $col.axis
## [1] "black"
##
## $col.lab
## [1] "black"
##
## $col.main
## [1] "black"
##
## $col.sub
```

```
## [1] "black"
##
## $cra
## [1] 28.8 38.4
##
## $crt
## [1] 0
##
## $csi
## [1] 0.132
##
## $cxy
## [1] 0.5346771 1509.6144937
##
## $din
## [1] 6.999999 4.999999
##
## $err
## [1] 0
##
## $family
## [1] ""
##
## $fg
## [1] "black"
##
## $fig
## [1] 0.6666667 1.0000000 0.0000000 0.5000000
##
## $fin
## [1] 2.333333 2.500000
##
## $font
## [1] 1
##
## $font.axis
## [1] 1
##
## $font.lab
## [1] 1
##
## $font.main
## [1] 2
##
## $font.sub
## [1] 1
##
## $lab
## [1] 5 5 7
##
## $las
## [1] 0
```

```
##  
## $lend  
## [1] "round"  
##  
## $lheight  
## [1] 1  
##  
## $ljoin  
## [1] "round"  
##  
## $lmitre  
## [1] 10  
##  
## $lty  
## [1] "solid"  
##  
## $lwd  
## [1] 1  
##  
## $mai  
## [1] 0.6732 0.5412 0.5412 0.2772  
##  
## $mar  
## [1] 5.1 4.1 4.1 2.1  
##  
## $mex  
## [1] 1  
##  
## $mfcol  
## [1] 2 3  
##  
## $mfg  
## [1] 2 3 2 3  
##  
## $mfrow  
## [1] 2 3  
##  
## $mgp  
## [1] 3 1 0  
##  
## $mkh  
## [1] 0.001  
##  
## $new  
## [1] FALSE  
##  
## $oma  
## [1] 0 0 0 0  
##  
## $omd  
## [1] 0 1 0 1  
##
```

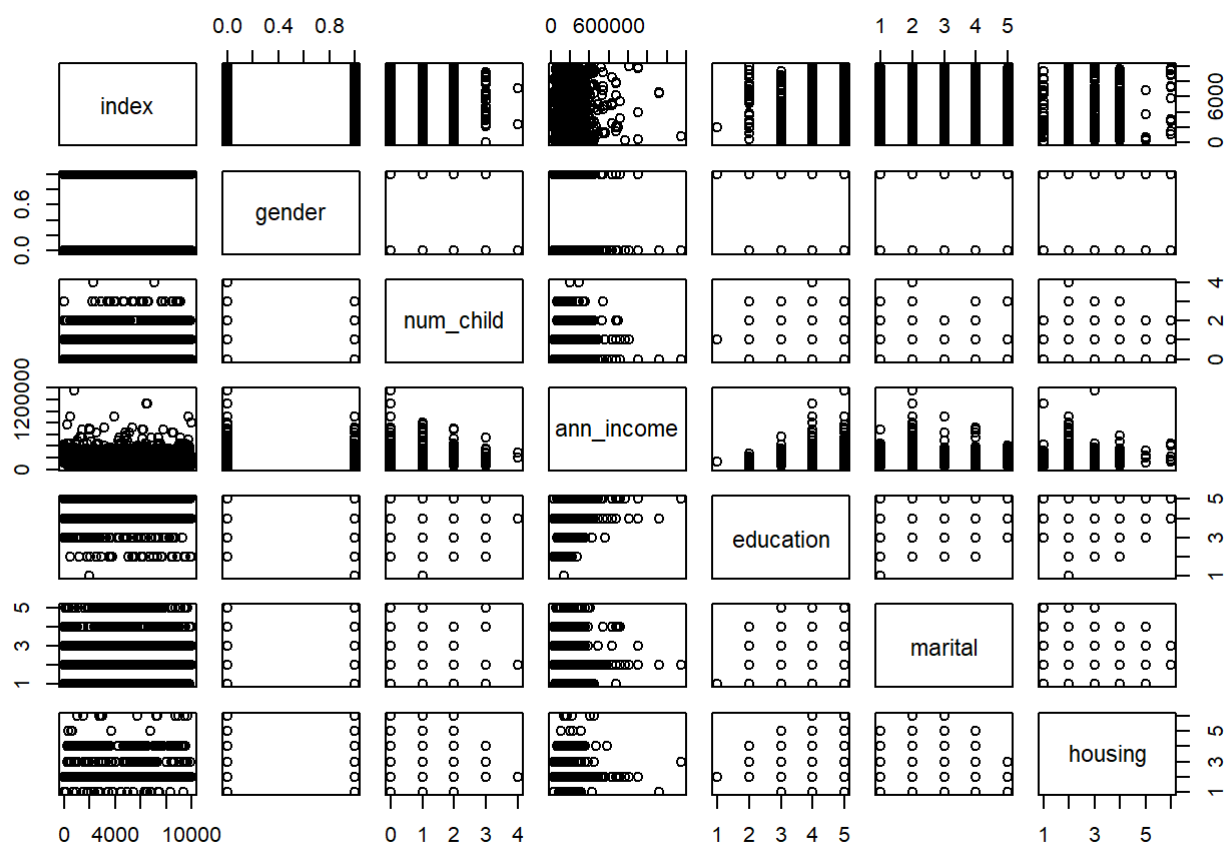


```
## $omi
## [1] 0 0 0 0
##
## $page
## [1] TRUE
##
## $pch
## [1] 1
##
## $pin
## [1] 1.514933 1.285600
##
## $plt
## [1] 0.2319429 0.8812000 0.2692800 0.7835200
##
## $ps
## [1] 12
##
## $pty
## [1] "m"
##
## $smo
## [1] 1
##
## $srt
## [1] 0
##
## $tck
## [1] NA
##
## $tcl
## [1] -0.5
##
## $usr
## [1] 0.8 6.2 -359.4 9344.4
##
## $xaxp
## [1] 1 6 5
##
## $xaxs
## [1] "r"
##
## $xaxt
## [1] "s"
##
## $xpd
## [1] FALSE
##
## $yaxp
## [1] 0 8000 4
##
## $yaxs
```

```
## [1] "r"
##
## $yaxt
## [1] "s"
##
## $ylbias
## [1] 0.2
```

We could also get the matrix of scatterplots related to the "application1.csv", which is shown below.

```
pairs(newdata)
```



1.-Statistical Tests based Approaches:

a) Dixon test (small sample size)

Here we test the first 30 rows of the feature "Annual Income".

```
x<-newdata[1:30,4]
dixon.test(x,type=0,opposite=TRUE)
```

```
##
## Dixon test for outliers
##
## data:  x
## Q = 0, p-value < 2.2e-16
## alternative hypothesis: lowest value 112500 is an outlier
```

Since the data set we use in our project is really large, it is obvious that it would not fit the Dixon test which is for small sample size. We would not use this method for our data set.

b) Normalscore (Deviation with respect to the mean)

```
x<-newdata[,2:7]
#scores(X,type="z",prob=0.95)
#Displaying first 10 scores
scores(x,type="z",prob=0.95)[1:10,]
```

	gender <lgl>	num_child <lgl>	ann_income <lgl>	education <lgl>	marital <lgl>	housing <lgl>
1	FALSE	FALSE	TRUE	FALSE	FALSE	TRUE
2	FALSE	FALSE	TRUE	FALSE	FALSE	TRUE
3	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
4	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
5	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
6	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
7	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
8	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
9	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
10	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
1-10 of 10 rows						

In the first 10 rows, the outliers are the first two values of ann_income, the last three values of marital and the first two values of housing.

c) Median Absolute Deviation (Deviation with respect to the median)

```
x<-newdata[,2:7]
#scores(X,type="mad",prob=0.95)
#Displaying first 10 scores
scores(x,type="mad",prob=0.95)[1:10,]
```

	gender <lgl>	num_child <lgl>	ann_income <lgl>	education <lgl>	marital <lgl>	housing <lgl>

	gender <lgl>	num_child <lgl>	ann_income <lgl>	education <lgl>	marital <lgl>	housing <lgl>
1	TRUE	NA	TRUE	TRUE	TRUE	TRUE
2	TRUE	NA	TRUE	TRUE	TRUE	TRUE
3	TRUE	NA	FALSE	NA	NA	NA
4	NA	NA	FALSE	NA	TRUE	NA
5	NA	NA	FALSE	NA	TRUE	NA
6	NA	NA	FALSE	NA	TRUE	NA
7	NA	NA	FALSE	NA	TRUE	NA
8	NA	NA	FALSE	TRUE	TRUE	NA
9	NA	NA	FALSE	TRUE	TRUE	NA
10	NA	NA	FALSE	TRUE	TRUE	NA
1-10 of 10 rows						

Since there are null values in the test results, we could conclude that the MAD method is not suitable for our data set of credit card approval.

d) Interquantile range score

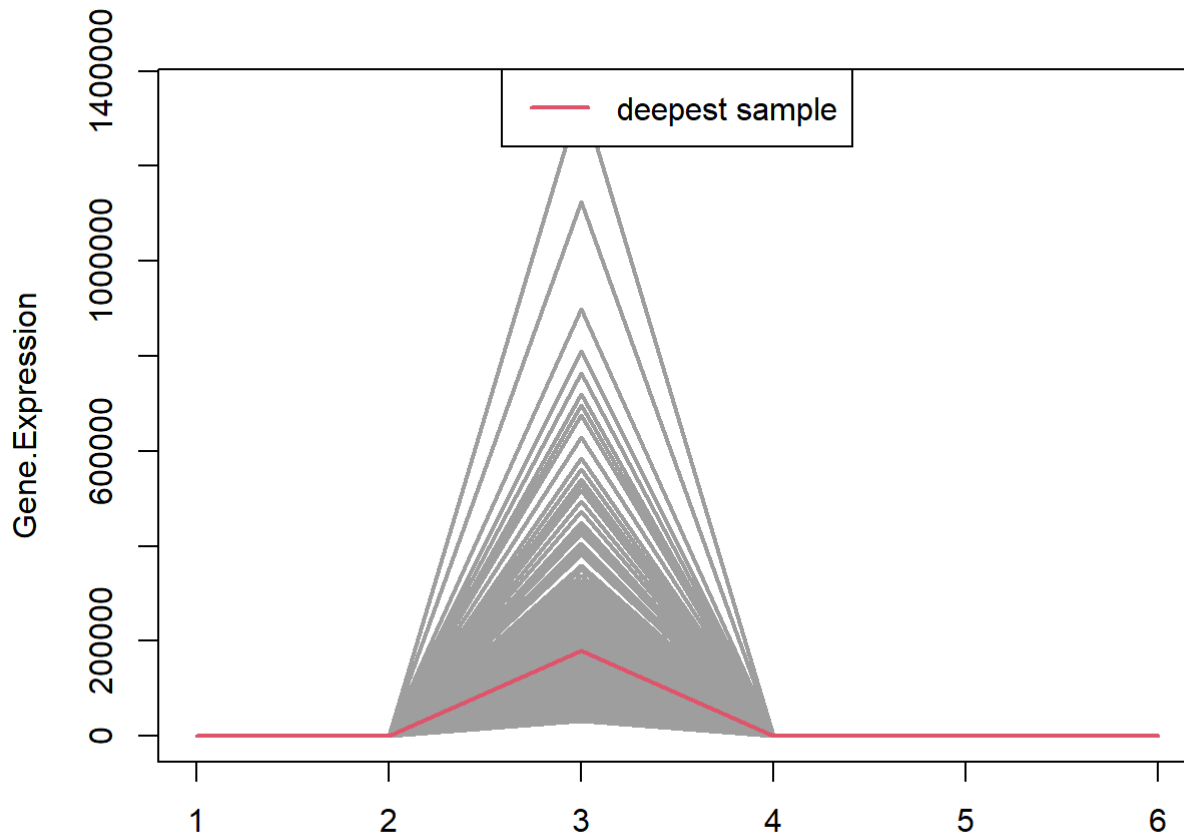
```
x<-newdata[,2:7]
#scores(X,type="iqr",lim=1)
#Displaying first 10 scores
scores(x,type="iqr",lim=1)[1:10,]
```

	gender <lgl>	num_child <lgl>	ann_income <lgl>	education <lgl>	marital <lgl>	housing <lgl>
1	FALSE	FALSE	TRUE	FALSE	TRUE	TRUE
2	FALSE	FALSE	TRUE	FALSE	TRUE	TRUE
3	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
4	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
5	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
6	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
7	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
8	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
9	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
10	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
1-10 of 10 rows						

In the first ten rows, the outliers are: the first two values of ann_income and housing, all values of marital except the ninth value.

2. Depth-based Approach:

```
x<-newdata[,2:7]  
depthout(x,cutoff=0.05)
```



```
## $`Outlier Observations`
```

```
##      gender num_child ann_income education marital housing
## 1         0         0    427500          5         1         1
## 2         0         0    427500          5         1         1
## 78        1         0    247500          5         4         1
## 79        1         0    247500          5         4         1
## 80        1         0    247500          5         4         1
## 81        1         0    247500          5         4         1
## 217       1         0    255150          3         1         1
## 218       1         0    255150          3         1         1
## 219       1         0    255150          3         1         1
## 220       1         0    255150          3         1         1
## 221       1         0    255150          3         1         1
## 222       1         0    255150          3         1         1
## 250       1         0    270000          3         1         3
## 251       1         0    270000          3         1         3
## 252       1         0    270000          3         1         3
## 285       1         0    157500          5         4         4
## 286       1         0    157500          5         4         4
## 287       1         0    157500          5         4         4
## 288       1         0    157500          5         4         4
## 289       1         0    157500          5         4         4
## 290       1         0    157500          5         4         4
## 291       1         0    157500          5         4         4
## 292       1         0    157500          5         4         4
## 293       1         0    157500          5         4         4
## 294       1         0    157500          5         4         4
## 295       1         0    157500          5         4         4
## 296       1         0    157500          5         4         4
## 297       1         0    157500          5         4         4
## 298       1         0    157500          5         4         4
## 299       1         0    157500          5         4         4
## 338       0         0    229500          3         2         5
## 339       0         0    229500          3         2         5
## 340       0         0    229500          3         2         5
## 341       0         0    229500          3         2         5
## 342       0         0    229500          3         2         5
## 343       0         0    229500          3         2         5
## 344       0         0    229500          3         2         5
## 345       0         0    229500          3         2         5
## 394       1         0     74250          5         4         3
## 395       1         0     74250          5         4         3
## 396       1         0     74250          5         4         3
## 415       0         0    337500          5         2         4
## 416       0         0    337500          5         2         4
## 417       0         0    337500          5         2         4
## 418       0         0    337500          5         2         4
## 419       0         0    337500          5         2         4
## 530       1         1     76500          5         1         2
## 531       1         1     76500          5         1         2
## 532       1         1     76500          5         1         2
## 533       1         1     76500          5         1         2
```

## 534	1	1	76500	5	1	2
## 535	1	1	76500	5	1	2
## 555	0	0	108000	4	3	5
## 556	0	0	108000	4	3	5
## 561	0	0	360000	5	2	3
## 562	0	0	360000	5	2	3
## 642	0	1	112500	4	4	5
## 643	0	1	112500	4	4	5
## 793	0	0	1350000	5	2	3
## 794	0	0	1350000	5	2	3
## 795	0	0	1350000	5	2	3
## 796	0	0	1350000	5	2	3
## 797	0	0	1350000	5	2	3
## 798	0	0	1350000	5	2	3
## 799	0	0	1350000	5	2	3
## 864	0	2	445500	5	2	3
## 865	0	2	445500	5	2	3
## 929	0	0	360000	4	4	4
## 930	0	0	360000	4	4	4
## 931	0	0	360000	4	4	4
## 932	0	0	360000	4	4	4
## 933	0	0	360000	4	4	4
## 934	0	0	360000	4	4	4
## 935	0	0	360000	4	4	4
## 936	0	0	360000	4	4	4
## 937	0	0	360000	4	4	4
## 938	0	0	360000	4	4	4
## 939	0	0	225000	5	1	1
## 940	0	0	225000	5	1	1
## 941	0	0	225000	5	1	1
## 942	0	0	225000	5	1	1
## 943	0	0	225000	5	1	1
## 1059	1	1	112500	3	1	2
## 1060	1	1	112500	3	1	2
## 1061	1	1	112500	3	1	2
## 1062	1	1	112500	3	1	2
## 1063	1	1	112500	3	1	2
## 1064	1	1	112500	3	1	2
## 1065	1	1	112500	3	1	2
## 1072	1	0	99000	5	3	4
## 1073	1	0	99000	5	3	4
## 1133	1	0	112500	3	3	4
## 1228	0	0	135000	2	2	4
## 1229	0	0	135000	2	2	4
## 1230	0	0	135000	2	2	4
## 1231	0	0	135000	2	2	4
## 1232	0	0	135000	2	2	4
## 1233	0	0	135000	2	2	4
## 1234	0	0	135000	2	2	4
## 1235	0	0	135000	2	2	4
## 1236	0	0	135000	2	2	4
## 1237	0	0	135000	2	2	4

## 1277	0	1	562500	3	2	2
## 1278	0	1	562500	3	2	2
## 1279	0	1	562500	3	2	2
## 1280	0	1	562500	3	2	2
## 1281	0	1	562500	3	2	2
## 1282	0	1	562500	3	2	2
## 1283	0	1	562500	3	2	2
## 1284	0	1	562500	3	2	2
## 1285	0	1	562500	3	2	2
## 1286	0	1	562500	3	2	2
## 1287	0	1	562500	3	2	2
## 1288	0	1	562500	3	2	2
## 1289	0	1	562500	3	2	2
## 1290	0	1	562500	3	2	2
## 1291	0	1	562500	3	2	2
## 1292	0	1	562500	3	2	2
## 1293	0	1	562500	3	2	2
## 1294	0	1	562500	3	2	2
## 1295	0	1	562500	3	2	2
## 1296	0	1	562500	3	2	2
## 1297	0	1	562500	3	2	2
## 1298	0	1	562500	3	2	2
## 1299	0	1	562500	3	2	2
## 1300	0	1	562500	3	2	2
## 1368	0	1	180000	3	2	4
## 1369	0	1	180000	3	2	4
## 1503	1	1	90000	4	4	1
## 1516	0	1	450000	5	2	6
## 1517	0	1	450000	5	2	6
## 1518	0	1	450000	5	2	6
## 1519	0	1	450000	5	2	6
## 1520	0	1	450000	5	2	6
## 1521	0	1	450000	5	2	6
## 1522	0	1	450000	5	2	6
## 1523	0	1	450000	5	2	6
## 1524	0	1	450000	5	2	6
## 1525	0	1	450000	5	2	6
## 1526	0	1	450000	5	2	6
## 1527	0	1	450000	5	2	6
## 1528	0	1	450000	5	2	6
## 1529	0	1	450000	5	2	6
## 1677	0	0	202500	3	1	4
## 1678	0	0	202500	3	1	4
## 1679	0	0	202500	3	1	4
## 1680	0	0	202500	3	1	4
## 1868	1	0	94500	4	5	1
## 1869	1	0	94500	4	5	1
## 1928	1	0	121500	5	3	1
## 1929	1	0	121500	5	3	1
## 1930	1	0	121500	5	3	1
## 1958	0	2	99000	4	2	4
## 1959	0	2	99000	4	2	4

## 1960	0	2	99000	4	2	4
## 1961	0	2	99000	4	2	4
## 1962	0	2	99000	4	2	4
## 1963	0	2	99000	4	2	4
## 1964	0	2	99000	4	2	4
## 1967	1	1	135000	1	1	2
## 1968	1	1	135000	1	1	2
## 1969	1	1	135000	1	1	2
## 1982	0	2	697500	5	4	2
## 1983	0	2	697500	5	4	2
## 2099	1	2	112500	5	1	2
## 2100	1	2	112500	5	1	2
## 2131	1	0	135000	3	3	1
## 2132	1	0	135000	3	3	1
## 2162	0	1	472500	5	2	4
## 2210	1	2	67500	3	2	4
## 2211	1	2	67500	3	2	4
## 2212	1	2	67500	3	2	4
## 2213	1	2	67500	3	2	4
## 2500	0	2	337500	3	2	2
## 2501	0	2	337500	3	2	2
## 2502	0	2	337500	3	2	2
## 2633	1	1	135000	4	1	4
## 2634	1	1	135000	4	1	4
## 2635	1	1	135000	4	1	4
## 2636	1	1	135000	4	1	4
## 2637	1	1	135000	4	1	4
## 2638	1	1	135000	4	1	4
## 2639	1	1	135000	4	1	4
## 2640	1	1	135000	4	1	4
## 2641	1	1	135000	4	1	4
## 2644	1	1	315000	5	5	2
## 2645	1	1	315000	5	5	2
## 2646	1	1	315000	5	5	2
## 2647	1	1	315000	5	5	2
## 2648	1	1	315000	5	5	2
## 2649	1	1	315000	5	5	2
## 2650	1	1	315000	5	5	2
## 2651	1	1	315000	5	5	2
## 2652	1	1	315000	5	5	2
## 2653	1	1	315000	5	5	2
## 2654	1	1	315000	5	5	2
## 2655	1	1	315000	5	5	2
## 2656	1	1	315000	5	5	2
## 2954	1	0	315000	5	4	4
## 2955	1	0	315000	5	4	4
## 3429	0	1	216000	5	5	2
## 3430	0	1	216000	5	5	2
## 3431	0	1	216000	5	5	2
## 3432	0	1	216000	5	5	2
## 3583	0	0	135000	3	3	4
## 3584	0	0	135000	3	3	4

## 3652	0	0	112500	4	1	4
## 3677	1	2	202500	4	1	5
## 3678	1	2	202500	4	1	5
## 3825	0	2	225000	4	2	1
## 3826	0	2	225000	4	2	1
## 3827	0	2	225000	4	2	1
## 3828	0	2	225000	4	2	1
## 3829	0	2	225000	4	2	1
## 3830	0	2	225000	4	2	1
## 3831	0	2	225000	4	2	1
## 3832	0	2	225000	4	2	1
## 3833	0	2	225000	4	2	1
## 3834	0	2	225000	4	2	1
## 4041	1	1	63000	4	3	3
## 4042	1	1	63000	4	3	3
## 4043	1	1	63000	4	3	3
## 4044	1	1	63000	4	3	3
## 4045	1	1	63000	4	3	3
## 4046	1	1	63000	4	3	3
## 4047	1	1	63000	4	3	3
## 4807	1	1	148500	4	4	4
## 5064	1	2	157500	2	1	2
## 5288	0	1	112500	4	4	4
## 5289	0	1	112500	4	4	4
## 5290	0	1	112500	4	4	4
## 5291	0	1	112500	4	4	4
## 5292	0	1	112500	4	4	4
## 5293	0	1	112500	4	4	4
## 5294	0	1	112500	4	4	4
## 5295	0	1	112500	4	4	4
## 5313	0	1	112500	3	2	4
## 5314	0	1	112500	3	2	4
## 5315	0	1	112500	3	2	4
## 5465	1	1	225000	4	1	3
## 5466	1	1	225000	4	1	3
## 5467	1	1	225000	4	1	3
## 5468	1	1	225000	4	1	3
## 5469	1	1	225000	4	1	3
## 5470	1	1	225000	4	1	3
## 5471	1	1	225000	4	1	3
## 5472	1	1	225000	4	1	3
## 5784	0	0	360000	3	3	3
## 5785	0	0	360000	3	3	3
## 5786	0	0	360000	3	3	3
## 5857	0	1	405000	5	1	2
## 5858	0	1	405000	5	1	2
## 5859	0	1	405000	5	1	2
## 5860	0	1	405000	5	1	2
## 6031	1	0	135000	3	3	3
## 6032	1	0	135000	3	3	3
## 6033	1	0	135000	3	3	3
## 6034	1	0	135000	3	3	3

## 6112	0	1	360000	5	1	2
## 6113	0	1	360000	5	1	2
## 6114	0	1	360000	5	1	2
## 6115	0	1	360000	5	1	2
## 6116	0	1	360000	5	1	2
## 6117	0	1	360000	5	1	2
## 6118	0	1	360000	5	1	2
## 6119	0	1	360000	5	1	2
## 6120	0	1	360000	5	1	2
## 6121	0	1	360000	5	1	2
## 6122	0	1	360000	5	1	2
## 6123	0	1	360000	5	1	2
## 6124	0	1	360000	5	1	2
## 6125	0	2	531000	5	2	2
## 6126	0	2	531000	5	2	2
## 6127	0	2	531000	5	2	2
## 6128	0	2	531000	5	2	2
## 6129	0	2	531000	5	2	2
## 6130	0	2	531000	5	2	2
## 6131	0	2	531000	5	2	2
## 6132	0	2	531000	5	2	2
## 6221	0	0	135000	5	3	4
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## 6240	0	3	90000	2	4	4
## 6241	0	3	90000	2	4	4
## 6249	0	0	315000	4	3	3
## 6250	0	0	315000	4	3	3
## 6251	0	0	315000	4	3	3
## 6252	0	0	315000	4	3	3
## 6253	0	0	315000	4	3	3
## 6275	0	2	270000	3	2	2
## 6276	0	2	270000	3	2	2
## 6319	0	1	202500	3	2	1
## 6320	0	1	202500	3	2	1
## 6321	0	1	202500	3	2	1
## 6322	0	1	202500	3	2	1
## 6423	0	0	270000	3	2	3
## 6424	0	0	270000	3	2	3
## 6425	0	0	270000	3	2	3
## 6426	0	0	270000	3	2	3
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## 6429	0	0	270000	3	2	3
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## 6443	1	0	135000	3	3	3
## 6444	1	0	135000	3	3	3
## 6445	1	0	135000	3	3	3
## 6471	1	1	112500	4	1	4
## 6540	0	3	225000	4	2	3

## 6541	0	3	225000	4	2	3
## 6571	0	1	283500	5	2	3
## 6572	0	1	283500	5	2	3
## 6573	0	1	283500	5	2	3
## 6574	0	1	283500	5	2	3
## 6575	0	1	283500	5	2	3
## 6610	1	0	36000	4	4	3
## 6639	0	1	360000	4	3	3
## 6640	0	1	360000	4	3	3
## 6641	0	1	360000	4	3	3
## 6642	0	1	360000	4	3	3
## 6780	0	1	315000	5	2	5
## 6781	0	1	315000	5	2	5
## 6782	0	1	315000	5	2	5
## 7009	0	1	202500	2	3	2
## 7010	0	1	202500	2	3	2
## 7011	0	1	202500	2	3	2
## 7082	0	2	247500	4	2	4
## 7083	0	2	247500	4	2	4
## 7084	0	2	247500	4	2	4
## 7085	0	2	247500	4	2	4
## 7086	0	2	247500	4	2	4
## 7138	1	1	157500	3	2	4
## 7139	1	1	157500	3	2	4
## 7140	1	1	157500	3	2	4
## 7141	1	1	157500	3	2	4
## 7142	1	1	157500	3	2	4
## 7143	1	1	157500	3	2	4
## 7144	1	1	157500	3	2	4
## 7145	1	1	157500	3	2	4
## 7146	1	1	157500	3	2	4
## 7147	1	1	157500	3	2	4
## 7148	1	1	157500	3	2	4
## 7186	1	1	225000	5	3	4
## 7187	1	1	225000	5	3	4
## 7188	1	1	225000	5	3	4
## 7189	1	1	225000	5	3	4
## 7190	1	1	225000	5	3	4
## 7191	1	1	225000	5	3	4
## 7192	1	1	225000	5	3	4
## 7193	1	1	225000	5	3	4
## 7225	0	0	337500	4	3	4
## 7226	0	0	337500	4	3	4
## 7227	0	0	337500	4	3	4
## 7228	0	0	337500	4	3	4
## 7229	0	0	337500	4	3	4
## 7230	0	0	337500	4	3	4
## 7231	0	0	337500	4	3	4
## 7232	0	0	337500	4	3	4
## 7233	0	0	337500	4	3	4
## 7234	0	0	337500	4	3	4
## 7302	0	0	225000	2	2	3

## 7303	0	0	225000	2	2	3
## 7304	0	0	225000	2	2	3
## 7305	0	0	225000	2	2	3
## 7306	0	0	225000	2	2	3
## 7307	0	0	225000	2	2	3
## 7367	0	0	99000	3	1	1
## 7368	0	0	99000	3	1	1
## 7369	0	0	99000	3	1	1
## 7418	0	0	225000	5	3	4
## 7419	0	0	225000	5	3	4
## 7420	0	0	225000	5	3	4
## 7421	0	0	225000	5	3	4
## 7422	0	0	225000	5	3	4
## 7423	0	0	225000	5	3	4
## 7424	0	0	225000	5	3	4
## 7425	0	0	225000	5	3	4
## 7483	0	1	270000	5	2	1
## 7484	0	1	270000	5	2	1
## 7485	0	1	270000	5	2	1
## 7486	0	1	270000	5	2	1
## 7639	0	3	126000	4	1	4
## 7640	0	3	126000	4	1	4
## 7641	0	3	126000	4	1	4
## 7642	0	3	126000	4	1	4
## 7643	0	3	126000	4	1	4
## 7644	0	3	126000	4	1	4
## 7645	0	3	126000	4	1	4
## 7646	0	3	126000	4	1	4
## 7647	0	3	126000	4	1	4
## 7648	0	3	126000	4	1	4
## 7656	0	0	270000	2	4	2
## 7657	0	0	270000	2	4	2
## 7658	0	0	270000	2	4	2
## 7659	0	0	270000	2	4	2
## 7660	0	0	270000	2	4	2
## 7661	0	0	270000	2	4	2
## 7662	0	0	270000	2	4	2
## 7663	0	0	270000	2	4	2
## 7664	0	0	270000	2	4	2
## 7665	0	0	270000	2	4	2
## 7666	0	0	270000	2	4	2
## 7667	0	0	270000	2	4	2
## 7668	0	0	270000	2	4	2
## 7669	0	0	270000	2	4	2
## 7743	1	2	81000	2	3	2
## 7744	1	2	81000	2	3	2
## 7745	1	2	81000	2	3	2
## 7793	0	2	675000	5	2	2
## 7794	0	2	675000	5	2	2
## 7795	0	2	675000	5	2	2
## 7796	0	2	675000	5	2	2
## 7797	0	2	675000	5	2	2

## 7798	0	2	675000	5	2	2
## 7799	0	2	675000	5	2	2
## 7800	0	2	675000	5	2	2
## 7801	0	2	675000	5	2	2
## 7802	0	2	675000	5	2	2
## 7803	0	2	675000	5	2	2
## 7804	0	2	675000	5	2	2
## 8315	0	0	135000	5	3	4
## 8316	0	0	135000	5	3	4
## 8317	0	0	135000	5	3	4
## 8318	0	0	135000	5	3	4
## 8425	0	1	225000	5	2	3
## 8426	0	1	225000	5	2	3
## 8606	0	0	202500	3	3	4
## 8661	0	1	238500	5	2	4
## 8662	0	1	238500	5	2	4
## 8663	0	1	238500	5	2	4
## 8664	0	1	238500	5	2	4
## 8665	0	1	238500	5	2	4
## 8666	0	1	238500	5	2	4
## 8667	0	1	238500	5	2	4
## 8668	0	1	238500	5	2	4
## 8669	0	1	238500	5	2	4
## 8670	0	1	238500	5	2	4
## 8671	0	1	238500	5	2	4
## 8706	1	0	315000	3	3	4
## 8707	1	0	315000	3	3	4
## 8708	1	0	315000	3	3	4
## 8709	1	0	315000	3	3	4
## 8710	1	0	315000	3	3	4
## 8711	1	0	315000	3	3	4
## 8712	1	0	315000	3	3	4
## 8713	1	0	315000	3	3	4
## 8714	1	0	315000	3	3	4
## 8715	1	0	315000	3	3	4
## 8716	1	0	315000	3	3	4
## 8735	1	1	270000	4	4	4
## 8736	1	1	270000	4	4	4
## 8737	1	1	270000	4	4	4
## 8738	1	1	270000	4	4	4
## 8739	1	1	270000	4	4	4
## 8969	0	0	405000	5	2	6
## 8970	0	0	405000	5	2	6
## 8971	0	0	405000	5	2	6
## 8972	0	0	405000	5	2	6
## 8975	0	1	202500	5	2	4
## 8976	0	1	202500	5	2	4
## 8977	0	1	202500	5	2	4
## 8978	0	1	202500	5	2	4
## 9310	1	2	270000	5	4	4
## 9311	1	2	270000	5	4	4
## 9312	1	2	270000	5	4	4

```

## 9313      1      2      270000      5      4      4
## 9314      1      2      270000      5      4      4
## 9315      1      2      270000      5      4      4
## 9316      1      2      270000      5      4      4
## 9317      1      2      270000      5      4      4
## 9318      1      2      270000      5      4      4
## 9319      1      2      270000      5      4      4
## 9320      1      2      270000      5      4      4
## 9321      1      2      270000      5      4      4
## 9478      0      0      90000      5      3      4
## 9479      1      1      157500      2      1      2
## 9480      1      1      157500      2      1      2
## 9481      1      1      157500      2      1      2
## 9482      1      1      157500      2      1      2
## 9483      1      1      157500      2      1      2
## 9504      1      1      202500      5      1      4
## 9505      1      1      202500      5      1      4
## 9506      1      1      202500      5      1      4
## 9507      1      1      202500      5      1      4
## 9508      1      1      202500      5      1      4
## 9509      1      1      202500      5      1      4
## 9510      1      1      202500      5      1      4
## 9562      1      1      405000      5      5      2
## 9563      1      1      405000      5      5      2
## 9564      1      1      405000      5      5      2
## 9663      0      2      405000      4      2      6
## 9664      0      2      405000      4      2      6
## 9885      0      2      90000      4      2      3
##
## $`Location of Outlier`
## [1]      1      2      78      79      80      81      217      218      219      220      221      222      250      251      252
## [16]      285      286      287      288      289      290      291      292      293      294      295      296      297      298      299
## [31]      338      339      340      341      342      343      344      345      394      395      396      415      416      417      418
## [46]      419      530      531      532      533      534      535      555      556      561      562      642      643      793      794
## [61]      795      796      797      798      799      864      865      929      930      931      932      933      934      935      936
## [76]      937      938      939      940      941      942      943      1059      1060      1061      1062      1063      1064      1065      1072
## [91]     1073     1133     1228     1229     1230     1231     1232     1233     1234     1235     1236     1237     1277     1278     1279
## [106]     1280     1281     1282     1283     1284     1285     1286     1287     1288     1289     1290     1291     1292     1293     1294
## [121]     1295     1296     1297     1298     1299     1300     1368     1369     1503     1516     1517     1518     1519     1520     1521
## [136]     1522     1523     1524     1525     1526     1527     1528     1529     1677     1678     1679     1680     1868     1869     1928
## [151]     1929     1930     1958     1959     1960     1961     1962     1963     1964     1967     1968     1969     1982     1983     2099
## [166]     2100     2131     2132     2162     2210     2211     2212     2213     2500     2501     2502     2633     2634     2635     2636
## [181]     2637     2638     2639     2640     2641     2644     2645     2646     2647     2648     2649     2650     2651     2652     2653
## [196]     2654     2655     2656     2954     2955     3429     3430     3431     3432     3583     3584     3652     3677     3678     3825
## [211]     3826     3827     3828     3829     3830     3831     3832     3833     3834     4041     4042     4043     4044     4045     4046
## [226]     4047     4807     5064     5288     5289     5290     5291     5292     5293     5294     5295     5313     5314     5315     5465
## [241]     5466     5467     5468     5469     5470     5471     5472     5784     5785     5786     5857     5858     5859     5860     6031
## [256]     6032     6033     6034     6112     6113     6114     6115     6116     6117     6118     6119     6120     6121     6122     6123
## [271]     6124     6125     6126     6127     6128     6129     6130     6131     6132     6221     6222     6223     6238     6239     6240
## [286]     6241     6249     6250     6251     6252     6253     6275     6276     6319     6320     6321     6322     6423     6424     6425
## [301]     6426     6427     6428     6429     6442     6443     6444     6445     6471     6540     6541     6571     6572     6573     6574
## [316]     6575     6610     6639     6640     6641     6642     6780     6781     6782     7009     7010     7011     7082     7083     7084

```

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## [331] 7085 7086 7138 7139 7140 7141 7142 7143 7144 7145 7146 7147 7148 7186 7187
## [346] 7188 7189 7190 7191 7192 7193 7225 7226 7227 7228 7229 7230 7231 7232 7233
## [361] 7234 7302 7303 7304 7305 7306 7307 7367 7368 7369 7418 7419 7420 7421 7422
## [376] 7423 7424 7425 7483 7484 7485 7486 7639 7640 7641 7642 7643 7644 7645 7646
## [391] 7647 7648 7656 7657 7658 7659 7660 7661 7662 7663 7664 7665 7666 7667 7668
## [406] 7669 7743 7744 7745 7793 7794 7795 7796 7797 7798 7799 7800 7801 7802 7803
## [421] 7804 8315 8316 8317 8318 8425 8426 8606 8661 8662 8663 8664 8665 8666 8667
## [436] 8668 8669 8670 8671 8706 8707 8708 8709 8710 8711 8712 8713 8714 8715 8716
## [451] 8735 8736 8737 8738 8739 8969 8970 8971 8972 8975 8976 8977 8978 9310 9311
## [466] 9312 9313 9314 9315 9316 9317 9318 9319 9320 9321 9478 9479 9480 9481 9482
## [481] 9483 9504 9505 9506 9507 9508 9509 9510 9562 9563 9564 9663 9664 9885
##
## $`Outlier Probability`
## [1] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [16] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [31] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [46] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.75 0.75 1.00 1.00 1.00
## [61] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [76] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [91] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.95 0.95
## [106] 0.95 0.95 0.95 0.95 0.95 0.95 0.95 0.95 0.95 0.95 0.95 0.95 0.95 0.95 0.95
## [121] 0.95 0.95 0.95 0.95 0.95 0.95 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [136] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [151] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [166] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [181] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [196] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [211] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [226] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [241] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [256] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [271] 1.00 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.59 1.00 1.00 1.00 1.00 1.00
## [286] 1.00 0.70 0.70 0.70 0.70 0.70 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [301] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [316] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [331] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [346] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [361] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [376] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [391] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [406] 1.00 1.00 1.00 1.00 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76
## [421] 0.76 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [436] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [451] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [466] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.91 0.91 0.91
## [481] 0.91 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00

```

With the threshold as 0.05, there are 493 outliers.

3. Deviation-based Approaches

4. Distance-based Approaches

a) Outlier detection using Mahalanobis Distance

```
x<-newdata[,2:7]  
maha(x,cutoff=0.9)
```

```
## $`Outlier Observations`
```

```
##      gender num_child ann_income education marital housing
## 1         0         0    427500          5         1         1
## 2         0         0    427500          5         1         1
## 28        0         3    270000          4         2         2
## 29        0         3    270000          4         2         2
## 77        1         0    315000          4         5         2
## 217       1         0    255150          3         1         1
## 218       1         0    255150          3         1         1
## 219       1         0    255150          3         1         1
## 220       1         0    255150          3         1         1
## 221       1         0    255150          3         1         1
## 222       1         0    255150          3         1         1
## 250       1         0    270000          3         1         3
## 251       1         0    270000          3         1         3
## 252       1         0    270000          3         1         3
## 255       0         1    180000          4         2         4
## 268       0         1    765000          5         2         2
## 269       0         1    765000          5         2         2
## 270       0         1    765000          5         2         2
## 271       0         1    765000          5         2         2
## 277       0         2    157500          4         2         4
## 278       0         2    157500          4         2         4
## 279       0         2    157500          4         2         4
## 280       0         2    157500          4         2         4
## 281       0         2    157500          4         2         4
## 285       1         0    157500          5         4         4
## 286       1         0    157500          5         4         4
## 287       1         0    157500          5         4         4
## 288       1         0    157500          5         4         4
## 289       1         0    157500          5         4         4
## 290       1         0    157500          5         4         4
## 291       1         0    157500          5         4         4
## 292       1         0    157500          5         4         4
## 293       1         0    157500          5         4         4
## 294       1         0    157500          5         4         4
## 295       1         0    157500          5         4         4
## 296       1         0    157500          5         4         4
## 297       1         0    157500          5         4         4
## 298       1         0    157500          5         4         4
## 299       1         0    157500          5         4         4
## 300       0         0    382500          4         5         2
## 301       0         0    382500          4         5         2
## 302       0         0    382500          4         5         2
## 303       0         0    382500          4         5         2
## 304       0         0    382500          4         5         2
## 305       0         0    382500          4         5         2
## 306       0         0    382500          4         5         2
## 307       0         0    382500          4         5         2
## 338       0         0    229500          3         2         5
## 339       0         0    229500          3         2         5
## 340       0         0    229500          3         2         5
```

## 341	0	0	229500	3	2	5
## 342	0	0	229500	3	2	5
## 343	0	0	229500	3	2	5
## 344	0	0	229500	3	2	5
## 345	0	0	229500	3	2	5
## 389	0	0	157500	3	2	4
## 390	0	0	157500	3	2	4
## 391	0	0	157500	3	2	4
## 392	0	0	157500	3	2	4
## 393	0	0	157500	3	2	4
## 394	1	0	74250	5	4	3
## 395	1	0	74250	5	4	3
## 396	1	0	74250	5	4	3
## 409	1	0	202500	5	2	4
## 410	1	0	202500	5	2	4
## 411	1	0	202500	5	2	4
## 412	1	0	202500	5	2	4
## 413	1	0	202500	5	2	4
## 415	0	0	337500	5	2	4
## 416	0	0	337500	5	2	4
## 417	0	0	337500	5	2	4
## 418	0	0	337500	5	2	4
## 419	0	0	337500	5	2	4
## 487	0	0	180000	2	2	2
## 488	0	0	180000	2	2	2
## 489	0	0	180000	2	2	2
## 490	0	0	180000	2	2	2
## 493	1	0	900000	5	3	2
## 494	1	0	900000	5	3	2
## 555	0	0	108000	4	3	5
## 556	0	0	108000	4	3	5
## 559	0	0	198000	4	3	4
## 560	0	0	198000	4	3	4
## 577	0	0	81000	4	2	4
## 578	0	0	81000	4	2	4
## 579	0	0	81000	4	2	4
## 638	0	2	180000	3	2	2
## 639	0	2	180000	3	2	2
## 640	0	2	180000	3	2	2
## 641	0	2	180000	3	2	2
## 642	0	1	112500	4	4	5
## 643	0	1	112500	4	4	5
## 746	0	0	202500	4	3	4
## 747	0	0	202500	4	3	4
## 773	1	0	90000	4	5	2
## 774	1	0	90000	4	5	2
## 775	1	0	90000	4	5	2
## 776	1	0	90000	4	5	2
## 777	1	0	90000	4	5	2
## 778	1	0	90000	4	5	2
## 779	1	0	90000	4	5	2
## 780	1	0	90000	4	5	2

## 781	1	0	90000	4	5	2
## 782	1	0	90000	4	5	2
## 783	1	0	90000	4	5	2
## 784	1	0	90000	4	5	2
## 785	1	0	90000	4	5	2
## 786	1	0	90000	4	5	2
## 787	1	0	90000	4	5	2
## 793	0	0	1350000	5	2	3
## 794	0	0	1350000	5	2	3
## 795	0	0	1350000	5	2	3
## 796	0	0	1350000	5	2	3
## 797	0	0	1350000	5	2	3
## 798	0	0	1350000	5	2	3
## 799	0	0	1350000	5	2	3
## 809	1	0	135000	4	1	4
## 810	1	0	135000	4	1	4
## 864	0	2	445500	5	2	3
## 865	0	2	445500	5	2	3
## 911	0	0	166500	5	2	4
## 912	0	0	166500	5	2	4
## 913	0	0	166500	5	2	4
## 914	0	0	166500	5	2	4
## 915	0	0	166500	5	2	4
## 916	0	0	166500	5	2	4
## 917	0	0	166500	5	2	4
## 929	0	0	360000	4	4	4
## 930	0	0	360000	4	4	4
## 931	0	0	360000	4	4	4
## 932	0	0	360000	4	4	4
## 933	0	0	360000	4	4	4
## 934	0	0	360000	4	4	4
## 935	0	0	360000	4	4	4
## 936	0	0	360000	4	4	4
## 937	0	0	360000	4	4	4
## 938	0	0	360000	4	4	4
## 939	0	0	225000	5	1	1
## 940	0	0	225000	5	1	1
## 941	0	0	225000	5	1	1
## 942	0	0	225000	5	1	1
## 943	0	0	225000	5	1	1
## 944	0	2	427500	5	2	2
## 945	0	2	427500	5	2	2
## 946	0	2	427500	5	2	2
## 947	0	2	427500	5	2	2
## 948	0	2	427500	5	2	2
## 1039	0	0	495000	5	3	2
## 1040	0	0	495000	5	3	2
## 1041	0	0	495000	5	3	2
## 1042	0	2	157500	4	2	6
## 1043	0	2	157500	4	2	6
## 1072	1	0	99000	5	3	4
## 1073	1	0	99000	5	3	4

## 1115	1	0	360000	4	5	2
## 1116	1	0	360000	4	5	2
## 1133	1	0	112500	3	3	4
## 1151	1	0	202500	5	5	2
## 1152	1	0	202500	5	5	2
## 1153	1	0	202500	5	5	2
## 1154	1	0	202500	5	5	2
## 1155	1	0	202500	5	5	2
## 1193	0	0	202500	2	2	2
## 1194	0	0	202500	2	2	2
## 1228	0	0	135000	2	2	4
## 1229	0	0	135000	2	2	4
## 1230	0	0	135000	2	2	4
## 1231	0	0	135000	2	2	4
## 1232	0	0	135000	2	2	4
## 1233	0	0	135000	2	2	4
## 1234	0	0	135000	2	2	4
## 1235	0	0	135000	2	2	4
## 1236	0	0	135000	2	2	4
## 1237	0	0	135000	2	2	4
## 1277	0	1	562500	3	2	2
## 1278	0	1	562500	3	2	2
## 1279	0	1	562500	3	2	2
## 1280	0	1	562500	3	2	2
## 1281	0	1	562500	3	2	2
## 1282	0	1	562500	3	2	2
## 1283	0	1	562500	3	2	2
## 1284	0	1	562500	3	2	2
## 1285	0	1	562500	3	2	2
## 1286	0	1	562500	3	2	2
## 1287	0	1	562500	3	2	2
## 1288	0	1	562500	3	2	2
## 1289	0	1	562500	3	2	2
## 1290	0	1	562500	3	2	2
## 1291	0	1	562500	3	2	2
## 1292	0	1	562500	3	2	2
## 1293	0	1	562500	3	2	2
## 1294	0	1	562500	3	2	2
## 1295	0	1	562500	3	2	2
## 1296	0	1	562500	3	2	2
## 1297	0	1	562500	3	2	2
## 1298	0	1	562500	3	2	2
## 1299	0	1	562500	3	2	2
## 1300	0	1	562500	3	2	2
## 1367	1	0	126000	4	3	4
## 1368	0	1	180000	3	2	4
## 1369	0	1	180000	3	2	4
## 1374	1	2	67500	4	4	2
## 1399	1	0	540000	5	2	2
## 1400	1	0	540000	5	2	2
## 1401	1	0	540000	5	2	2
## 1402	1	0	540000	5	2	2

## 1403	1	0	540000	5	2	2
## 1404	1	0	540000	5	2	2
## 1405	1	0	540000	5	2	2
## 1406	1	0	540000	5	2	2
## 1407	1	0	540000	5	2	2
## 1476	0	0	675000	5	2	2
## 1477	0	0	675000	5	2	2
## 1478	0	0	675000	5	2	2
## 1479	0	0	675000	5	2	2
## 1516	0	1	450000	5	2	6
## 1517	0	1	450000	5	2	6
## 1518	0	1	450000	5	2	6
## 1519	0	1	450000	5	2	6
## 1520	0	1	450000	5	2	6
## 1521	0	1	450000	5	2	6
## 1522	0	1	450000	5	2	6
## 1523	0	1	450000	5	2	6
## 1524	0	1	450000	5	2	6
## 1525	0	1	450000	5	2	6
## 1526	0	1	450000	5	2	6
## 1527	0	1	450000	5	2	6
## 1528	0	1	450000	5	2	6
## 1529	0	1	450000	5	2	6
## 1596	1	0	65250	4	5	2
## 1597	1	0	65250	4	5	2
## 1598	1	0	65250	4	5	2
## 1599	1	0	65250	4	5	2
## 1600	1	0	65250	4	5	2
## 1601	1	0	65250	4	5	2
## 1602	1	0	65250	4	5	2
## 1677	0	0	202500	3	1	4
## 1678	0	0	202500	3	1	4
## 1679	0	0	202500	3	1	4
## 1680	0	0	202500	3	1	4
## 1744	1	0	135000	5	2	4
## 1745	1	0	135000	5	2	4
## 1746	1	0	135000	5	2	4
## 1811	1	0	54000	2	2	2
## 1812	1	0	54000	2	2	2
## 1868	1	0	94500	4	5	1
## 1869	1	0	94500	4	5	1
## 1958	0	2	99000	4	2	4
## 1959	0	2	99000	4	2	4
## 1960	0	2	99000	4	2	4
## 1961	0	2	99000	4	2	4
## 1962	0	2	99000	4	2	4
## 1963	0	2	99000	4	2	4
## 1964	0	2	99000	4	2	4
## 1967	1	1	135000	1	1	2
## 1968	1	1	135000	1	1	2
## 1969	1	1	135000	1	1	2
## 1982	0	2	697500	5	4	2

## 1983	0	2	697500	5	4	2
## 2004	1	1	675000	5	2	2
## 2005	1	1	675000	5	2	2
## 2006	1	1	675000	5	2	2
## 2007	1	1	675000	5	2	2
## 2008	1	1	675000	5	2	2
## 2009	1	1	675000	5	2	2
## 2010	1	1	675000	5	2	2
## 2011	1	1	675000	5	2	2
## 2034	1	0	90000	2	2	2
## 2035	1	0	90000	2	2	2
## 2036	1	0	90000	2	2	2
## 2037	1	0	90000	2	2	2
## 2038	1	0	90000	2	2	2
## 2039	1	0	90000	2	2	2
## 2040	1	0	90000	2	2	2
## 2041	1	0	90000	2	2	2
## 2042	0	1	675000	5	2	2
## 2043	0	1	675000	5	2	2
## 2044	0	1	675000	5	2	2
## 2063	1	0	225000	5	3	4
## 2068	1	0	675000	4	1	2
## 2069	1	0	675000	4	1	2
## 2070	1	0	675000	4	1	2
## 2071	1	0	675000	4	1	2
## 2072	1	0	675000	4	1	2
## 2073	1	0	675000	4	1	2
## 2074	1	0	675000	4	1	2
## 2075	1	0	675000	4	1	2
## 2076	1	0	675000	4	1	2
## 2162	0	1	472500	5	2	4
## 2191	0	3	270000	5	2	2
## 2192	0	3	270000	5	2	2
## 2193	0	3	270000	5	2	2
## 2194	0	3	270000	5	2	2
## 2195	0	3	270000	5	2	2
## 2210	1	2	67500	3	2	4
## 2211	1	2	67500	3	2	4
## 2212	1	2	67500	3	2	4
## 2213	1	2	67500	3	2	4
## 2241	1	0	189000	3	5	2
## 2242	1	0	189000	3	5	2
## 2243	1	0	189000	3	5	2
## 2244	1	0	189000	3	5	2
## 2245	1	0	189000	3	5	2
## 2246	1	0	189000	3	5	2
## 2247	1	0	189000	3	5	2
## 2248	1	0	189000	3	5	2
## 2249	1	0	189000	3	5	2
## 2250	1	0	189000	3	5	2
## 2251	1	0	189000	3	5	2
## 2278	1	0	121500	4	2	4

## 2279	1	0	121500	4	2	4
## 2280	1	0	121500	4	2	4
## 2281	1	0	121500	4	2	4
## 2319	0	0	135000	4	1	4
## 2320	0	0	135000	4	1	4
## 2321	0	0	135000	4	1	4
## 2331	0	4	292500	4	2	2
## 2332	0	4	292500	4	2	2
## 2355	1	0	112500	5	5	2
## 2356	1	0	112500	5	5	2
## 2357	1	0	112500	5	5	2
## 2358	0	0	135000	4	2	4
## 2437	1	3	126000	5	2	2
## 2438	1	3	126000	5	2	2
## 2439	1	3	126000	5	2	2
## 2440	1	3	126000	5	2	2
## 2500	0	2	337500	3	2	2
## 2501	0	2	337500	3	2	2
## 2502	0	2	337500	3	2	2
## 2516	1	2	202500	2	2	2
## 2517	1	2	202500	2	2	2
## 2518	1	2	202500	2	2	2
## 2519	1	2	202500	2	2	2
## 2520	1	2	202500	2	2	2
## 2526	1	1	630000	4	2	2
## 2527	1	1	630000	4	2	2
## 2528	1	1	630000	4	2	2
## 2529	1	1	630000	4	2	2
## 2530	1	1	630000	4	2	2
## 2531	1	1	630000	4	2	2
## 2532	1	1	630000	4	2	2
## 2533	1	1	630000	4	2	2
## 2534	1	1	630000	4	2	2
## 2535	1	1	630000	4	2	2
## 2536	1	1	630000	4	2	2
## 2539	1	0	135000	5	5	2
## 2560	1	0	432000	3	2	2
## 2561	1	0	112500	4	2	4
## 2562	1	0	112500	4	2	4
## 2563	1	0	112500	4	2	4
## 2564	1	0	112500	4	2	4
## 2565	1	0	112500	4	2	4
## 2566	1	0	112500	4	2	4
## 2567	1	0	112500	4	2	4
## 2568	1	0	112500	4	2	4
## 2569	1	0	112500	4	2	4
## 2633	1	1	135000	4	1	4
## 2634	1	1	135000	4	1	4
## 2635	1	1	135000	4	1	4
## 2636	1	1	135000	4	1	4
## 2637	1	1	135000	4	1	4
## 2638	1	1	135000	4	1	4

## 2639	1	1	135000	4	1	4
## 2640	1	1	135000	4	1	4
## 2641	1	1	135000	4	1	4
## 2644	1	1	315000	5	5	2
## 2645	1	1	315000	5	5	2
## 2646	1	1	315000	5	5	2
## 2647	1	1	315000	5	5	2
## 2648	1	1	315000	5	5	2
## 2649	1	1	315000	5	5	2
## 2650	1	1	315000	5	5	2
## 2651	1	1	315000	5	5	2
## 2652	1	1	315000	5	5	2
## 2653	1	1	315000	5	5	2
## 2654	1	1	315000	5	5	2
## 2655	1	1	315000	5	5	2
## 2656	1	1	315000	5	5	2
## 2700	1	2	135000	5	4	2
## 2723	1	0	67500	4	3	4
## 2724	1	0	67500	4	3	4
## 2725	1	0	67500	4	3	4
## 2726	1	0	67500	4	3	4
## 2811	0	0	135000	4	2	6
## 2812	0	0	135000	4	2	6
## 2813	0	0	135000	4	2	6
## 2830	1	0	216000	5	2	4
## 2919	0	0	45000	2	2	2
## 2941	0	3	135000	4	2	2
## 2942	0	3	135000	4	2	2
## 2943	0	3	135000	4	2	2
## 2944	0	3	135000	4	2	2
## 2954	1	0	315000	5	4	4
## 2955	1	0	315000	5	4	4
## 3012	1	0	166500	4	3	6
## 3065	1	0	67500	4	5	2
## 3078	1	0	54000	4	5	2
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## 9513	0	2	450000	5	2	2
## 9514	0	2	450000	5	2	2
## 9515	0	2	450000	5	2	2
## 9516	0	2	450000	5	2	2
## 9517	0	2	450000	5	2	2
## 9518	0	2	450000	5	2	2

##	9562	1	1	405000	5	5	2								
##	9563	1	1	405000	5	5	2								
##	9564	1	1	405000	5	5	2								
##	9634	1	0	135000	4	5	3								
##	9635	1	0	135000	4	5	3								
##	9636	1	0	135000	4	5	3								
##	9637	1	0	135000	4	5	3								
##	9638	1	0	135000	4	5	3								
##	9639	1	0	135000	4	5	3								
##	9663	0	2	405000	4	2	6								
##	9664	0	2	405000	4	2	6								
##	9753	0	0	900000	5	2	2								
##	9754	0	0	900000	5	2	2								
##	9755	0	0	900000	5	2	2								
##	9756	0	0	900000	5	2	2								
##	9757	0	0	900000	5	2	2								
##	9759	1	0	517500	5	2	2								
##	9760	1	0	517500	5	2	2								
##	9761	1	0	517500	5	2	2								
##	9762	1	0	517500	5	2	2								
##	9763	1	0	517500	5	2	2								
##	9764	1	0	517500	5	2	2								
##	9765	1	0	517500	5	2	2								
##	9766	1	0	517500	5	2	2								
##	9824	0	2	180000	4	4	2								
##	9825	0	2	180000	4	4	2								
##	9826	0	2	180000	4	4	2								
##	9827	0	2	180000	4	4	2								
##	9828	0	2	180000	4	4	2								
##	9829	0	2	180000	4	4	2								
##	9925	0	0	135000	2	2	2								
##	9926	0	0	135000	2	2	2								
##	9927	0	0	135000	2	2	2								
##	9928	0	0	135000	2	2	2								
##	9929	0	0	135000	2	2	2								
##	9930	0	0	135000	2	2	2								
##	9984	0	1	810000	4	2	2								
##	9985	0	1	810000	4	2	2								
##	9986	0	1	810000	4	2	2								
##	9990	1	0	90000	2	3	2								
##	9991	1	0	90000	2	3	2								
##	9992	1	0	90000	2	3	2								
##	9993	1	0	90000	2	3	2								
##	9994	1	0	90000	2	3	2								
##	9995	1	0	90000	2	3	2								
##	9996	1	0	90000	2	3	2								
##															
##	\$`Location of Outlier`														
##	[1]	1	2	28	29	77	217	218	219	220	221	222	250	251	252
##	[15]	255	268	269	270	271	277	278	279	280	281	285	286	287	288
##	[29]	289	290	291	292	293	294	295	296	297	298	299	300	301	302
##	[43]	303	304	305	306	307	338	339	340	341	342	343	344	345	389

##	[57]	390	391	392	393	394	395	396	409	410	411	412	413	415	416
##	[71]	417	418	419	487	488	489	490	493	494	555	556	559	560	577
##	[85]	578	579	638	639	640	641	642	643	746	747	773	774	775	776
##	[99]	777	778	779	780	781	782	783	784	785	786	787	793	794	795
##	[113]	796	797	798	799	809	810	864	865	911	912	913	914	915	916
##	[127]	917	929	930	931	932	933	934	935	936	937	938	939	940	941
##	[141]	942	943	944	945	946	947	948	1039	1040	1041	1042	1043	1072	1073
##	[155]	1115	1116	1133	1151	1152	1153	1154	1155	1193	1194	1228	1229	1230	1231
##	[169]	1232	1233	1234	1235	1236	1237	1277	1278	1279	1280	1281	1282	1283	1284
##	[183]	1285	1286	1287	1288	1289	1290	1291	1292	1293	1294	1295	1296	1297	1298
##	[197]	1299	1300	1367	1368	1369	1374	1399	1400	1401	1402	1403	1404	1405	1406
##	[211]	1407	1476	1477	1478	1479	1516	1517	1518	1519	1520	1521	1522	1523	1524
##	[225]	1525	1526	1527	1528	1529	1596	1597	1598	1599	1600	1601	1602	1677	1678
##	[239]	1679	1680	1744	1745	1746	1811	1812	1868	1869	1958	1959	1960	1961	1962
##	[253]	1963	1964	1967	1968	1969	1982	1983	2004	2005	2006	2007	2008	2009	2010
##	[267]	2011	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2063	2068
##	[281]	2069	2070	2071	2072	2073	2074	2075	2076	2162	2191	2192	2193	2194	2195
##	[295]	2210	2211	2212	2213	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250
##	[309]	2251	2278	2279	2280	2281	2319	2320	2321	2331	2332	2355	2356	2357	2358
##	[323]	2437	2438	2439	2440	2500	2501	2502	2516	2517	2518	2519	2520	2526	2527
##	[337]	2528	2529	2530	2531	2532	2533	2534	2535	2536	2539	2560	2561	2562	2563
##	[351]	2564	2565	2566	2567	2568	2569	2633	2634	2635	2636	2637	2638	2639	2640
##	[365]	2641	2644	2645	2646	2647	2648	2649	2650	2651	2652	2653	2654	2655	2656
##	[379]	2700	2723	2724	2725	2726	2811	2812	2813	2830	2919	2941	2942	2943	2944
##	[393]	2954	2955	3012	3065	3078	3087	3088	3089	3090	3091	3092	3111	3112	3113
##	[407]	3114	3115	3116	3117	3197	3198	3199	3218	3219	3220	3297	3298	3299	3300
##	[421]	3301	3302	3303	3304	3334	3352	3353	3354	3384	3385	3416	3417	3418	3419
##	[435]	3420	3421	3422	3423	3424	3429	3430	3431	3432	3435	3436	3437	3438	3439
##	[449]	3440	3441	3442	3443	3444	3445	3446	3447	3570	3583	3584	3593	3594	3595
##	[463]	3652	3653	3654	3655	3656	3657	3658	3659	3666	3667	3677	3678	3695	3696
##	[477]	3711	3712	3713	3714	3766	3767	3814	3815	3825	3826	3827	3828	3829	3830
##	[491]	3831	3832	3833	3834	3857	3858	3859	3915	3916	3917	3918	3919	3981	3982
##	[505]	3983	3984	3985	4101	4102	4147	4148	4149	4150	4151	4152	4153	4154	4155
##	[519]	4156	4239	4279	4280	4281	4282	4283	4284	4285	4286	4287	4288	4289	4290
##	[533]	4291	4371	4372	4373	4374	4375	4376	4377	4378	4379	4380	4522	4523	4524
##	[547]	4525	4526	4527	4528	4529	4530	4531	4617	4618	4619	4620	4644	4645	4646
##	[561]	4652	4653	4660	4661	4662	4663	4694	4695	4696	4697	4698	4699	4700	4701
##	[575]	4702	4703	4713	4714	4715	4716	4717	4718	4719	4728	4729	4730	4731	4732
##	[589]	4755	4773	4774	4775	4776	4777	4778	4779	4780	4781	4782	4783	4784	4806
##	[603]	4807	4830	4831	4843	4844	4874	4875	4876	4877	4878	4879	4880	4881	4882
##	[617]	4883	4895	4896	4922	4923	4924	4937	4938	4939	4940	5032	5033	5034	5064
##	[631]	5076	5077	5078	5079	5080	5081	5082	5083	5084	5085	5086	5093	5094	5095
##	[645]	5096	5097	5098	5099	5100	5101	5104	5105	5106	5107	5108	5109	5161	5162
##	[659]	5163	5164	5165	5185	5186	5187	5188	5189	5190	5191	5192	5193	5194	5195
##	[673]	5196	5213	5214	5216	5217	5235	5288	5289	5290	5291	5292	5293	5294	5295
##	[687]	5313	5314	5315	5335	5336	5337	5338	5347	5348	5349	5350	5351	5352	5353
##	[701]	5379	5380	5381	5382	5383	5384	5385	5386	5387	5388	5389	5390	5391	5392
##	[715]	5393	5399	5400	5401	5402	5403	5461	5478	5479	5480	5481	5482	5483	5484
##	[729]	5485	5486	5487	5488	5495	5496	5497	5498	5499	5500	5523	5524	5584	5585
##	[743]	5586	5587	5588	5589	5642	5643	5644	5698	5699	5700	5701	5702	5703	5704
##	[757]	5722	5723	5724	5725	5726	5727	5728	5729	5730	5784	5785	5786	5833	5834
##	[771]	5835	5836	5837	5838	5839	5840	5841	5842	5843	5844	5845	5846	5847	5848

```

## [785] 5849 5850 5851 5852 5853 5854 5855 5856 5975 5976 6017 6018 6019 6020
## [799] 6021 6022 6023 6024 6025 6066 6067 6068 6069 6070 6071 6087 6088 6089
## [813] 6090 6125 6126 6127 6128 6129 6130 6131 6132 6148 6149 6150 6151 6176
## [827] 6177 6178 6179 6180 6181 6182 6183 6184 6185 6186 6211 6212 6213 6214
## [841] 6215 6216 6217 6218 6221 6222 6223 6238 6239 6240 6241 6275 6276 6319
## [855] 6320 6321 6322 6396 6397 6398 6399 6400 6401 6402 6409 6410 6471 6478
## [869] 6479 6480 6494 6495 6496 6497 6498 6499 6500 6540 6541 6542 6543 6544
## [883] 6545 6546 6547 6548 6549 6550 6551 6552 6553 6554 6626 6627 6628 6629
## [897] 6630 6685 6705 6706 6707 6708 6709 6710 6711 6712 6713 6714 6715 6716
## [911] 6780 6781 6782 6803 6804 6805 6806 6807 6808 6809 6810 6811 6846 6847
## [925] 6848 6849 6850 6903 6904 6905 6906 6907 6908 6909 7009 7010 7011 7082
## [939] 7083 7084 7085 7086 7112 7113 7114 7115 7132 7133 7134 7135 7136 7137
## [953] 7138 7139 7140 7141 7142 7143 7144 7145 7146 7147 7148 7186 7187 7188
## [967] 7189 7190 7191 7192 7193 7210 7211 7212 7213 7214 7215 7216 7217 7218
## [981] 7219 7225 7226 7227 7228 7229 7230 7231 7232 7233 7234 7267 7268 7269
## [995] 7302 7303 7304 7305 7306 7307 7311 7312 7313 7314 7315 7316 7326 7367
## [1009] 7368 7369 7399 7400 7401 7418 7419 7420 7421 7422 7423 7424 7425 7435
## [1023] 7436 7488 7489 7490 7491 7492 7493 7494 7495 7499 7500 7501 7541 7542
## [1037] 7543 7544 7590 7591 7592 7593 7594 7633 7634 7635 7636 7639 7640 7641
## [1051] 7642 7643 7644 7645 7646 7647 7648 7653 7654 7655 7656 7657 7658 7659
## [1065] 7660 7661 7662 7663 7664 7665 7666 7667 7668 7669 7727 7728 7729 7730
## [1079] 7731 7732 7733 7734 7735 7736 7743 7744 7745 7775 7776 7777 7793 7794
## [1093] 7795 7796 7797 7798 7799 7800 7801 7802 7803 7804 7951 7952 7953 7954
## [1107] 7955 7956 7957 8236 8237 8238 8315 8316 8317 8318 8378 8379 8380 8381
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## [1149] 8661 8662 8663 8664 8665 8666 8667 8668 8669 8670 8671 8706 8707 8708
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## [1177] 8751 8752 8753 8754 8755 8756 8757 8788 8789 8790 8791 8792 8793 8794
## [1191] 8907 8908 8909 8910 8911 8912 8913 8914 8915 8916 8917 8918 8919 8920
## [1205] 8921 8922 8954 8955 8956 8957 8958 8959 8960 8961 8962 8963 8964 8965
## [1219] 8966 8967 8968 8969 8970 8971 8972 8974 8975 8976 8977 8978 9051 9052
## [1233] 9053 9054 9119 9120 9121 9122 9123 9124 9125 9130 9131 9132 9133 9134
## [1247] 9135 9136 9137 9138 9139 9140 9141 9142 9228 9229 9230 9310 9311 9312
## [1261] 9313 9314 9315 9316 9317 9318 9319 9320 9321 9414 9415 9416 9469 9470
## [1275] 9471 9472 9473 9478 9479 9480 9481 9482 9483 9504 9505 9506 9507 9508
## [1289] 9509 9510 9511 9512 9513 9514 9515 9516 9517 9518 9562 9563 9564 9634
## [1303] 9635 9636 9637 9638 9639 9663 9664 9753 9754 9755 9756 9757 9759 9760
## [1317] 9761 9762 9763 9764 9765 9766 9824 9825 9826 9827 9828 9829 9925 9926
## [1331] 9927 9928 9929 9930 9984 9985 9986 9990 9991 9992 9993 9994 9995 9996
##
## $`Outlier Probability`
## [1] 0.9706045 0.9706045 0.9854474 0.9854474 0.9282508 0.9586177 0.9586177
## [8] 0.9586177 0.9586177 0.9586177 0.9586177 0.9551921 0.9551921 0.9551921
## [15] 0.9557221 0.9999045 0.9999045 0.9999045 0.9999045 0.9907071 0.9907071
## [22] 0.9907071 0.9907071 0.9907071 0.9945805 0.9945805 0.9945805 0.9945805
## [29] 0.9945805 0.9945805 0.9945805 0.9945805 0.9945805 0.9945805 0.9945805
## [36] 0.9945805 0.9945805 0.9945805 0.9945805 0.9808043 0.9808043 0.9808043
## [43] 0.9808043 0.9808043 0.9808043 0.9808043 0.9808043 0.9999862 0.9999862
## [50] 0.9999862 0.9999862 0.9999862 0.9999862 0.9999862 0.9999862 0.9915147
## [57] 0.9915147 0.9915147 0.9915147 0.9915147 0.9022623 0.9022623 0.9022623
## [64] 0.9810925 0.9810925 0.9810925 0.9810925 0.9810925 0.9873476 0.9873476

```

##	[71]	0.9873476	0.9873476	0.9873476	0.9922870	0.9922870	0.9922870	0.9922870
##	[78]	1.0000000	1.0000000	0.9999484	0.9999484	0.9663050	0.9663050	0.9764756
##	[85]	0.9764756	0.9764756	0.9339505	0.9339505	0.9339505	0.9339505	0.9999879
##	[92]	0.9999879	0.9661544	0.9661544	0.9039087	0.9039087	0.9039087	0.9039087
##	[99]	0.9039087	0.9039087	0.9039087	0.9039087	0.9039087	0.9039087	0.9039087
##	[106]	0.9039087	0.9039087	0.9039087	0.9039087	1.0000000	1.0000000	1.0000000
##	[113]	1.0000000	1.0000000	1.0000000	1.0000000	0.9857028	0.9857028	0.9678444
##	[120]	0.9678444	0.9863465	0.9863465	0.9863465	0.9863465	0.9863465	0.9863465
##	[127]	0.9863465	0.9951059	0.9951059	0.9951059	0.9951059	0.9951059	0.9951059
##	[134]	0.9951059	0.9951059	0.9951059	0.9951059	0.9220505	0.9220505	0.9220505
##	[141]	0.9220505	0.9220505	0.9272602	0.9272602	0.9272602	0.9272602	0.9272602
##	[148]	0.9089417	0.9089417	0.9089417	1.0000000	1.0000000	0.9873401	0.9873401
##	[155]	0.9542220	0.9542220	0.9923157	0.9459860	0.9459860	0.9459860	0.9459860
##	[162]	0.9459860	0.9927972	0.9927972	0.9998929	0.9998929	0.9998929	0.9998929
##	[169]	0.9998929	0.9998929	0.9998929	0.9998929	0.9998929	0.9998929	0.9970594
##	[176]	0.9970594	0.9970594	0.9970594	0.9970594	0.9970594	0.9970594	0.9970594
##	[183]	0.9970594	0.9970594	0.9970594	0.9970594	0.9970594	0.9970594	0.9970594
##	[190]	0.9970594	0.9970594	0.9970594	0.9970594	0.9970594	0.9970594	0.9970594
##	[197]	0.9970594	0.9970594	0.9615249	0.9913076	0.9913076	0.9373708	0.9596973
##	[204]	0.9596973	0.9596973	0.9596973	0.9596973	0.9596973	0.9596973	0.9596973
##	[211]	0.9596973	0.9980281	0.9980281	0.9980281	0.9980281	1.0000000	1.0000000
##	[218]	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
##	[225]	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	0.9180597	0.9180597
##	[232]	0.9180597	0.9180597	0.9180597	0.9180597	0.9180597	0.9967473	0.9967473
##	[239]	0.9967473	0.9967473	0.9833043	0.9833043	0.9833043	0.9891282	0.9891282
##	[246]	0.9782024	0.9782024	0.9934960	0.9934960	0.9934960	0.9934960	0.9934960
##	[253]	0.9934960	0.9934960	0.9999989	0.9999989	0.9999989	0.9999772	0.9999772
##	[260]	0.9991703	0.9991703	0.9991703	0.9991703	0.9991703	0.9991703	0.9991703
##	[267]	0.9991703	0.9883872	0.9883872	0.9883872	0.9883872	0.9883872	0.9883872
##	[274]	0.9883872	0.9883872	0.9977916	0.9977916	0.9977916	0.9823611	0.9998393
##	[281]	0.9998393	0.9998393	0.9998393	0.9998393	0.9998393	0.9998393	0.9998393
##	[288]	0.9998393	0.9964444	0.9914521	0.9914521	0.9914521	0.9914521	0.9914521
##	[295]	0.9991010	0.9991010	0.9991010	0.9991010	0.9730336	0.9730336	0.9730336
##	[302]	0.9730336	0.9730336	0.9730336	0.9730336	0.9730336	0.9730336	0.9730336
##	[309]	0.9730336	0.9613774	0.9613774	0.9613774	0.9613774	0.9849715	0.9849715
##	[316]	0.9849715	0.9999310	0.9999310	0.9617751	0.9617751	0.9617751	0.9659151
##	[323]	0.9904657	0.9904657	0.9904657	0.9904657	0.9682741	0.9682741	0.9682741
##	[330]	0.9993566	0.9993566	0.9993566	0.9993566	0.9993566	0.9975956	0.9975956
##	[337]	0.9975956	0.9975956	0.9975956	0.9975956	0.9975956	0.9975956	0.9975956
##	[344]	0.9975956	0.9975956	0.9561728	0.9638929	0.9623670	0.9623670	0.9623670
##	[351]	0.9623670	0.9623670	0.9623670	0.9623670	0.9623670	0.9623670	0.9841307
##	[358]	0.9841307	0.9841307	0.9841307	0.9841307	0.9841307	0.9841307	0.9841307
##	[365]	0.9841307	0.9746707	0.9746707	0.9746707	0.9746707	0.9746707	0.9746707
##	[372]	0.9746707	0.9746707	0.9746707	0.9746707	0.9746707	0.9746707	0.9746707
##	[379]	0.9587123	0.9705084	0.9705084	0.9705084	0.9705084	1.0000000	1.0000000
##	[386]	1.0000000	0.9813267	0.9945175	0.9881041	0.9881041	0.9881041	0.9881041
##	[393]	0.9962014	0.9962014	1.0000000	0.9167254	0.9248016	0.9457687	0.9457687
##	[400]	0.9457687	0.9457687	0.9457687	0.9457687	0.9806193	0.9806193	0.9806193
##	[407]	0.9806193	0.9806193	0.9806193	0.9806193	0.9998439	0.9998439	0.9998439
##	[414]	0.9591145	0.9591145	0.9591145	0.9830726	0.9830726	0.9830726	0.9830726
##	[421]	0.9830726	0.9830726	0.9830726	0.9830726	0.9651149	0.9857240	0.9857240
##	[428]	0.9857240	0.9917709	0.9917709	0.9936127	0.9936127	0.9936127	0.9936127

##	[435]	0.9936127	0.9936127	0.9936127	0.9936127	0.9936127	0.9904009	0.9904009
##	[442]	0.9904009	0.9904009	0.9459860	0.9459860	0.9459860	0.9459860	0.9459860
##	[449]	0.9459860	0.9459860	0.9459860	0.9459860	0.9459860	0.9459860	0.9459860
##	[456]	0.9459860	0.9939125	0.9931685	0.9931685	0.9816273	0.9816273	0.9816273
##	[463]	0.9867768	0.9039087	0.9039087	0.9039087	0.9039087	0.9039087	0.9039087
##	[470]	0.9039087	0.9830000	0.9830000	0.9999958	0.9999958	0.9884800	0.9884800
##	[477]	0.9883652	0.9883652	0.9883652	0.9883652	0.9895108	0.9895108	0.9039087
##	[484]	0.9039087	0.9412288	0.9412288	0.9412288	0.9412288	0.9412288	0.9412288
##	[491]	0.9412288	0.9412288	0.9412288	0.9412288	0.9114657	0.9114657	0.9114657
##	[498]	0.9999999	0.9999999	0.9999999	0.9999999	0.9999999	0.9940334	0.9940334
##	[505]	0.9940334	0.9940334	0.9940334	0.9854474	0.9854474	0.9233210	0.9233210
##	[512]	0.9233210	0.9233210	0.9021521	0.9021521	0.9021521	0.9021521	0.9021521
##	[519]	0.9021521	0.9664277	0.9841138	0.9841138	0.9841138	0.9841138	0.9841138
##	[526]	0.9841138	0.9841138	0.9841138	0.9841138	0.9841138	0.9841138	0.9841138
##	[533]	0.9841138	0.9626116	0.9626116	0.9626116	0.9626116	0.9626116	0.9626116
##	[540]	0.9626116	0.9626116	0.9626116	0.9626116	0.9120863	0.9120863	0.9120863
##	[547]	0.9120863	0.9120863	0.9120863	0.9120863	0.9120863	0.9120863	0.9120863
##	[554]	0.9929306	0.9929306	0.9929306	0.9929306	0.9816273	0.9816273	0.9816273
##	[561]	0.9669893	0.9669893	0.9188753	0.9188753	0.9188753	0.9188753	0.9314077
##	[568]	0.9314077	0.9314077	0.9314077	0.9314077	0.9314077	0.9314077	0.9314077
##	[575]	0.9314077	0.9314077	0.9812214	0.9812214	0.9812214	0.9812214	0.9812214
##	[582]	0.9812214	0.9812214	0.9846004	0.9846004	0.9846004	0.9846004	0.9846004
##	[589]	0.9929306	0.9596973	0.9596973	0.9596973	0.9596973	0.9596973	0.9596973
##	[596]	0.9596973	0.9596973	0.9596973	0.9596973	0.9596973	0.9596973	0.9920263
##	[603]	0.9894017	0.9623670	0.9623670	0.9661544	0.9661544	0.9997268	0.9997268
##	[610]	0.9997268	0.9997268	0.9997268	0.9997268	0.9997268	0.9997268	0.9997268
##	[617]	0.9997268	0.9457687	0.9457687	0.9688101	0.9688101	0.9688101	0.9914195
##	[624]	0.9914195	0.9914195	0.9914195	0.9021521	0.9021521	0.9021521	0.9996551
##	[631]	0.9666139	0.9666139	0.9666139	0.9666139	0.9666139	0.9666139	0.9666139
##	[638]	0.9666139	0.9666139	0.9666139	0.9666139	0.9624903	0.9624903	0.9624903
##	[645]	0.9624903	0.9624903	0.9624903	0.9624903	0.9624903	0.9624903	0.9971141
##	[652]	0.9971141	0.9971141	0.9971141	0.9971141	0.9971141	0.9850619	0.9850619
##	[659]	0.9850619	0.9850619	0.9850619	0.9659151	0.9659151	0.9659151	0.9659151
##	[666]	0.9659151	0.9659151	0.9659151	0.9659151	0.9659151	0.9659151	0.9659151
##	[673]	0.9659151	0.9039087	0.9039087	0.9470444	0.9470444	0.9624903	0.9944552
##	[680]	0.9944552	0.9944552	0.9944552	0.9944552	0.9944552	0.9944552	0.9944552
##	[687]	0.9925198	0.9925198	0.9925198	0.9856250	0.9856250	0.9856250	0.9856250
##	[694]	0.9961089	0.9961089	0.9961089	0.9961089	0.9961089	0.9961089	0.9961089
##	[701]	0.9999491	0.9999491	0.9999491	0.9999491	0.9999491	0.9999491	0.9724758
##	[708]	0.9724758	0.9724758	0.9724758	0.9724758	0.9724758	0.9724758	0.9724758
##	[715]	0.9724758	0.9718353	0.9718353	0.9718353	0.9718353	0.9718353	0.9947916
##	[722]	0.9821146	0.9821146	0.9821146	0.9821146	0.9821146	0.9821146	0.9821146
##	[729]	0.9821146	0.9821146	0.9821146	0.9821146	0.9477514	0.9477514	0.9477514
##	[736]	0.9477514	0.9477514	0.9477514	0.9916253	0.9916253	0.9936415	0.9936415
##	[743]	0.9936415	0.9936415	0.9936415	0.9936415	0.9167254	0.9167254	0.9167254
##	[750]	0.9062766	0.9062766	0.9062766	0.9062766	0.9062766	0.9062766	0.9062766
##	[757]	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
##	[764]	1.0000000	1.0000000	0.9387885	0.9387885	0.9387885	0.9764756	0.9764756
##	[771]	0.9764756	0.9764756	0.9764756	0.9764756	0.9764756	0.9764756	0.9764756
##	[778]	0.9764756	0.9764756	0.9764756	0.9764756	0.9542220	0.9542220	0.9542220
##	[785]	0.9542220	0.9542220	0.9542220	0.9542220	0.9542220	0.9542220	0.9542220
##	[792]	0.9542220	0.9940036	0.9940036	0.9479294	0.9479294	0.9479294	0.9479294

##	[799]	0.9479294	0.9479294	0.9479294	0.9479294	0.9479294	0.9830000	0.9830000
##	[806]	0.9830000	0.9830000	0.9900085	0.9900085	0.9884405	0.9884405	0.9884405
##	[813]	0.9884405	0.9840908	0.9840908	0.9840908	0.9840908	0.9840908	0.9840908
##	[820]	0.9840908	0.9840908	0.9896968	0.9896968	0.9896968	0.9896968	0.9997291
##	[827]	0.9997291	0.9997291	0.9997291	0.9997291	0.9997291	0.9997291	0.9997291
##	[834]	0.9997291	0.9997291	0.9997291	0.9222115	0.9222115	0.9222115	0.9222115
##	[841]	0.9222115	0.9222115	0.9222115	0.9222115	0.9916563	0.9916563	0.9916563
##	[848]	1.0000000	1.0000000	1.0000000	1.0000000	0.9468785	0.9468785	0.9385677
##	[855]	0.9385677	0.9385677	0.9385677	0.9655543	0.9655543	0.9655543	0.9655543
##	[862]	0.9655543	0.9655543	0.9655543	0.9370328	0.9370328	0.9849580	0.9479294
##	[869]	0.9479294	0.9479294	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
##	[876]	1.0000000	1.0000000	0.9906230	0.9906230	0.9660810	0.9660810	0.9660810
##	[883]	0.9457687	0.9457687	0.9457687	0.9457687	0.9457687	0.9457687	0.9457687
##	[890]	0.9457687	0.9457687	0.9457687	0.9806537	0.9806537	0.9806537	0.9806537
##	[897]	0.9806537	0.9677986	0.9917943	0.9917943	0.9917943	0.9917943	0.9917943
##	[904]	0.9917943	0.9917943	0.9917943	0.9917943	0.9917943	0.9917943	0.9917943
##	[911]	0.9999619	0.9999619	0.9999619	0.9167254	0.9167254	0.9167254	0.9167254
##	[918]	0.9167254	0.9167254	0.9167254	0.9167254	0.9167254	0.9867199	0.9867199
##	[925]	0.9867199	0.9867199	0.9867199	0.9561728	0.9561728	0.9561728	0.9561728
##	[932]	0.9561728	0.9561728	0.9561728	0.9959708	0.9959708	0.9959708	0.9899599
##	[939]	0.9899599	0.9899599	0.9899599	0.9899599	0.9999200	0.9999200	0.9999200
##	[946]	0.9999200	0.9841302	0.9841302	0.9841302	0.9841302	0.9841302	0.9841302
##	[953]	0.9936480	0.9936480	0.9936480	0.9936480	0.9936480	0.9936480	0.9936480
##	[960]	0.9936480	0.9936480	0.9936480	0.9936480	0.9831715	0.9831715	0.9831715
##	[967]	0.9831715	0.9831715	0.9831715	0.9831715	0.9831715	1.0000000	1.0000000
##	[974]	1.0000000	0.9470444	0.9470444	0.9470444	0.9470444	0.9470444	0.9470444
##	[981]	0.9470444	0.9793979	0.9793979	0.9793979	0.9793979	0.9793979	0.9793979
##	[988]	0.9793979	0.9793979	0.9793979	0.9793979	0.9549072	0.9549072	0.9549072
##	[995]	0.9970776	0.9970776	0.9970776	0.9970776	0.9970776	0.9970776	0.9931052
##	[1002]	0.9931052	0.9931052	0.9931052	0.9931052	0.9931052	1.0000000	0.9700792
##	[1009]	0.9700792	0.9700792	0.9453778	0.9453778	0.9453778	0.9870410	0.9870410
##	[1016]	0.9870410	0.9870410	0.9870410	0.9870410	0.9870410	0.9870410	0.9617751
##	[1023]	0.9617751	0.9472971	0.9472971	0.9472971	0.9472971	0.9472971	0.9472971
##	[1030]	0.9472971	0.9472971	0.9830006	0.9830006	0.9830006	0.9439208	0.9439208
##	[1037]	0.9439208	0.9439208	0.9139037	0.9139037	0.9139037	0.9139037	0.9139037
##	[1044]	0.9816273	0.9816273	0.9816273	0.9816273	0.9998294	0.9998294	0.9998294
##	[1051]	0.9998294	0.9998294	0.9998294	0.9998294	0.9998294	0.9998294	0.9998294
##	[1058]	0.9021521	0.9021521	0.9021521	0.9989011	0.9989011	0.9989011	0.9989011
##	[1065]	0.9989011	0.9989011	0.9989011	0.9989011	0.9989011	0.9989011	0.9989011
##	[1072]	0.9989011	0.9989011	0.9989011	0.9806601	0.9806601	0.9806601	0.9806601
##	[1079]	0.9806601	0.9806601	0.9806601	0.9806601	0.9806601	0.9806601	0.9993135
##	[1086]	0.9993135	0.9993135	0.9695357	0.9695357	0.9695357	0.9995682	0.9995682
##	[1093]	0.9995682	0.9995682	0.9995682	0.9995682	0.9995682	0.9995682	0.9995682
##	[1100]	0.9995682	0.9995682	0.9995682	0.9891265	0.9989805	0.9989805	0.9989805
##	[1107]	0.9989805	0.9989805	0.9989805	0.9900085	0.9900085	0.9900085	0.9916563
##	[1114]	0.9916563	0.9916563	0.9916563	0.9167254	0.9167254	0.9167254	0.9167254
##	[1121]	0.9167254	0.9923571	0.9931952	0.9926069	0.9926069	0.9926069	0.9926069
##	[1128]	0.9926069	0.9606030	0.9606030	0.9606030	0.9606030	0.9988055	0.9988055
##	[1135]	0.9988055	0.9988055	0.9988055	0.9988055	0.9988055	0.9988055	0.9988055
##	[1142]	0.9988055	0.9988055	0.9988055	0.9824865	0.9824865	0.9824865	0.9927805
##	[1149]	0.9791055	0.9791055	0.9791055	0.9791055	0.9791055	0.9791055	0.9791055
##	[1156]	0.9791055	0.9791055	0.9791055	0.9791055	0.9977089	0.9977089	0.9977089


```
## [1163] 0.9977089 0.9977089 0.9977089 0.9977089 0.9977089 0.9977089 0.9977089
## [1170] 0.9977089 0.9922900 0.9922900 0.9922900 0.9922900 0.9922900 1.0000000
## [1177] 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## [1184] 0.9917565 0.9917565 0.9917565 0.9917565 0.9917565 0.9917565 0.9917565
## [1191] 0.9633337 0.9633337 0.9633337 0.9922870 0.9922870 0.9936127 0.9936127
## [1198] 0.9936127 0.9936127 0.9936127 0.9936127 0.9936127 0.9936127 0.9857887
## [1205] 0.9857887 0.9857887 0.9543058 0.9543058 0.9543058 0.9543058 0.9850619
## [1212] 0.9850619 0.9850619 0.9850619 0.9850619 0.9850619 0.9850619 0.9850619
## [1219] 0.9850619 0.9850619 0.9850619 1.0000000 1.0000000 1.0000000 1.0000000
## [1226] 0.9821146 0.9804470 0.9804470 0.9804470 0.9804470 0.9915846 0.9915846
## [1233] 0.9915846 0.9915846 0.9997786 0.9997786 0.9997786 0.9997786 0.9997786
## [1240] 0.9997786 0.9997786 0.9998566 0.9998566 0.9998566 0.9998566 0.9998566
## [1247] 0.9998566 0.9998566 0.9998566 0.9998566 0.9998566 0.9998566 0.9998566
## [1254] 0.9998566 0.9816669 0.9816669 0.9816669 0.9993764 0.9993764 0.9993764
## [1261] 0.9993764 0.9993764 0.9993764 0.9993764 0.9993764 0.9993764 0.9993764
## [1268] 0.9993764 0.9993764 0.9656426 0.9656426 0.9656426 1.0000000 1.0000000
## [1275] 1.0000000 1.0000000 1.0000000 0.9946183 0.9973955 0.9973955 0.9973955
## [1282] 0.9973955 0.9973955 0.9915285 0.9915285 0.9915285 0.9915285 0.9915285
## [1289] 0.9915285 0.9915285 0.9439208 0.9439208 0.9439208 0.9439208 0.9439208
## [1296] 0.9439208 0.9439208 0.9439208 0.9894171 0.9894171 0.9894171 0.9501091
## [1303] 0.9501091 0.9501091 0.9501091 0.9501091 0.9501091 1.0000000 1.0000000
## [1310] 0.9999998 0.9999998 0.9999998 0.9999998 0.9999998 0.9352954 0.9352954
## [1317] 0.9352954 0.9352954 0.9352954 0.9352954 0.9352954 0.9352954 0.9563342
## [1324] 0.9563342 0.9563342 0.9563342 0.9563342 0.9563342 0.9920553 0.9920553
## [1331] 0.9920553 0.9920553 0.9920553 0.9920553 0.9999923 0.9999923 0.9999923
## [1338] 0.9884512 0.9884512 0.9884512 0.9884512 0.9884512 0.9884512 0.9884512
```

When the threshold is 0.9, there are 1,344 outliers.

b) Outlier detection using k Nearest Neighbours Distance method

```
nn(x, k=4)
```

```
## $`Outlier Observations`
```

```
##      gender num_child ann_income education marital housing
## 1         0         0  427500.0          5         1         1
## 2         0         0  427500.0          5         1         1
## 8         1         0  283500.0          5         4         2
## 9         1         0  283500.0          5         4         2
## 10        1         0  283500.0          5         4         2
## 20        1         0  130500.0          3         2         2
## 21        1         0  130500.0          3         2         2
## 63        1         1  211500.0          4         1         2
## 64        1         1  211500.0          4         1         2
## 77        1         0  315000.0          4         5         2
## 223       1         2  157500.0          4         3         2
## 224       1         2  157500.0          4         3         2
## 240       1         0   94500.0          5         2         2
## 250       1         0  270000.0          3         1         3
## 251       1         0  270000.0          3         1         3
## 252       1         0  270000.0          3         1         3
## 253       1         1  450000.0          5         2         2
## 254       1         1  450000.0          5         2         2
## 255       0         1  180000.0          4         2         4
## 275       1         0  315000.0          5         4         2
## 276       1         0  315000.0          5         4         2
## 394       1         0   74250.0          5         4         3
## 395       1         0   74250.0          5         4         3
## 396       1         0   74250.0          5         4         3
## 406       1         0  144000.0          4         3         2
## 407       1         0  144000.0          4         3         2
## 408       1         0  144000.0          4         3         2
## 414       1         0   40500.0          4         3         2
## 493       1         0  900000.0          5         3         2
## 494       1         0  900000.0          5         3         2
## 555       0         0  108000.0          4         3         5
## 556       0         0  108000.0          4         3         5
## 559       0         0  198000.0          4         3         4
## 560       0         0  198000.0          4         3         4
## 561       0         0  360000.0          5         2         3
## 562       0         0  360000.0          5         2         3
## 575       1         0  270000.0          3         1         2
## 576       1         0  270000.0          3         1         2
## 642       0         1  112500.0          4         4         5
## 643       0         1  112500.0          4         4         5
## 654       0         0  216000.0          4         2         2
## 698       1         0   45000.0          4         4         2
## 699       1         0   45000.0          4         4         2
## 702       1         0  112500.0          4         3         1
## 703       1         0  112500.0          4         3         1
## 740       0         1  144000.0          3         2         2
## 741       0         1  144000.0          3         2         2
## 809       1         0  135000.0          4         1         4
## 810       1         0  135000.0          4         1         4
## 864       0         2  445500.0          5         2         3
```

## 865	0	2	445500.0	5	2	3
## 925	0	0	225000.0	5	1	2
## 949	1	2	157500.0	5	2	2
## 950	1	2	157500.0	5	2	2
## 951	1	2	144000.0	4	2	3
## 963	0	0	270000.0	4	3	2
## 964	0	0	270000.0	4	3	2
## 1008	1	0	135000.0	3	3	2
## 1009	1	2	99000.0	4	2	2
## 1014	0	0	90000.0	4	1	2
## 1039	0	0	495000.0	5	3	2
## 1040	0	0	495000.0	5	3	2
## 1041	0	0	495000.0	5	3	2
## 1042	0	2	157500.0	4	2	6
## 1043	0	2	157500.0	4	2	6
## 1072	1	0	99000.0	5	3	4
## 1073	1	0	99000.0	5	3	4
## 1079	0	0	85500.0	4	2	2
## 1080	0	0	85500.0	4	2	2
## 1117	1	0	279000.0	5	3	2
## 1123	0	2	157500.0	4	2	3
## 1124	0	2	157500.0	4	2	3
## 1125	0	2	157500.0	4	2	3
## 1133	1	0	112500.0	3	3	4
## 1140	1	2	306000.0	5	2	2
## 1141	1	2	306000.0	5	2	2
## 1142	1	2	306000.0	5	2	2
## 1143	1	0	166500.0	4	2	2
## 1144	1	0	166500.0	4	2	2
## 1145	1	0	166500.0	4	2	2
## 1156	1	1	67500.0	4	2	3
## 1193	0	0	202500.0	2	2	2
## 1194	0	0	202500.0	2	2	2
## 1311	1	0	99000.0	4	3	2
## 1312	1	0	99000.0	4	3	2
## 1313	1	0	99000.0	4	3	2
## 1367	1	0	126000.0	4	3	4
## 1368	0	1	180000.0	3	2	4
## 1369	0	1	180000.0	3	2	4
## 1370	1	0	310500.0	5	3	2
## 1371	1	0	310500.0	5	3	2
## 1374	1	2	67500.0	4	4	2
## 1480	0	0	135000.0	5	1	2
## 1481	0	0	135000.0	5	1	2
## 1482	0	0	135000.0	5	1	2
## 1503	1	1	90000.0	4	4	1
## 1530	1	0	76500.0	4	1	2
## 1531	1	0	76500.0	4	1	2
## 1532	1	0	76500.0	4	1	2
## 1603	1	0	184500.0	4	2	2
## 1638	0	0	180000.0	5	3	2
## 1662	1	2	225000.0	4	1	2

## 1674	0	0	99000.0	4	3	2
## 1675	0	0	99000.0	4	3	2
## 1676	0	0	99000.0	4	3	2
## 1728	1	0	162000.0	4	2	2
## 1729	1	0	162000.0	4	2	2
## 1730	1	0	162000.0	4	2	2
## 1744	1	0	135000.0	5	2	4
## 1745	1	0	135000.0	5	2	4
## 1746	1	0	135000.0	5	2	4
## 1750	1	0	165150.0	5	2	2
## 1751	1	0	165150.0	5	2	2
## 1802	0	2	139500.0	4	2	2
## 1811	1	0	54000.0	2	2	2
## 1812	1	0	54000.0	2	2	2
## 1868	1	0	94500.0	4	5	1
## 1869	1	0	94500.0	4	5	1
## 1917	0	0	126000.0	5	2	2
## 1918	0	0	126000.0	5	2	2
## 1919	0	0	126000.0	5	2	2
## 1920	1	0	67500.0	4	4	3
## 1921	1	0	67500.0	4	4	3
## 1924	0	1	270000.0	3	2	2
## 1925	0	1	270000.0	3	2	2
## 1928	1	0	121500.0	5	3	1
## 1929	1	0	121500.0	5	3	1
## 1930	1	0	121500.0	5	3	1
## 1967	1	1	135000.0	1	1	2
## 1968	1	1	135000.0	1	1	2
## 1969	1	1	135000.0	1	1	2
## 1980	1	1	33300.0	4	2	2
## 1981	1	1	33300.0	4	2	2
## 1982	0	2	697500.0	5	4	2
## 1983	0	2	697500.0	5	4	2
## 2003	1	1	198000.0	4	2	2
## 2042	0	1	675000.0	5	2	2
## 2043	0	1	675000.0	5	2	2
## 2044	0	1	675000.0	5	2	2
## 2045	1	0	54000.0	4	4	2
## 2063	1	0	225000.0	5	3	4
## 2077	0	0	171000.0	5	1	2
## 2099	1	2	112500.0	5	1	2
## 2100	1	2	112500.0	5	1	2
## 2131	1	0	135000.0	3	3	1
## 2132	1	0	135000.0	3	3	1
## 2162	0	1	472500.0	5	2	4
## 2196	0	0	112500.0	4	1	2
## 2198	1	0	67500.0	4	2	3
## 2199	1	0	67500.0	4	2	3
## 2200	1	0	67500.0	4	2	3
## 2263	1	0	126000.0	5	3	2
## 2264	1	0	126000.0	5	3	2
## 2265	1	0	126000.0	5	3	2

## 2282	1	0	196650.0	4	2	2
## 2283	1	0	196650.0	4	2	2
## 2298	1	1	166500.0	5	2	2
## 2299	1	1	166500.0	5	2	2
## 2319	0	0	135000.0	4	1	4
## 2320	0	0	135000.0	4	1	4
## 2321	0	0	135000.0	4	1	4
## 2325	1	1	157500.0	4	2	3
## 2326	1	1	157500.0	4	2	3
## 2331	0	4	292500.0	4	2	2
## 2332	0	4	292500.0	4	2	2
## 2380	0	1	202500.0	4	4	2
## 2417	0	1	306000.0	4	2	2
## 2418	0	1	306000.0	4	2	2
## 2434	0	1	189000.0	4	2	3
## 2435	1	0	270000.0	3	2	2
## 2436	1	0	99000.0	4	1	2
## 2497	0	1	225000.0	3	2	2
## 2498	0	1	225000.0	3	2	2
## 2499	0	1	225000.0	3	2	2
## 2500	0	2	337500.0	3	2	2
## 2501	0	2	337500.0	3	2	2
## 2502	0	2	337500.0	3	2	2
## 2521	1	1	243000.0	5	2	2
## 2522	1	1	243000.0	5	2	2
## 2523	1	1	243000.0	5	2	2
## 2557	1	0	171000.0	3	2	2
## 2558	1	0	171000.0	3	2	2
## 2559	1	0	171000.0	3	2	2
## 2560	1	0	432000.0	3	2	2
## 2630	1	1	90000.0	4	1	2
## 2631	1	1	90000.0	4	1	2
## 2632	1	1	90000.0	4	1	2
## 2657	0	0	171000.0	4	3	1
## 2658	0	0	171000.0	4	3	1
## 2695	1	1	76500.0	4	2	3
## 2696	1	1	76500.0	4	2	3
## 2700	1	2	135000.0	5	4	2
## 2764	1	0	257625.0	4	1	2
## 2801	0	0	143100.0	4	2	2
## 2802	0	0	143100.0	4	2	2
## 2808	1	1	225000.0	4	4	2
## 2809	1	1	225000.0	4	4	2
## 2810	1	1	225000.0	4	4	2
## 2811	0	0	135000.0	4	2	6
## 2812	0	0	135000.0	4	2	6
## 2813	0	0	135000.0	4	2	6
## 2830	1	0	216000.0	5	2	4
## 2860	1	0	94500.0	4	3	1
## 2861	1	0	94500.0	4	3	1
## 2896	1	0	207000.0	4	3	2
## 2897	1	0	207000.0	4	3	2

## 2898	1	0	207000.0	4	3	2
## 2914	1	0	288000.0	4	4	2
## 2915	1	0	288000.0	4	4	2
## 2919	0	0	45000.0	2	2	2
## 2920	1	0	135000.0	4	3	3
## 2921	1	0	135000.0	4	3	3
## 2922	1	0	135000.0	4	3	3
## 2954	1	0	315000.0	5	4	4
## 2955	1	0	315000.0	5	4	4
## 3012	1	0	166500.0	4	3	6
## 3041	1	2	189000.0	4	2	2
## 3042	1	2	189000.0	4	2	2
## 3078	1	0	54000.0	4	5	2
## 3197	1	1	720000.0	5	2	2
## 3198	1	1	720000.0	5	2	2
## 3199	1	1	720000.0	5	2	2
## 3218	0	0	225000.0	4	2	4
## 3219	0	0	225000.0	4	2	4
## 3220	0	0	225000.0	4	2	4
## 3331	1	0	247500.0	4	3	2
## 3332	1	0	247500.0	4	3	2
## 3333	1	0	247500.0	4	3	2
## 3334	1	1	157500.0	4	3	4
## 3346	1	1	315000.0	5	2	2
## 3347	1	1	315000.0	5	2	2
## 3352	1	0	157500.0	4	4	4
## 3353	1	0	157500.0	4	4	4
## 3354	1	0	157500.0	4	4	4
## 3359	1	0	135000.0	3	1	2
## 3360	1	0	135000.0	3	1	2
## 3384	0	3	360000.0	4	2	2
## 3385	0	3	360000.0	4	2	2
## 3450	0	0	135000.0	4	3	1
## 3451	0	0	135000.0	4	3	1
## 3490	1	0	202500.0	5	3	1
## 3491	1	0	202500.0	5	3	1
## 3495	1	0	67500.0	4	3	2
## 3570	0	1	135000.0	2	2	2
## 3583	0	0	135000.0	3	3	4
## 3584	0	0	135000.0	3	3	4
## 3632	1	0	99900.0	4	5	2
## 3633	1	0	99900.0	4	5	2
## 3652	0	0	112500.0	4	1	4
## 3677	1	2	202500.0	4	1	5
## 3678	1	2	202500.0	4	1	5
## 3695	1	0	81000.0	2	2	2
## 3696	1	0	81000.0	2	2	2
## 3766	1	0	153000.0	2	2	2
## 3767	1	0	153000.0	2	2	2
## 3786	1	1	315000.0	5	2	2
## 3816	0	0	270000.0	4	4	2
## 3857	1	0	76500.0	4	5	2

## 3858	1	0	76500.0	4	5	2
## 3859	1	0	76500.0	4	5	2
## 4076	1	0	81000.0	4	2	3
## 4205	1	0	117000.0	4	1	2
## 4206	1	0	117000.0	4	1	2
## 4207	1	0	117000.0	4	1	2
## 4239	1	0	90000.0	4	3	4
## 4240	1	0	216000.0	5	1	2
## 4241	1	0	216000.0	5	1	2
## 4341	0	1	247500.0	5	2	2
## 4342	0	1	247500.0	5	2	2
## 4343	0	1	247500.0	5	2	2
## 4444	0	0	405000.0	5	2	2
## 4445	0	0	405000.0	5	2	2
## 4446	0	0	405000.0	5	2	2
## 4447	0	0	49500.0	4	3	2
## 4448	0	0	49500.0	4	3	2
## 4483	1	0	189000.0	4	4	2
## 4484	1	0	189000.0	4	4	2
## 4505	1	2	184500.0	4	2	2
## 4519	1	0	157500.0	5	2	1
## 4520	1	0	157500.0	5	2	1
## 4521	1	0	157500.0	5	2	1
## 4588	0	0	112500.0	5	2	2
## 4625	0	1	135000.0	4	2	3
## 4647	1	1	108000.0	5	4	2
## 4652	0	0	292500.0	4	2	4
## 4653	0	0	292500.0	4	2	4
## 4682	1	0	90000.0	3	3	2
## 4683	1	0	90000.0	3	3	2
## 4801	1	0	247500.0	4	4	2
## 4802	1	0	247500.0	4	4	2
## 4803	1	0	247500.0	4	4	2
## 4806	0	1	630000.0	5	2	2
## 4807	1	1	148500.0	4	4	4
## 4808	0	1	121500.0	4	3	2
## 4809	0	0	162000.0	4	3	2
## 4810	0	0	162000.0	4	3	2
## 4811	0	0	162000.0	4	3	2
## 4815	1	1	65250.0	4	1	2
## 4832	1	0	67500.0	3	4	2
## 4849	1	0	216000.0	4	5	2
## 4871	0	0	198000.0	4	2	2
## 4872	0	0	198000.0	4	2	2
## 4873	0	0	198000.0	4	2	2
## 4884	1	0	139500.0	5	1	2
## 4885	1	0	139500.0	5	1	2
## 4899	1	2	112500.0	5	2	2
## 4922	1	0	76500.0	4	3	4
## 4923	1	0	76500.0	4	3	4
## 4924	1	0	76500.0	4	3	4
## 4933	1	1	90000.0	3	2	2

## 4934	1	1	90000.0	3	2	2
## 4935	0	0	360000.0	5	3	2
## 4936	0	0	360000.0	5	3	2
## 5007	0	0	495000.0	4	2	2
## 5008	0	0	495000.0	4	2	2
## 5064	1	2	157500.0	2	1	2
## 5220	0	0	207000.0	4	3	2
## 5221	0	0	207000.0	4	3	2
## 5222	0	0	162000.0	5	2	2
## 5285	1	1	247500.0	4	2	2
## 5286	1	1	247500.0	4	2	2
## 5287	1	1	247500.0	4	2	2
## 5313	0	1	112500.0	3	2	4
## 5314	0	1	112500.0	3	2	4
## 5315	0	1	112500.0	3	2	4
## 5363	0	0	63000.0	4	2	2
## 5364	0	0	63000.0	4	2	2
## 5365	0	0	63000.0	4	2	2
## 5428	0	0	180000.0	4	3	1
## 5461	0	0	38250.0	2	2	2
## 5462	0	0	99000.0	4	1	2
## 5463	0	0	99000.0	4	1	2
## 5464	0	0	99000.0	4	1	2
## 5523	0	3	90000.0	4	2	2
## 5524	0	3	90000.0	4	2	2
## 5590	1	2	247500.0	4	2	2
## 5591	1	2	247500.0	4	2	2
## 5592	1	2	247500.0	4	2	2
## 5689	0	1	180000.0	5	2	2
## 5690	0	1	180000.0	5	2	2
## 5784	0	0	360000.0	3	3	3
## 5785	0	0	360000.0	3	3	3
## 5786	0	0	360000.0	3	3	3
## 5975	1	3	67500.0	5	2	2
## 5976	1	3	67500.0	5	2	2
## 6051	0	1	144000.0	5	2	2
## 6052	0	1	144000.0	5	2	2
## 6053	0	1	144000.0	5	2	2
## 6166	1	1	94500.0	5	3	2
## 6167	1	1	94500.0	5	3	2
## 6168	1	1	94500.0	5	3	2
## 6219	1	0	94500.0	4	1	2
## 6220	1	0	94500.0	4	1	2
## 6275	0	2	270000.0	3	2	2
## 6276	0	2	270000.0	3	2	2
## 6343	1	0	180000.0	3	2	2
## 6344	1	0	180000.0	3	2	2
## 6345	1	0	180000.0	3	2	2
## 6375	1	1	270000.0	5	3	2
## 6409	1	1	112500.0	4	5	2
## 6410	1	1	112500.0	4	5	2
## 6462	0	2	130500.0	4	2	2

## 6463	0	2	130500.0	4	2	2
## 6471	1	1	112500.0	4	1	4
## 6540	0	3	225000.0	4	2	3
## 6541	0	3	225000.0	4	2	3
## 6542	0	0	225000.0	4	3	4
## 6543	0	0	225000.0	4	3	4
## 6544	0	0	225000.0	4	3	4
## 6576	1	0	72000.0	4	3	2
## 6577	1	0	72000.0	4	3	2
## 6610	1	0	36000.0	4	4	3
## 6673	0	2	148500.0	4	2	2
## 6674	0	2	148500.0	4	2	2
## 6685	1	0	90000.0	5	5	2
## 6717	1	1	270000.0	5	2	2
## 6733	0	0	81000.0	4	1	2
## 6734	0	0	81000.0	4	1	2
## 6777	1	1	135000.0	4	3	3
## 6778	1	1	135000.0	4	3	3
## 6779	0	1	189000.0	4	2	2
## 6780	0	1	315000.0	5	2	5
## 6781	0	1	315000.0	5	2	5
## 6782	0	1	315000.0	5	2	5
## 6783	0	1	112500.0	4	2	1
## 6834	1	0	180000.0	5	1	2
## 6879	0	1	315000.0	4	2	1
## 6880	0	1	315000.0	4	2	1
## 6881	0	1	315000.0	4	2	1
## 6967	1	1	126000.0	4	2	2
## 7009	0	1	202500.0	2	3	2
## 7010	0	1	202500.0	2	3	2
## 7011	0	1	202500.0	2	3	2
## 7024	0	1	99000.0	4	3	2
## 7025	0	1	99000.0	4	3	2
## 7033	0	0	67500.0	5	3	2
## 7034	0	0	67500.0	5	3	2
## 7035	0	0	67500.0	5	3	2
## 7079	0	0	76500.0	5	2	2
## 7080	0	0	76500.0	5	2	2
## 7081	0	0	76500.0	5	2	2
## 7123	0	0	112500.0	4	1	2
## 7124	0	0	112500.0	4	1	2
## 7183	1	0	189000.0	5	3	2
## 7184	1	0	189000.0	5	3	2
## 7185	1	0	189000.0	5	3	2
## 7199	0	1	337500.0	5	2	2
## 7200	0	1	337500.0	5	2	2
## 7210	0	0	225000.0	4	2	6
## 7211	0	0	225000.0	4	2	6
## 7212	0	0	225000.0	4	2	6
## 7267	1	0	292500.0	5	5	2
## 7268	1	0	292500.0	5	5	2
## 7269	1	0	292500.0	5	5	2

## 7326	1	1	225000.0	4	3	6
## 7367	0	0	99000.0	3	1	1
## 7368	0	0	99000.0	3	1	1
## 7369	0	0	99000.0	3	1	1
## 7399	0	0	540000.0	5	2	2
## 7400	0	0	540000.0	5	2	2
## 7401	0	0	540000.0	5	2	2
## 7411	1	2	148500.0	4	2	2
## 7412	1	2	148500.0	4	2	2
## 7428	0	1	180000.0	4	3	2
## 7434	1	2	157500.0	4	1	2
## 7437	1	1	118350.0	5	1	2
## 7487	1	0	112500.0	4	3	1
## 7499	1	0	139500.0	5	2	4
## 7500	1	0	139500.0	5	2	4
## 7501	1	0	139500.0	5	2	4
## 7521	0	1	63000.0	4	3	2
## 7522	0	1	63000.0	4	3	2
## 7628	0	0	270000.0	4	1	2
## 7629	0	0	270000.0	4	1	2
## 7637	1	0	234000.0	4	2	2
## 7638	1	0	234000.0	4	2	2
## 7649	1	2	112500.0	4	3	2
## 7650	1	2	112500.0	4	3	2
## 7651	1	2	112500.0	4	3	2
## 7710	0	0	103500.0	4	3	2
## 7711	0	0	103500.0	4	3	2
## 7743	1	2	81000.0	2	3	2
## 7744	1	2	81000.0	2	3	2
## 7745	1	2	81000.0	2	3	2
## 7746	1	0	103500.0	4	3	2
## 7747	1	0	103500.0	4	3	2
## 7756	0	1	252000.0	4	2	2
## 7757	0	1	252000.0	4	2	2
## 7775	0	0	157500.0	4	3	4
## 7776	0	0	157500.0	4	3	4
## 7777	0	0	157500.0	4	3	4
## 7778	1	0	157500.0	4	3	2
## 7779	1	0	157500.0	4	3	2
## 7780	1	0	157500.0	4	3	2
## 7951	1	3	157500.0	4	1	2
## 8206	0	0	116653.5	4	2	2
## 8207	0	0	116653.5	4	2	2
## 8208	0	0	116653.5	4	2	2
## 8247	1	0	40500.0	4	2	2
## 8248	1	0	40500.0	4	2	2
## 8249	1	0	40500.0	4	2	2
## 8425	0	1	225000.0	5	2	3
## 8426	0	1	225000.0	5	2	3
## 8427	0	0	112500.0	2	2	2
## 8463	1	3	337500.0	5	2	2
## 8533	1	1	180000.0	3	2	2

## 8549	0	0	180000.0	5	4	2
## 8550	0	0	180000.0	5	4	2
## 8590	1	1	265500.0	5	2	4
## 8591	1	1	265500.0	5	2	4
## 8592	1	1	265500.0	5	2	4
## 8606	0	0	202500.0	3	3	4
## 8732	1	0	144000.0	5	2	2
## 8733	1	0	144000.0	5	2	2
## 8734	1	0	144000.0	5	2	2
## 8743	1	0	247500.0	4	5	2
## 8744	0	0	324000.0	4	3	2
## 8745	0	0	324000.0	4	3	2
## 8746	0	0	324000.0	4	3	2
## 8776	0	2	270000.0	5	2	2
## 8777	0	2	270000.0	5	2	2
## 8778	0	2	270000.0	5	2	2
## 8907	0	0	270000.0	4	2	4
## 8908	0	0	270000.0	4	2	4
## 8909	0	0	270000.0	4	2	4
## 8920	1	0	153000.0	4	4	4
## 8921	1	0	153000.0	4	4	4
## 8922	1	0	153000.0	4	4	4
## 8985	1	1	112500.0	4	1	2
## 9039	1	0	441000.0	4	2	2
## 9040	1	0	441000.0	4	2	2
## 9228	1	0	315000.0	4	2	4
## 9229	1	0	315000.0	4	2	4
## 9230	1	0	315000.0	4	2	4
## 9336	0	0	382500.0	4	2	3
## 9337	0	0	382500.0	4	2	3
## 9338	0	0	382500.0	4	2	3
## 9414	0	0	157500.0	4	5	2
## 9415	0	0	157500.0	4	5	2
## 9416	0	0	157500.0	4	5	2
## 9478	0	0	90000.0	5	3	4
## 9562	1	1	405000.0	5	5	2
## 9563	1	1	405000.0	5	5	2
## 9564	1	1	405000.0	5	5	2
## 9641	0	0	148500.0	4	1	2
## 9642	0	0	148500.0	4	1	2
## 9643	0	0	148500.0	4	1	2
## 9663	0	2	405000.0	4	2	6
## 9664	0	2	405000.0	4	2	6
## 9670	0	1	427500.0	4	2	2
## 9671	0	1	427500.0	4	2	2
## 9672	0	1	427500.0	4	2	2
## 9798	0	0	144000.0	4	2	2
## 9799	0	0	144000.0	4	2	2
## 9800	0	0	144000.0	4	2	2
## 9885	0	2	90000.0	4	2	3
## 9909	0	1	247500.0	5	3	2
## 9910	0	1	247500.0	5	3	2

```

## 9984      0      1  810000.0      4      2      2
## 9985      0      1  810000.0      4      2      2
## 9986      0      1  810000.0      4      2      2
##
## $`Location of Outlier`
##  [1] 1 2 8 9 10 20 21 63 64 77 223 224 240 250 251
## [16] 252 253 254 255 275 276 394 395 396 406 407 408 414 493 494
## [31] 555 556 559 560 561 562 575 576 642 643 654 698 699 702 703
## [46] 740 741 809 810 864 865 925 949 950 951 963 964 1008 1009 1014
## [61] 1039 1040 1041 1042 1043 1072 1073 1079 1080 1117 1123 1124 1125 1133 1140
## [76] 1141 1142 1143 1144 1145 1156 1193 1194 1311 1312 1313 1367 1368 1369 1370
## [91] 1371 1374 1480 1481 1482 1503 1530 1531 1532 1603 1638 1662 1674 1675 1676
## [106] 1728 1729 1730 1744 1745 1746 1750 1751 1802 1811 1812 1868 1869 1917 1918
## [121] 1919 1920 1921 1924 1925 1928 1929 1930 1967 1968 1969 1980 1981 1982 1983
## [136] 2003 2042 2043 2044 2045 2063 2077 2099 2100 2131 2132 2162 2196 2198 2199
## [151] 2200 2263 2264 2265 2282 2283 2298 2299 2319 2320 2321 2325 2326 2331 2332
## [166] 2380 2417 2418 2434 2435 2436 2497 2498 2499 2500 2501 2502 2521 2522 2523
## [181] 2557 2558 2559 2560 2630 2631 2632 2657 2658 2695 2696 2700 2764 2801 2802
## [196] 2808 2809 2810 2811 2812 2813 2830 2860 2861 2896 2897 2898 2914 2915 2919
## [211] 2920 2921 2922 2954 2955 3012 3041 3042 3078 3197 3198 3199 3218 3219 3220
## [226] 3331 3332 3333 3334 3346 3347 3352 3353 3354 3359 3360 3384 3385 3450 3451
## [241] 3490 3491 3495 3570 3583 3584 3632 3633 3652 3677 3678 3695 3696 3766 3767
## [256] 3786 3816 3857 3858 3859 4076 4205 4206 4207 4239 4240 4241 4341 4342 4343
## [271] 4444 4445 4446 4447 4448 4483 4484 4505 4519 4520 4521 4588 4625 4647 4652
## [286] 4653 4682 4683 4801 4802 4803 4806 4807 4808 4809 4810 4811 4815 4832 4849
## [301] 4871 4872 4873 4884 4885 4899 4922 4923 4924 4933 4934 4935 4936 5007 5008
## [316] 5064 5220 5221 5222 5285 5286 5287 5313 5314 5315 5363 5364 5365 5428 5461
## [331] 5462 5463 5464 5523 5524 5590 5591 5592 5689 5690 5784 5785 5786 5975 5976
## [346] 6051 6052 6053 6166 6167 6168 6219 6220 6275 6276 6343 6344 6345 6375 6409
## [361] 6410 6462 6463 6471 6540 6541 6542 6543 6544 6576 6577 6610 6673 6674 6685
## [376] 6717 6733 6734 6777 6778 6779 6780 6781 6782 6783 6834 6879 6880 6881 6967
## [391] 7009 7010 7011 7024 7025 7033 7034 7035 7079 7080 7081 7123 7124 7183 7184
## [406] 7185 7199 7200 7210 7211 7212 7267 7268 7269 7326 7367 7368 7369 7399 7400
## [421] 7401 7411 7412 7428 7434 7437 7487 7499 7500 7501 7521 7522 7628 7629 7637
## [436] 7638 7649 7650 7651 7710 7711 7743 7744 7745 7746 7747 7756 7757 7775 7776
## [451] 7777 7778 7779 7780 7951 8206 8207 8208 8247 8248 8249 8425 8426 8427 8463
## [466] 8533 8549 8550 8590 8591 8592 8606 8732 8733 8734 8743 8744 8745 8746 8776
## [481] 8777 8778 8907 8908 8909 8920 8921 8922 8985 9039 9040 9228 9229 9230 9336
## [496] 9337 9338 9414 9415 9416 9478 9562 9563 9564 9641 9642 9643 9663 9664 9670
## [511] 9671 9672 9798 9799 9800 9885 9909 9910 9984 9985 9986
##
## $`Outlier Probability`
##  [1] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.19 0.19
## [16] 0.19 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.19 0.19 0.19 1.00 1.00 1.00
## [31] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.19 0.19
## [46] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [61] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.19 0.19 0.19 1.00 0.19
## [76] 0.19 0.19 0.19 0.19 0.19 1.00 1.00 1.00 0.19 0.19 0.19 1.00 1.00 1.00 1.00 1.00
## [91] 1.00 1.00 0.19 0.19 0.19 1.00 0.19 0.19 0.19 1.00 1.00 1.00 0.19 0.19 0.19 0.19
## [106] 0.19 0.19 0.19 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.19 0.19
## [121] 0.19 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [136] 1.00 0.19 0.19 0.19 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.19 0.19 0.19

```

```
## [151] 0.19 0.19 0.19 0.19 1.00 1.00 1.00 1.00 0.19 0.19 0.19 1.00 1.00 1.00 1.00
## [166] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.19 0.19 0.19 1.00 1.00 1.00 1.00 1.00
## [181] 0.19 0.19 0.19 1.00 0.19 0.19 0.19 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [196] 0.19 0.19 0.19 0.19 0.19 0.19 1.00 1.00 1.00 0.19 0.19 0.19 1.00 1.00 1.00
## [211] 0.19 0.19 0.19 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.19 0.19 0.19
## [226] 0.19 0.19 0.19 1.00 0.19 0.19 0.19 0.19 0.19 1.00 1.00 1.00 1.00 1.00 1.00
## [241] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [256] 0.19 1.00 1.00 1.00 1.00 1.00 1.00 0.19 0.19 0.19 1.00 1.00 1.00 0.19 0.19
## [271] 0.19 0.19 0.19 1.00 1.00 1.00 1.00 1.00 0.19 0.19 0.19 1.00 1.00 1.00 1.00
## [286] 1.00 1.00 1.00 0.19 0.19 0.19 1.00 1.00 1.00 0.19 0.19 0.19 1.00 1.00 1.00
## [301] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [316] 1.00 1.00 1.00 1.00 0.19 0.19 0.19 1.00 1.00 1.00 0.19 0.19 0.19 1.00 1.00
## [331] 0.19 0.19 0.19 1.00 1.00 0.19 0.19 0.19 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [346] 0.19 0.19 0.19 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.19 0.19 0.19 1.00 1.00
## [361] 1.00 1.00 1.00 1.00 1.00 1.00 0.19 0.19 0.19 1.00 1.00 1.00 1.00 1.00 1.00
## [376] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.19 0.19 0.19 1.00
## [391] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.19 0.19 0.19 0.19 0.19 0.19 0.19
## [406] 0.19 1.00 1.00 1.00 1.00 1.00 0.19 0.19 0.19 1.00 1.00 1.00 1.00 0.19 0.19
## [421] 0.19 1.00 1.00 1.00 1.00 1.00 0.19 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [436] 1.00 0.19 0.19 0.19 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.19 0.19
## [451] 0.19 0.19 0.19 0.19 1.00 1.00 1.00 1.00 0.19 0.19 0.19 1.00 1.00 1.00 1.00
## [466] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.19 0.19 0.19 1.00 1.00 1.00 1.00 0.19
## [481] 0.19 0.19 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.19 0.19 0.19 1.00
## [496] 1.00 1.00 0.19 0.19 0.19 1.00 1.00 1.00 1.00 0.19 0.19 0.19 1.00 1.00 1.00
## [511] 1.00 1.00 0.19 0.19 0.19 1.00 1.00 1.00 1.00 1.00 1.00 1.00
```

When k is 4, there are 521 outliers.

c) Outlier detection using kth Nearest Neighbour Distance method

```
nnk(x,k=4)
```

```
## $`Outlier Observations`
```

```
##      gender num_child ann_income education marital housing
## 1         0         0  427500.0         5         1         1
## 2         0         0  427500.0         5         1         1
## 8         1         0  283500.0         5         4         2
## 9         1         0  283500.0         5         4         2
## 10        1         0  283500.0         5         4         2
## 20        1         0  130500.0         3         2         2
## 21        1         0  130500.0         3         2         2
## 63        1         1  211500.0         4         1         2
## 64        1         1  211500.0         4         1         2
## 77        1         0  315000.0         4         5         2
## 223       1         2  157500.0         4         3         2
## 224       1         2  157500.0         4         3         2
## 240       1         0   94500.0         5         2         2
## 250       1         0  270000.0         3         1         3
## 251       1         0  270000.0         3         1         3
## 252       1         0  270000.0         3         1         3
## 253       1         1  450000.0         5         2         2
## 254       1         1  450000.0         5         2         2
## 255       0         1  180000.0         4         2         4
## 275       1         0  315000.0         5         4         2
## 276       1         0  315000.0         5         4         2
## 394       1         0   74250.0         5         4         3
## 395       1         0   74250.0         5         4         3
## 396       1         0   74250.0         5         4         3
## 406       1         0  144000.0         4         3         2
## 407       1         0  144000.0         4         3         2
## 408       1         0  144000.0         4         3         2
## 414       1         0   40500.0         4         3         2
## 493       1         0  900000.0         5         3         2
## 494       1         0  900000.0         5         3         2
## 555       0         0  108000.0         4         3         5
## 556       0         0  108000.0         4         3         5
## 559       0         0  198000.0         4         3         4
## 560       0         0  198000.0         4         3         4
## 561       0         0  360000.0         5         2         3
## 562       0         0  360000.0         5         2         3
## 575       1         0  270000.0         3         1         2
## 576       1         0  270000.0         3         1         2
## 642       0         1  112500.0         4         4         5
## 643       0         1  112500.0         4         4         5
## 654       0         0  216000.0         4         2         2
## 698       1         0   45000.0         4         4         2
## 699       1         0   45000.0         4         4         2
## 702       1         0  112500.0         4         3         1
## 703       1         0  112500.0         4         3         1
## 740       0         1  144000.0         3         2         2
## 741       0         1  144000.0         3         2         2
## 809       1         0  135000.0         4         1         4
## 810       1         0  135000.0         4         1         4
## 864       0         2  445500.0         5         2         3
```

## 865	0	2	445500.0	5	2	3
## 925	0	0	225000.0	5	1	2
## 949	1	2	157500.0	5	2	2
## 950	1	2	157500.0	5	2	2
## 951	1	2	144000.0	4	2	3
## 963	0	0	270000.0	4	3	2
## 964	0	0	270000.0	4	3	2
## 1008	1	0	135000.0	3	3	2
## 1009	1	2	99000.0	4	2	2
## 1014	0	0	90000.0	4	1	2
## 1039	0	0	495000.0	5	3	2
## 1040	0	0	495000.0	5	3	2
## 1041	0	0	495000.0	5	3	2
## 1042	0	2	157500.0	4	2	6
## 1043	0	2	157500.0	4	2	6
## 1072	1	0	99000.0	5	3	4
## 1073	1	0	99000.0	5	3	4
## 1079	0	0	85500.0	4	2	2
## 1080	0	0	85500.0	4	2	2
## 1117	1	0	279000.0	5	3	2
## 1123	0	2	157500.0	4	2	3
## 1124	0	2	157500.0	4	2	3
## 1125	0	2	157500.0	4	2	3
## 1133	1	0	112500.0	3	3	4
## 1140	1	2	306000.0	5	2	2
## 1141	1	2	306000.0	5	2	2
## 1142	1	2	306000.0	5	2	2
## 1143	1	0	166500.0	4	2	2
## 1144	1	0	166500.0	4	2	2
## 1145	1	0	166500.0	4	2	2
## 1156	1	1	67500.0	4	2	3
## 1193	0	0	202500.0	2	2	2
## 1194	0	0	202500.0	2	2	2
## 1311	1	0	99000.0	4	3	2
## 1312	1	0	99000.0	4	3	2
## 1313	1	0	99000.0	4	3	2
## 1367	1	0	126000.0	4	3	4
## 1368	0	1	180000.0	3	2	4
## 1369	0	1	180000.0	3	2	4
## 1370	1	0	310500.0	5	3	2
## 1371	1	0	310500.0	5	3	2
## 1374	1	2	67500.0	4	4	2
## 1480	0	0	135000.0	5	1	2
## 1481	0	0	135000.0	5	1	2
## 1482	0	0	135000.0	5	1	2
## 1503	1	1	90000.0	4	4	1
## 1530	1	0	76500.0	4	1	2
## 1531	1	0	76500.0	4	1	2
## 1532	1	0	76500.0	4	1	2
## 1603	1	0	184500.0	4	2	2
## 1638	0	0	180000.0	5	3	2
## 1662	1	2	225000.0	4	1	2

## 1674	0	0	99000.0	4	3	2
## 1675	0	0	99000.0	4	3	2
## 1676	0	0	99000.0	4	3	2
## 1728	1	0	162000.0	4	2	2
## 1729	1	0	162000.0	4	2	2
## 1730	1	0	162000.0	4	2	2
## 1744	1	0	135000.0	5	2	4
## 1745	1	0	135000.0	5	2	4
## 1746	1	0	135000.0	5	2	4
## 1750	1	0	165150.0	5	2	2
## 1751	1	0	165150.0	5	2	2
## 1802	0	2	139500.0	4	2	2
## 1811	1	0	54000.0	2	2	2
## 1812	1	0	54000.0	2	2	2
## 1868	1	0	94500.0	4	5	1
## 1869	1	0	94500.0	4	5	1
## 1917	0	0	126000.0	5	2	2
## 1918	0	0	126000.0	5	2	2
## 1919	0	0	126000.0	5	2	2
## 1920	1	0	67500.0	4	4	3
## 1921	1	0	67500.0	4	4	3
## 1924	0	1	270000.0	3	2	2
## 1925	0	1	270000.0	3	2	2
## 1928	1	0	121500.0	5	3	1
## 1929	1	0	121500.0	5	3	1
## 1930	1	0	121500.0	5	3	1
## 1967	1	1	135000.0	1	1	2
## 1968	1	1	135000.0	1	1	2
## 1969	1	1	135000.0	1	1	2
## 1980	1	1	33300.0	4	2	2
## 1981	1	1	33300.0	4	2	2
## 1982	0	2	697500.0	5	4	2
## 1983	0	2	697500.0	5	4	2
## 2003	1	1	198000.0	4	2	2
## 2042	0	1	675000.0	5	2	2
## 2043	0	1	675000.0	5	2	2
## 2044	0	1	675000.0	5	2	2
## 2045	1	0	54000.0	4	4	2
## 2063	1	0	225000.0	5	3	4
## 2077	0	0	171000.0	5	1	2
## 2099	1	2	112500.0	5	1	2
## 2100	1	2	112500.0	5	1	2
## 2131	1	0	135000.0	3	3	1
## 2132	1	0	135000.0	3	3	1
## 2162	0	1	472500.0	5	2	4
## 2196	0	0	112500.0	4	1	2
## 2198	1	0	67500.0	4	2	3
## 2199	1	0	67500.0	4	2	3
## 2200	1	0	67500.0	4	2	3
## 2263	1	0	126000.0	5	3	2
## 2264	1	0	126000.0	5	3	2
## 2265	1	0	126000.0	5	3	2

## 2282	1	0	196650.0	4	2	2
## 2283	1	0	196650.0	4	2	2
## 2298	1	1	166500.0	5	2	2
## 2299	1	1	166500.0	5	2	2
## 2319	0	0	135000.0	4	1	4
## 2320	0	0	135000.0	4	1	4
## 2321	0	0	135000.0	4	1	4
## 2325	1	1	157500.0	4	2	3
## 2326	1	1	157500.0	4	2	3
## 2331	0	4	292500.0	4	2	2
## 2332	0	4	292500.0	4	2	2
## 2380	0	1	202500.0	4	4	2
## 2417	0	1	306000.0	4	2	2
## 2418	0	1	306000.0	4	2	2
## 2434	0	1	189000.0	4	2	3
## 2435	1	0	270000.0	3	2	2
## 2436	1	0	99000.0	4	1	2
## 2497	0	1	225000.0	3	2	2
## 2498	0	1	225000.0	3	2	2
## 2499	0	1	225000.0	3	2	2
## 2500	0	2	337500.0	3	2	2
## 2501	0	2	337500.0	3	2	2
## 2502	0	2	337500.0	3	2	2
## 2521	1	1	243000.0	5	2	2
## 2522	1	1	243000.0	5	2	2
## 2523	1	1	243000.0	5	2	2
## 2557	1	0	171000.0	3	2	2
## 2558	1	0	171000.0	3	2	2
## 2559	1	0	171000.0	3	2	2
## 2560	1	0	432000.0	3	2	2
## 2630	1	1	90000.0	4	1	2
## 2631	1	1	90000.0	4	1	2
## 2632	1	1	90000.0	4	1	2
## 2657	0	0	171000.0	4	3	1
## 2658	0	0	171000.0	4	3	1
## 2695	1	1	76500.0	4	2	3
## 2696	1	1	76500.0	4	2	3
## 2700	1	2	135000.0	5	4	2
## 2764	1	0	257625.0	4	1	2
## 2801	0	0	143100.0	4	2	2
## 2802	0	0	143100.0	4	2	2
## 2808	1	1	225000.0	4	4	2
## 2809	1	1	225000.0	4	4	2
## 2810	1	1	225000.0	4	4	2
## 2811	0	0	135000.0	4	2	6
## 2812	0	0	135000.0	4	2	6
## 2813	0	0	135000.0	4	2	6
## 2830	1	0	216000.0	5	2	4
## 2860	1	0	94500.0	4	3	1
## 2861	1	0	94500.0	4	3	1
## 2896	1	0	207000.0	4	3	2
## 2897	1	0	207000.0	4	3	2

## 2898	1	0	207000.0	4	3	2
## 2914	1	0	288000.0	4	4	2
## 2915	1	0	288000.0	4	4	2
## 2919	0	0	45000.0	2	2	2
## 2920	1	0	135000.0	4	3	3
## 2921	1	0	135000.0	4	3	3
## 2922	1	0	135000.0	4	3	3
## 2954	1	0	315000.0	5	4	4
## 2955	1	0	315000.0	5	4	4
## 3012	1	0	166500.0	4	3	6
## 3041	1	2	189000.0	4	2	2
## 3042	1	2	189000.0	4	2	2
## 3078	1	0	54000.0	4	5	2
## 3197	1	1	720000.0	5	2	2
## 3198	1	1	720000.0	5	2	2
## 3199	1	1	720000.0	5	2	2
## 3218	0	0	225000.0	4	2	4
## 3219	0	0	225000.0	4	2	4
## 3220	0	0	225000.0	4	2	4
## 3331	1	0	247500.0	4	3	2
## 3332	1	0	247500.0	4	3	2
## 3333	1	0	247500.0	4	3	2
## 3334	1	1	157500.0	4	3	4
## 3346	1	1	315000.0	5	2	2
## 3347	1	1	315000.0	5	2	2
## 3352	1	0	157500.0	4	4	4
## 3353	1	0	157500.0	4	4	4
## 3354	1	0	157500.0	4	4	4
## 3359	1	0	135000.0	3	1	2
## 3360	1	0	135000.0	3	1	2
## 3384	0	3	360000.0	4	2	2
## 3385	0	3	360000.0	4	2	2
## 3450	0	0	135000.0	4	3	1
## 3451	0	0	135000.0	4	3	1
## 3490	1	0	202500.0	5	3	1
## 3491	1	0	202500.0	5	3	1
## 3495	1	0	67500.0	4	3	2
## 3570	0	1	135000.0	2	2	2
## 3583	0	0	135000.0	3	3	4
## 3584	0	0	135000.0	3	3	4
## 3632	1	0	99900.0	4	5	2
## 3633	1	0	99900.0	4	5	2
## 3652	0	0	112500.0	4	1	4
## 3677	1	2	202500.0	4	1	5
## 3678	1	2	202500.0	4	1	5
## 3695	1	0	81000.0	2	2	2
## 3696	1	0	81000.0	2	2	2
## 3766	1	0	153000.0	2	2	2
## 3767	1	0	153000.0	2	2	2
## 3786	1	1	315000.0	5	2	2
## 3816	0	0	270000.0	4	4	2
## 3857	1	0	76500.0	4	5	2

## 3858	1	0	76500.0	4	5	2
## 3859	1	0	76500.0	4	5	2
## 4076	1	0	81000.0	4	2	3
## 4205	1	0	117000.0	4	1	2
## 4206	1	0	117000.0	4	1	2
## 4207	1	0	117000.0	4	1	2
## 4239	1	0	90000.0	4	3	4
## 4240	1	0	216000.0	5	1	2
## 4241	1	0	216000.0	5	1	2
## 4341	0	1	247500.0	5	2	2
## 4342	0	1	247500.0	5	2	2
## 4343	0	1	247500.0	5	2	2
## 4444	0	0	405000.0	5	2	2
## 4445	0	0	405000.0	5	2	2
## 4446	0	0	405000.0	5	2	2
## 4447	0	0	49500.0	4	3	2
## 4448	0	0	49500.0	4	3	2
## 4483	1	0	189000.0	4	4	2
## 4484	1	0	189000.0	4	4	2
## 4505	1	2	184500.0	4	2	2
## 4519	1	0	157500.0	5	2	1
## 4520	1	0	157500.0	5	2	1
## 4521	1	0	157500.0	5	2	1
## 4588	0	0	112500.0	5	2	2
## 4625	0	1	135000.0	4	2	3
## 4647	1	1	108000.0	5	4	2
## 4652	0	0	292500.0	4	2	4
## 4653	0	0	292500.0	4	2	4
## 4682	1	0	90000.0	3	3	2
## 4683	1	0	90000.0	3	3	2
## 4801	1	0	247500.0	4	4	2
## 4802	1	0	247500.0	4	4	2
## 4803	1	0	247500.0	4	4	2
## 4806	0	1	630000.0	5	2	2
## 4807	1	1	148500.0	4	4	4
## 4808	0	1	121500.0	4	3	2
## 4809	0	0	162000.0	4	3	2
## 4810	0	0	162000.0	4	3	2
## 4811	0	0	162000.0	4	3	2
## 4815	1	1	65250.0	4	1	2
## 4832	1	0	67500.0	3	4	2
## 4849	1	0	216000.0	4	5	2
## 4871	0	0	198000.0	4	2	2
## 4872	0	0	198000.0	4	2	2
## 4873	0	0	198000.0	4	2	2
## 4884	1	0	139500.0	5	1	2
## 4885	1	0	139500.0	5	1	2
## 4899	1	2	112500.0	5	2	2
## 4922	1	0	76500.0	4	3	4
## 4923	1	0	76500.0	4	3	4
## 4924	1	0	76500.0	4	3	4
## 4933	1	1	90000.0	3	2	2

## 4934	1	1	90000.0	3	2	2
## 4935	0	0	360000.0	5	3	2
## 4936	0	0	360000.0	5	3	2
## 5007	0	0	495000.0	4	2	2
## 5008	0	0	495000.0	4	2	2
## 5064	1	2	157500.0	2	1	2
## 5220	0	0	207000.0	4	3	2
## 5221	0	0	207000.0	4	3	2
## 5222	0	0	162000.0	5	2	2
## 5285	1	1	247500.0	4	2	2
## 5286	1	1	247500.0	4	2	2
## 5287	1	1	247500.0	4	2	2
## 5313	0	1	112500.0	3	2	4
## 5314	0	1	112500.0	3	2	4
## 5315	0	1	112500.0	3	2	4
## 5363	0	0	63000.0	4	2	2
## 5364	0	0	63000.0	4	2	2
## 5365	0	0	63000.0	4	2	2
## 5428	0	0	180000.0	4	3	1
## 5461	0	0	38250.0	2	2	2
## 5462	0	0	99000.0	4	1	2
## 5463	0	0	99000.0	4	1	2
## 5464	0	0	99000.0	4	1	2
## 5523	0	3	90000.0	4	2	2
## 5524	0	3	90000.0	4	2	2
## 5590	1	2	247500.0	4	2	2
## 5591	1	2	247500.0	4	2	2
## 5592	1	2	247500.0	4	2	2
## 5689	0	1	180000.0	5	2	2
## 5690	0	1	180000.0	5	2	2
## 5784	0	0	360000.0	3	3	3
## 5785	0	0	360000.0	3	3	3
## 5786	0	0	360000.0	3	3	3
## 5975	1	3	67500.0	5	2	2
## 5976	1	3	67500.0	5	2	2
## 6051	0	1	144000.0	5	2	2
## 6052	0	1	144000.0	5	2	2
## 6053	0	1	144000.0	5	2	2
## 6166	1	1	94500.0	5	3	2
## 6167	1	1	94500.0	5	3	2
## 6168	1	1	94500.0	5	3	2
## 6219	1	0	94500.0	4	1	2
## 6220	1	0	94500.0	4	1	2
## 6275	0	2	270000.0	3	2	2
## 6276	0	2	270000.0	3	2	2
## 6343	1	0	180000.0	3	2	2
## 6344	1	0	180000.0	3	2	2
## 6345	1	0	180000.0	3	2	2
## 6375	1	1	270000.0	5	3	2
## 6409	1	1	112500.0	4	5	2
## 6410	1	1	112500.0	4	5	2
## 6462	0	2	130500.0	4	2	2

## 6463	0	2	130500.0	4	2	2
## 6471	1	1	112500.0	4	1	4
## 6540	0	3	225000.0	4	2	3
## 6541	0	3	225000.0	4	2	3
## 6542	0	0	225000.0	4	3	4
## 6543	0	0	225000.0	4	3	4
## 6544	0	0	225000.0	4	3	4
## 6576	1	0	72000.0	4	3	2
## 6577	1	0	72000.0	4	3	2
## 6610	1	0	36000.0	4	4	3
## 6673	0	2	148500.0	4	2	2
## 6674	0	2	148500.0	4	2	2
## 6685	1	0	90000.0	5	5	2
## 6717	1	1	270000.0	5	2	2
## 6733	0	0	81000.0	4	1	2
## 6734	0	0	81000.0	4	1	2
## 6777	1	1	135000.0	4	3	3
## 6778	1	1	135000.0	4	3	3
## 6779	0	1	189000.0	4	2	2
## 6780	0	1	315000.0	5	2	5
## 6781	0	1	315000.0	5	2	5
## 6782	0	1	315000.0	5	2	5
## 6783	0	1	112500.0	4	2	1
## 6834	1	0	180000.0	5	1	2
## 6879	0	1	315000.0	4	2	1
## 6880	0	1	315000.0	4	2	1
## 6881	0	1	315000.0	4	2	1
## 6967	1	1	126000.0	4	2	2
## 7009	0	1	202500.0	2	3	2
## 7010	0	1	202500.0	2	3	2
## 7011	0	1	202500.0	2	3	2
## 7024	0	1	99000.0	4	3	2
## 7025	0	1	99000.0	4	3	2
## 7033	0	0	67500.0	5	3	2
## 7034	0	0	67500.0	5	3	2
## 7035	0	0	67500.0	5	3	2
## 7079	0	0	76500.0	5	2	2
## 7080	0	0	76500.0	5	2	2
## 7081	0	0	76500.0	5	2	2
## 7123	0	0	112500.0	4	1	2
## 7124	0	0	112500.0	4	1	2
## 7183	1	0	189000.0	5	3	2
## 7184	1	0	189000.0	5	3	2
## 7185	1	0	189000.0	5	3	2
## 7199	0	1	337500.0	5	2	2
## 7200	0	1	337500.0	5	2	2
## 7210	0	0	225000.0	4	2	6
## 7211	0	0	225000.0	4	2	6
## 7212	0	0	225000.0	4	2	6
## 7267	1	0	292500.0	5	5	2
## 7268	1	0	292500.0	5	5	2
## 7269	1	0	292500.0	5	5	2

## 7326	1	1	225000.0	4	3	6
## 7367	0	0	99000.0	3	1	1
## 7368	0	0	99000.0	3	1	1
## 7369	0	0	99000.0	3	1	1
## 7399	0	0	540000.0	5	2	2
## 7400	0	0	540000.0	5	2	2
## 7401	0	0	540000.0	5	2	2
## 7411	1	2	148500.0	4	2	2
## 7412	1	2	148500.0	4	2	2
## 7428	0	1	180000.0	4	3	2
## 7434	1	2	157500.0	4	1	2
## 7437	1	1	118350.0	5	1	2
## 7487	1	0	112500.0	4	3	1
## 7499	1	0	139500.0	5	2	4
## 7500	1	0	139500.0	5	2	4
## 7501	1	0	139500.0	5	2	4
## 7521	0	1	63000.0	4	3	2
## 7522	0	1	63000.0	4	3	2
## 7628	0	0	270000.0	4	1	2
## 7629	0	0	270000.0	4	1	2
## 7637	1	0	234000.0	4	2	2
## 7638	1	0	234000.0	4	2	2
## 7649	1	2	112500.0	4	3	2
## 7650	1	2	112500.0	4	3	2
## 7651	1	2	112500.0	4	3	2
## 7710	0	0	103500.0	4	3	2
## 7711	0	0	103500.0	4	3	2
## 7743	1	2	81000.0	2	3	2
## 7744	1	2	81000.0	2	3	2
## 7745	1	2	81000.0	2	3	2
## 7746	1	0	103500.0	4	3	2
## 7747	1	0	103500.0	4	3	2
## 7756	0	1	252000.0	4	2	2
## 7757	0	1	252000.0	4	2	2
## 7775	0	0	157500.0	4	3	4
## 7776	0	0	157500.0	4	3	4
## 7777	0	0	157500.0	4	3	4
## 7778	1	0	157500.0	4	3	2
## 7779	1	0	157500.0	4	3	2
## 7780	1	0	157500.0	4	3	2
## 7951	1	3	157500.0	4	1	2
## 8206	0	0	116653.5	4	2	2
## 8207	0	0	116653.5	4	2	2
## 8208	0	0	116653.5	4	2	2
## 8247	1	0	40500.0	4	2	2
## 8248	1	0	40500.0	4	2	2
## 8249	1	0	40500.0	4	2	2
## 8425	0	1	225000.0	5	2	3
## 8426	0	1	225000.0	5	2	3
## 8427	0	0	112500.0	2	2	2
## 8463	1	3	337500.0	5	2	2
## 8533	1	1	180000.0	3	2	2

## 8549	0	0	180000.0	5	4	2
## 8550	0	0	180000.0	5	4	2
## 8590	1	1	265500.0	5	2	4
## 8591	1	1	265500.0	5	2	4
## 8592	1	1	265500.0	5	2	4
## 8606	0	0	202500.0	3	3	4
## 8732	1	0	144000.0	5	2	2
## 8733	1	0	144000.0	5	2	2
## 8734	1	0	144000.0	5	2	2
## 8743	1	0	247500.0	4	5	2
## 8744	0	0	324000.0	4	3	2
## 8745	0	0	324000.0	4	3	2
## 8746	0	0	324000.0	4	3	2
## 8776	0	2	270000.0	5	2	2
## 8777	0	2	270000.0	5	2	2
## 8778	0	2	270000.0	5	2	2
## 8907	0	0	270000.0	4	2	4
## 8908	0	0	270000.0	4	2	4
## 8909	0	0	270000.0	4	2	4
## 8920	1	0	153000.0	4	4	4
## 8921	1	0	153000.0	4	4	4
## 8922	1	0	153000.0	4	4	4
## 8985	1	1	112500.0	4	1	2
## 9039	1	0	441000.0	4	2	2
## 9040	1	0	441000.0	4	2	2
## 9228	1	0	315000.0	4	2	4
## 9229	1	0	315000.0	4	2	4
## 9230	1	0	315000.0	4	2	4
## 9336	0	0	382500.0	4	2	3
## 9337	0	0	382500.0	4	2	3
## 9338	0	0	382500.0	4	2	3
## 9414	0	0	157500.0	4	5	2
## 9415	0	0	157500.0	4	5	2
## 9416	0	0	157500.0	4	5	2
## 9478	0	0	90000.0	5	3	4
## 9562	1	1	405000.0	5	5	2
## 9563	1	1	405000.0	5	5	2
## 9564	1	1	405000.0	5	5	2
## 9641	0	0	148500.0	4	1	2
## 9642	0	0	148500.0	4	1	2
## 9643	0	0	148500.0	4	1	2
## 9663	0	2	405000.0	4	2	6
## 9664	0	2	405000.0	4	2	6
## 9670	0	1	427500.0	4	2	2
## 9671	0	1	427500.0	4	2	2
## 9672	0	1	427500.0	4	2	2
## 9798	0	0	144000.0	4	2	2
## 9799	0	0	144000.0	4	2	2
## 9800	0	0	144000.0	4	2	2
## 9885	0	2	90000.0	4	2	3
## 9909	0	1	247500.0	5	3	2
## 9910	0	1	247500.0	5	3	2

```

## 9984      0      1  810000.0      4      2      2
## 9985      0      1  810000.0      4      2      2
## 9986      0      1  810000.0      4      2      2
##
## $`Location of Outlier`
##  [1] 1 2 8 9 10 20 21 63 64 77 223 224 240 250 251
## [16] 252 253 254 255 275 276 394 395 396 406 407 408 414 493 494
## [31] 555 556 559 560 561 562 575 576 642 643 654 698 699 702 703
## [46] 740 741 809 810 864 865 925 949 950 951 963 964 1008 1009 1014
## [61] 1039 1040 1041 1042 1043 1072 1073 1079 1080 1117 1123 1124 1125 1133 1140
## [76] 1141 1142 1143 1144 1145 1156 1193 1194 1311 1312 1313 1367 1368 1369 1370
## [91] 1371 1374 1480 1481 1482 1503 1530 1531 1532 1603 1638 1662 1674 1675 1676
## [106] 1728 1729 1730 1744 1745 1746 1750 1751 1802 1811 1812 1868 1869 1917 1918
## [121] 1919 1920 1921 1924 1925 1928 1929 1930 1967 1968 1969 1980 1981 1982 1983
## [136] 2003 2042 2043 2044 2045 2063 2077 2099 2100 2131 2132 2162 2196 2198 2199
## [151] 2200 2263 2264 2265 2282 2283 2298 2299 2319 2320 2321 2325 2326 2331 2332
## [166] 2380 2417 2418 2434 2435 2436 2497 2498 2499 2500 2501 2502 2521 2522 2523
## [181] 2557 2558 2559 2560 2630 2631 2632 2657 2658 2695 2696 2700 2764 2801 2802
## [196] 2808 2809 2810 2811 2812 2813 2830 2860 2861 2896 2897 2898 2914 2915 2919
## [211] 2920 2921 2922 2954 2955 3012 3041 3042 3078 3197 3198 3199 3218 3219 3220
## [226] 3331 3332 3333 3334 3346 3347 3352 3353 3354 3359 3360 3384 3385 3450 3451
## [241] 3490 3491 3495 3570 3583 3584 3632 3633 3652 3677 3678 3695 3696 3766 3767
## [256] 3786 3816 3857 3858 3859 4076 4205 4206 4207 4239 4240 4241 4341 4342 4343
## [271] 4444 4445 4446 4447 4448 4483 4484 4505 4519 4520 4521 4588 4625 4647 4652
## [286] 4653 4682 4683 4801 4802 4803 4806 4807 4808 4809 4810 4811 4815 4832 4849
## [301] 4871 4872 4873 4884 4885 4899 4922 4923 4924 4933 4934 4935 4936 5007 5008
## [316] 5064 5220 5221 5222 5285 5286 5287 5313 5314 5315 5363 5364 5365 5428 5461
## [331] 5462 5463 5464 5523 5524 5590 5591 5592 5689 5690 5784 5785 5786 5975 5976
## [346] 6051 6052 6053 6166 6167 6168 6219 6220 6275 6276 6343 6344 6345 6375 6409
## [361] 6410 6462 6463 6471 6540 6541 6542 6543 6544 6576 6577 6610 6673 6674 6685
## [376] 6717 6733 6734 6777 6778 6779 6780 6781 6782 6783 6834 6879 6880 6881 6967
## [391] 7009 7010 7011 7024 7025 7033 7034 7035 7079 7080 7081 7123 7124 7183 7184
## [406] 7185 7199 7200 7210 7211 7212 7267 7268 7269 7326 7367 7368 7369 7399 7400
## [421] 7401 7411 7412 7428 7434 7437 7487 7499 7500 7501 7521 7522 7628 7629 7637
## [436] 7638 7649 7650 7651 7710 7711 7743 7744 7745 7746 7747 7756 7757 7775 7776
## [451] 7777 7778 7779 7780 7951 8206 8207 8208 8247 8248 8249 8425 8426 8427 8463
## [466] 8533 8549 8550 8590 8591 8592 8606 8732 8733 8734 8743 8744 8745 8746 8776
## [481] 8777 8778 8907 8908 8909 8920 8921 8922 8985 9039 9040 9228 9229 9230 9336
## [496] 9337 9338 9414 9415 9416 9478 9562 9563 9564 9641 9642 9643 9663 9664 9670
## [511] 9671 9672 9798 9799 9800 9885 9909 9910 9984 9985 9986
##
## $`Outlier Probability`
##  [1] 1.00 1.00 1.00 1.00 1.00 0.17 0.17 1.00 1.00 0.17 0.17 0.17 0.17 0.17 0.17
## [16] 0.17 0.17 0.17 0.17 0.17 0.17 1.00 1.00 1.00 0.17 0.17 0.17 0.17 1.00 1.00
## [31] 1.00 1.00 1.00 1.00 0.17 0.17 0.17 0.17 0.17 0.17 0.17 1.00 1.00 0.17 0.17
## [46] 0.17 0.17 0.17 0.17 1.00 1.00 0.17 0.17 0.17 0.17 0.17 0.17 0.17 0.17 0.17
## [61] 1.00 1.00 1.00 0.17 0.17 1.00 1.00 0.17 0.17 0.17 0.17 0.17 0.17 1.00 0.17
## [76] 0.17 0.17 0.17 0.17 0.17 0.17 1.00 1.00 0.17 0.17 0.17 1.00 0.17 0.17 0.17
## [91] 0.17 1.00 0.17 0.17 0.17 1.00 0.17 0.17 0.17 0.17 0.17 0.17 0.17 0.17 0.17
## [106] 0.17 0.17 0.17 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.17 0.17
## [121] 0.17 1.00 1.00 0.17 0.17 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [136] 1.00 0.17 0.17 0.17 1.00 0.17 1.00 0.17 0.17 1.00 1.00 1.00 0.17 0.17 0.17

```



```
## [151] 0.17 0.17 0.17 0.17 1.00 1.00 0.17 0.17 0.17 0.17 0.17 0.17 0.17 1.00 1.00
## [166] 0.17 1.00 1.00 1.00 0.17 0.17 0.17 0.17 0.17 1.00 1.00 1.00 1.00 1.00 1.00
## [181] 0.17 0.17 0.17 1.00 0.17 0.17 0.17 1.00 1.00 0.17 0.17 0.17 1.00 1.00 1.00
## [196] 0.17 0.17 0.17 0.17 0.17 0.17 0.17 1.00 1.00 0.17 0.17 0.17 1.00 1.00 1.00
## [211] 0.17 0.17 0.17 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.17 0.17 0.17
## [226] 0.17 0.17 0.17 1.00 0.17 0.17 0.17 0.17 0.17 0.17 0.17 0.17 0.17 0.17 0.17
## [241] 0.17 0.17 0.17 0.17 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.17 0.17
## [256] 0.17 0.17 1.00 1.00 1.00 0.17 0.17 0.17 0.17 0.17 1.00 1.00 0.17 0.17 0.17
## [271] 0.17 0.17 0.17 1.00 1.00 0.17 0.17 0.17 0.17 0.17 0.17 0.17 0.17 1.00 1.00
## [286] 1.00 0.17 0.17 0.17 0.17 0.17 1.00 1.00 0.17 0.17 0.17 0.17 1.00 1.00 1.00
## [301] 1.00 1.00 1.00 1.00 1.00 0.17 1.00 1.00 1.00 0.17 0.17 0.17 0.17 0.17 0.17
## [316] 0.17 0.17 0.17 0.17 0.17 0.17 0.17 1.00 1.00 1.00 0.17 0.17 0.17 0.17 1.00
## [331] 0.17 0.17 0.17 1.00 1.00 0.17 0.17 0.17 0.17 0.17 0.17 1.00 1.00 0.17 0.17
## [346] 0.17 0.17 0.17 1.00 1.00 1.00 0.17 0.17 0.17 0.17 0.17 0.17 0.17 0.17 0.17
## [361] 0.17 1.00 1.00 1.00 1.00 1.00 0.17 0.17 0.17 0.17 0.17 1.00 0.17 0.17 0.17
## [376] 0.17 0.17 0.17 0.17 0.17 0.17 1.00 1.00 1.00 0.17 0.17 0.17 0.17 0.17 0.17
## [391] 1.00 1.00 1.00 0.17 0.17 1.00 1.00 1.00 0.17 0.17 0.17 0.17 0.17 0.17 0.17
## [406] 0.17 0.17 0.17 1.00 1.00 1.00 0.17 0.17 0.17 1.00 1.00 1.00 1.00 0.17 0.17
## [421] 0.17 0.17 0.17 0.17 0.17 1.00 0.17 1.00 1.00 1.00 0.17 0.17 0.17 0.17 1.00
## [436] 1.00 0.17 0.17 0.17 0.17 0.17 1.00 1.00 1.00 0.17 0.17 0.17 0.17 0.17 0.17
## [451] 0.17 0.17 0.17 0.17 1.00 1.00 1.00 1.00 0.17 0.17 0.17 0.17 0.17 0.17 1.00
## [466] 0.17 0.17 0.17 1.00 1.00 1.00 0.17 0.17 0.17 0.17 0.17 1.00 1.00 1.00 0.17
## [481] 0.17 0.17 1.00 1.00 1.00 1.00 1.00 1.00 0.17 1.00 1.00 0.17 0.17 0.17 1.00
## [496] 1.00 1.00 0.17 0.17 0.17 1.00 1.00 1.00 1.00 0.17 0.17 0.17 1.00 1.00 1.00
## [511] 1.00 1.00 0.17 0.17 0.17 1.00 0.17 0.17 1.00 1.00 1.00
```

When k is 4, there are 521 outliers.

5. Density-based Approaches

a) Outlier detection using Robust Kernel-based Outlier Factor(RKOF) algorithm

This method is not suitable for our data set, so we would not use it here.

b) Outlier detection using genralised dispersion

```
x<-newdata[,2:7]
disp(x,cutoff=0.99)
```

```
## $`Outlier Observations`
```

```
##      gender num_child ann_income education marital housing
## 268      0         1      765000         5         2         2
## 269      0         1      765000         5         2         2
## 270      0         1      765000         5         2         2
## 271      0         1      765000         5         2         2
## 285      1         0      157500         5         4         4
## 286      1         0      157500         5         4         4
## 287      1         0      157500         5         4         4
## 288      1         0      157500         5         4         4
## 289      1         0      157500         5         4         4
## 290      1         0      157500         5         4         4
## 291      1         0      157500         5         4         4
## 292      1         0      157500         5         4         4
## 293      1         0      157500         5         4         4
## 294      1         0      157500         5         4         4
## 295      1         0      157500         5         4         4
## 296      1         0      157500         5         4         4
## 297      1         0      157500         5         4         4
## 298      1         0      157500         5         4         4
## 299      1         0      157500         5         4         4
## 338      0         0      229500         3         2         5
## 339      0         0      229500         3         2         5
## 340      0         0      229500         3         2         5
## 341      0         0      229500         3         2         5
## 342      0         0      229500         3         2         5
## 343      0         0      229500         3         2         5
## 344      0         0      229500         3         2         5
## 345      0         0      229500         3         2         5
## 487      0         0      180000         2         2         2
## 488      0         0      180000         2         2         2
## 489      0         0      180000         2         2         2
## 490      0         0      180000         2         2         2
## 493      1         0      900000         5         3         2
## 494      1         0      900000         5         3         2
## 555      0         0      108000         4         3         5
## 556      0         0      108000         4         3         5
## 642      0         1      112500         4         4         5
## 643      0         1      112500         4         4         5
## 793      0         0      1350000        5         2         3
## 794      0         0      1350000        5         2         3
## 795      0         0      1350000        5         2         3
## 796      0         0      1350000        5         2         3
## 797      0         0      1350000        5         2         3
## 798      0         0      1350000        5         2         3
## 799      0         0      1350000        5         2         3
## 929      0         0      360000         4         4         4
## 930      0         0      360000         4         4         4
## 931      0         0      360000         4         4         4
## 932      0         0      360000         4         4         4
## 933      0         0      360000         4         4         4
## 934      0         0      360000         4         4         4
```

## 935	0	0	360000	4	4	4
## 936	0	0	360000	4	4	4
## 937	0	0	360000	4	4	4
## 938	0	0	360000	4	4	4
## 1042	0	2	157500	4	2	6
## 1043	0	2	157500	4	2	6
## 1133	1	0	112500	3	3	4
## 1193	0	0	202500	2	2	2
## 1194	0	0	202500	2	2	2
## 1228	0	0	135000	2	2	4
## 1229	0	0	135000	2	2	4
## 1230	0	0	135000	2	2	4
## 1231	0	0	135000	2	2	4
## 1232	0	0	135000	2	2	4
## 1233	0	0	135000	2	2	4
## 1234	0	0	135000	2	2	4
## 1235	0	0	135000	2	2	4
## 1236	0	0	135000	2	2	4
## 1237	0	0	135000	2	2	4
## 1277	0	1	562500	3	2	2
## 1278	0	1	562500	3	2	2
## 1279	0	1	562500	3	2	2
## 1280	0	1	562500	3	2	2
## 1281	0	1	562500	3	2	2
## 1282	0	1	562500	3	2	2
## 1283	0	1	562500	3	2	2
## 1284	0	1	562500	3	2	2
## 1285	0	1	562500	3	2	2
## 1286	0	1	562500	3	2	2
## 1287	0	1	562500	3	2	2
## 1288	0	1	562500	3	2	2
## 1289	0	1	562500	3	2	2
## 1290	0	1	562500	3	2	2
## 1291	0	1	562500	3	2	2
## 1292	0	1	562500	3	2	2
## 1293	0	1	562500	3	2	2
## 1294	0	1	562500	3	2	2
## 1295	0	1	562500	3	2	2
## 1296	0	1	562500	3	2	2
## 1297	0	1	562500	3	2	2
## 1298	0	1	562500	3	2	2
## 1299	0	1	562500	3	2	2
## 1300	0	1	562500	3	2	2
## 1476	0	0	675000	5	2	2
## 1477	0	0	675000	5	2	2
## 1478	0	0	675000	5	2	2
## 1479	0	0	675000	5	2	2
## 1516	0	1	450000	5	2	6
## 1517	0	1	450000	5	2	6
## 1518	0	1	450000	5	2	6
## 1519	0	1	450000	5	2	6
## 1520	0	1	450000	5	2	6

## 1521	0	1	450000	5	2	6
## 1522	0	1	450000	5	2	6
## 1523	0	1	450000	5	2	6
## 1524	0	1	450000	5	2	6
## 1525	0	1	450000	5	2	6
## 1526	0	1	450000	5	2	6
## 1527	0	1	450000	5	2	6
## 1528	0	1	450000	5	2	6
## 1529	0	1	450000	5	2	6
## 1677	0	0	202500	3	1	4
## 1678	0	0	202500	3	1	4
## 1679	0	0	202500	3	1	4
## 1680	0	0	202500	3	1	4
## 1958	0	2	99000	4	2	4
## 1959	0	2	99000	4	2	4
## 1960	0	2	99000	4	2	4
## 1961	0	2	99000	4	2	4
## 1962	0	2	99000	4	2	4
## 1963	0	2	99000	4	2	4
## 1964	0	2	99000	4	2	4
## 1967	1	1	135000	1	1	2
## 1968	1	1	135000	1	1	2
## 1969	1	1	135000	1	1	2
## 1982	0	2	697500	5	4	2
## 1983	0	2	697500	5	4	2
## 2004	1	1	675000	5	2	2
## 2005	1	1	675000	5	2	2
## 2006	1	1	675000	5	2	2
## 2007	1	1	675000	5	2	2
## 2008	1	1	675000	5	2	2
## 2009	1	1	675000	5	2	2
## 2010	1	1	675000	5	2	2
## 2011	1	1	675000	5	2	2
## 2042	0	1	675000	5	2	2
## 2043	0	1	675000	5	2	2
## 2044	0	1	675000	5	2	2
## 2068	1	0	675000	4	1	2
## 2069	1	0	675000	4	1	2
## 2070	1	0	675000	4	1	2
## 2071	1	0	675000	4	1	2
## 2072	1	0	675000	4	1	2
## 2073	1	0	675000	4	1	2
## 2074	1	0	675000	4	1	2
## 2075	1	0	675000	4	1	2
## 2076	1	0	675000	4	1	2
## 2162	0	1	472500	5	2	4
## 2210	1	2	67500	3	2	4
## 2211	1	2	67500	3	2	4
## 2212	1	2	67500	3	2	4
## 2213	1	2	67500	3	2	4
## 2331	0	4	292500	4	2	2
## 2332	0	4	292500	4	2	2

## 2516	1	2	202500	2	2	2
## 2517	1	2	202500	2	2	2
## 2518	1	2	202500	2	2	2
## 2519	1	2	202500	2	2	2
## 2520	1	2	202500	2	2	2
## 2526	1	1	630000	4	2	2
## 2527	1	1	630000	4	2	2
## 2528	1	1	630000	4	2	2
## 2529	1	1	630000	4	2	2
## 2530	1	1	630000	4	2	2
## 2531	1	1	630000	4	2	2
## 2532	1	1	630000	4	2	2
## 2533	1	1	630000	4	2	2
## 2534	1	1	630000	4	2	2
## 2535	1	1	630000	4	2	2
## 2536	1	1	630000	4	2	2
## 2811	0	0	135000	4	2	6
## 2812	0	0	135000	4	2	6
## 2813	0	0	135000	4	2	6
## 2919	0	0	45000	2	2	2
## 2954	1	0	315000	5	4	4
## 2955	1	0	315000	5	4	4
## 3012	1	0	166500	4	3	6
## 3197	1	1	720000	5	2	2
## 3198	1	1	720000	5	2	2
## 3199	1	1	720000	5	2	2
## 3416	1	2	90000	4	2	4
## 3417	1	2	90000	4	2	4
## 3418	1	2	90000	4	2	4
## 3419	1	2	90000	4	2	4
## 3420	1	2	90000	4	2	4
## 3421	1	2	90000	4	2	4
## 3422	1	2	90000	4	2	4
## 3423	1	2	90000	4	2	4
## 3424	1	2	90000	4	2	4
## 3570	0	1	135000	2	2	2
## 3583	0	0	135000	3	3	4
## 3584	0	0	135000	3	3	4
## 3677	1	2	202500	4	1	5
## 3678	1	2	202500	4	1	5
## 3915	0	0	900000	4	2	2
## 3916	0	0	900000	4	2	2
## 3917	0	0	900000	4	2	2
## 3918	0	0	900000	4	2	2
## 3919	0	0	900000	4	2	2
## 3981	0	3	157500	5	2	2
## 3982	0	3	157500	5	2	2
## 3983	0	3	157500	5	2	2
## 3984	0	3	157500	5	2	2
## 3985	0	3	157500	5	2	2
## 4617	1	2	112500	4	2	4
## 4618	1	2	112500	4	2	4

## 4619	1	2	112500	4	2	4
## 4620	1	2	112500	4	2	4
## 4755	1	2	112500	4	2	4
## 4806	0	1	630000	5	2	2
## 4874	0	0	585000	4	2	4
## 4875	0	0	585000	4	2	4
## 4876	0	0	585000	4	2	4
## 4877	0	0	585000	4	2	4
## 4878	0	0	585000	4	2	4
## 4879	0	0	585000	4	2	4
## 4880	0	0	585000	4	2	4
## 4881	0	0	585000	4	2	4
## 4882	0	0	585000	4	2	4
## 4883	0	0	585000	4	2	4
## 5064	1	2	157500	2	1	2
## 5104	1	0	630000	4	3	2
## 5105	1	0	630000	4	3	2
## 5106	1	0	630000	4	3	2
## 5107	1	0	630000	4	3	2
## 5108	1	0	630000	4	3	2
## 5109	1	0	630000	4	3	2
## 5288	0	1	112500	4	4	4
## 5289	0	1	112500	4	4	4
## 5290	0	1	112500	4	4	4
## 5291	0	1	112500	4	4	4
## 5292	0	1	112500	4	4	4
## 5293	0	1	112500	4	4	4
## 5294	0	1	112500	4	4	4
## 5295	0	1	112500	4	4	4
## 5313	0	1	112500	3	2	4
## 5314	0	1	112500	3	2	4
## 5315	0	1	112500	3	2	4
## 5347	1	0	112500	2	1	2
## 5348	1	0	112500	2	1	2
## 5349	1	0	112500	2	1	2
## 5350	1	0	112500	2	1	2
## 5351	1	0	112500	2	1	2
## 5352	1	0	112500	2	1	2
## 5353	1	0	112500	2	1	2
## 5379	1	0	720000	5	4	2
## 5380	1	0	720000	5	4	2
## 5381	1	0	720000	5	4	2
## 5382	1	0	720000	5	4	2
## 5383	1	0	720000	5	4	2
## 5384	1	0	720000	5	4	2
## 5461	0	0	38250	2	2	2
## 5584	0	0	180000	2	3	2
## 5585	0	0	180000	2	3	2
## 5586	0	0	180000	2	3	2
## 5587	0	0	180000	2	3	2
## 5588	0	0	180000	2	3	2
## 5589	0	0	180000	2	3	2

## 5722	0	1	157500	4	2	6
## 5723	0	1	157500	4	2	6
## 5724	0	1	157500	4	2	6
## 5725	0	1	157500	4	2	6
## 5726	0	1	157500	4	2	6
## 5727	0	1	157500	4	2	6
## 5728	0	1	157500	4	2	6
## 5729	0	1	157500	4	2	6
## 5730	0	1	157500	4	2	6
## 5975	1	3	67500	5	2	2
## 5976	1	3	67500	5	2	2
## 6176	1	0	675000	5	4	2
## 6177	1	0	675000	5	4	2
## 6178	1	0	675000	5	4	2
## 6179	1	0	675000	5	4	2
## 6180	1	0	675000	5	4	2
## 6181	1	0	675000	5	4	2
## 6182	1	0	675000	5	4	2
## 6183	1	0	675000	5	4	2
## 6184	1	0	675000	5	4	2
## 6185	1	0	675000	5	4	2
## 6186	1	0	675000	5	4	2
## 6238	0	3	90000	2	4	4
## 6239	0	3	90000	2	4	4
## 6240	0	3	90000	2	4	4
## 6241	0	3	90000	2	4	4
## 6494	0	0	1125000	4	2	1
## 6495	0	0	1125000	4	2	1
## 6496	0	0	1125000	4	2	1
## 6497	0	0	1125000	4	2	1
## 6498	0	0	1125000	4	2	1
## 6499	0	0	1125000	4	2	1
## 6500	0	0	1125000	4	2	1
## 6780	0	1	315000	5	2	5
## 6781	0	1	315000	5	2	5
## 6782	0	1	315000	5	2	5
## 7009	0	1	202500	2	3	2
## 7010	0	1	202500	2	3	2
## 7011	0	1	202500	2	3	2
## 7112	0	4	202500	4	2	2
## 7113	0	4	202500	4	2	2
## 7114	0	4	202500	4	2	2
## 7115	0	4	202500	4	2	2
## 7138	1	1	157500	3	2	4
## 7139	1	1	157500	3	2	4
## 7140	1	1	157500	3	2	4
## 7141	1	1	157500	3	2	4
## 7142	1	1	157500	3	2	4
## 7143	1	1	157500	3	2	4
## 7144	1	1	157500	3	2	4
## 7145	1	1	157500	3	2	4
## 7146	1	1	157500	3	2	4

## 7147	1	1	157500	3	2	4
## 7148	1	1	157500	3	2	4
## 7210	0	0	225000	4	2	6
## 7211	0	0	225000	4	2	6
## 7212	0	0	225000	4	2	6
## 7302	0	0	225000	2	2	3
## 7303	0	0	225000	2	2	3
## 7304	0	0	225000	2	2	3
## 7305	0	0	225000	2	2	3
## 7306	0	0	225000	2	2	3
## 7307	0	0	225000	2	2	3
## 7311	1	0	220500	2	2	2
## 7312	1	0	220500	2	2	2
## 7313	1	0	220500	2	2	2
## 7314	1	0	220500	2	2	2
## 7315	1	0	220500	2	2	2
## 7316	1	0	220500	2	2	2
## 7326	1	1	225000	4	3	6
## 7639	0	3	126000	4	1	4
## 7640	0	3	126000	4	1	4
## 7641	0	3	126000	4	1	4
## 7642	0	3	126000	4	1	4
## 7643	0	3	126000	4	1	4
## 7644	0	3	126000	4	1	4
## 7645	0	3	126000	4	1	4
## 7646	0	3	126000	4	1	4
## 7647	0	3	126000	4	1	4
## 7648	0	3	126000	4	1	4
## 7656	0	0	270000	2	4	2
## 7657	0	0	270000	2	4	2
## 7658	0	0	270000	2	4	2
## 7659	0	0	270000	2	4	2
## 7660	0	0	270000	2	4	2
## 7661	0	0	270000	2	4	2
## 7662	0	0	270000	2	4	2
## 7663	0	0	270000	2	4	2
## 7664	0	0	270000	2	4	2
## 7665	0	0	270000	2	4	2
## 7666	0	0	270000	2	4	2
## 7667	0	0	270000	2	4	2
## 7668	0	0	270000	2	4	2
## 7669	0	0	270000	2	4	2
## 7743	1	2	81000	2	3	2
## 7744	1	2	81000	2	3	2
## 7745	1	2	81000	2	3	2
## 7793	0	2	675000	5	2	2
## 7794	0	2	675000	5	2	2
## 7795	0	2	675000	5	2	2
## 7796	0	2	675000	5	2	2
## 7797	0	2	675000	5	2	2
## 7798	0	2	675000	5	2	2
## 7799	0	2	675000	5	2	2

## 7800	0	2	675000	5	2	2
## 7801	0	2	675000	5	2	2
## 7802	0	2	675000	5	2	2
## 7803	0	2	675000	5	2	2
## 7804	0	2	675000	5	2	2
## 7952	1	3	292500	3	2	2
## 7953	1	3	292500	3	2	2
## 7954	1	3	292500	3	2	2
## 7955	1	3	292500	3	2	2
## 7956	1	3	292500	3	2	2
## 7957	1	3	292500	3	2	2
## 8427	0	0	112500	2	2	2
## 8463	1	3	337500	5	2	2
## 8482	1	1	139500	2	2	2
## 8483	1	1	139500	2	2	2
## 8484	1	1	139500	2	2	2
## 8485	1	1	139500	2	2	2
## 8486	1	1	139500	2	2	2
## 8537	1	0	630000	5	4	2
## 8538	1	0	630000	5	4	2
## 8539	1	0	630000	5	4	2
## 8540	1	0	630000	5	4	2
## 8541	1	0	630000	5	4	2
## 8542	1	0	630000	5	4	2
## 8543	1	0	630000	5	4	2
## 8544	1	0	630000	5	4	2
## 8545	1	0	630000	5	4	2
## 8546	1	0	630000	5	4	2
## 8547	1	0	630000	5	4	2
## 8548	1	0	630000	5	4	2
## 8606	0	0	202500	3	3	4
## 8706	1	0	315000	3	3	4
## 8707	1	0	315000	3	3	4
## 8708	1	0	315000	3	3	4
## 8709	1	0	315000	3	3	4
## 8710	1	0	315000	3	3	4
## 8711	1	0	315000	3	3	4
## 8712	1	0	315000	3	3	4
## 8713	1	0	315000	3	3	4
## 8714	1	0	315000	3	3	4
## 8715	1	0	315000	3	3	4
## 8716	1	0	315000	3	3	4
## 8735	1	1	270000	4	4	4
## 8736	1	1	270000	4	4	4
## 8737	1	1	270000	4	4	4
## 8738	1	1	270000	4	4	4
## 8739	1	1	270000	4	4	4
## 8750	1	0	135000	4	3	6
## 8751	1	0	135000	4	3	6
## 8752	1	0	135000	4	3	6
## 8753	1	0	135000	4	3	6
## 8754	1	0	135000	4	3	6

## 8755	1	0	135000	4	3	6
## 8756	1	0	135000	4	3	6
## 8757	1	0	135000	4	3	6
## 8910	0	0	180000	2	2	2
## 8911	0	0	180000	2	2	2
## 8912	1	2	90000	4	2	4
## 8913	1	2	90000	4	2	4
## 8914	1	2	90000	4	2	4
## 8915	1	2	90000	4	2	4
## 8916	1	2	90000	4	2	4
## 8917	1	2	90000	4	2	4
## 8918	1	2	90000	4	2	4
## 8919	1	2	90000	4	2	4
## 8969	0	0	405000	5	2	6
## 8970	0	0	405000	5	2	6
## 8971	0	0	405000	5	2	6
## 8972	0	0	405000	5	2	6
## 9119	1	3	540000	5	2	2
## 9120	1	3	540000	5	2	2
## 9121	1	3	540000	5	2	2
## 9122	1	3	540000	5	2	2
## 9123	1	3	540000	5	2	2
## 9124	1	3	540000	5	2	2
## 9125	1	3	540000	5	2	2
## 9130	1	3	202500	4	5	2
## 9131	1	3	202500	4	5	2
## 9132	1	3	202500	4	5	2
## 9133	1	3	202500	4	5	2
## 9134	1	3	202500	4	5	2
## 9135	1	3	202500	4	5	2
## 9136	1	3	202500	4	5	2
## 9137	1	3	202500	4	5	2
## 9138	1	3	202500	4	5	2
## 9139	1	3	202500	4	5	2
## 9140	1	3	202500	4	5	2
## 9141	1	3	202500	4	5	2
## 9142	1	3	202500	4	5	2
## 9310	1	2	270000	5	4	4
## 9311	1	2	270000	5	4	4
## 9312	1	2	270000	5	4	4
## 9313	1	2	270000	5	4	4
## 9314	1	2	270000	5	4	4
## 9315	1	2	270000	5	4	4
## 9316	1	2	270000	5	4	4
## 9317	1	2	270000	5	4	4
## 9318	1	2	270000	5	4	4
## 9319	1	2	270000	5	4	4
## 9320	1	2	270000	5	4	4
## 9321	1	2	270000	5	4	4
## 9469	0	0	135000	5	2	6
## 9470	0	0	135000	5	2	6
## 9471	0	0	135000	5	2	6

```

## 9472      0      0      135000      5      2      6
## 9473      0      0      135000      5      2      6
## 9478      0      0       90000      5      3      4
## 9479      1      1      157500      2      1      2
## 9480      1      1      157500      2      1      2
## 9481      1      1      157500      2      1      2
## 9482      1      1      157500      2      1      2
## 9483      1      1      157500      2      1      2
## 9663      0      2      405000      4      2      6
## 9664      0      2      405000      4      2      6
## 9753      0      0      900000      5      2      2
## 9754      0      0      900000      5      2      2
## 9755      0      0      900000      5      2      2
## 9756      0      0      900000      5      2      2
## 9757      0      0      900000      5      2      2
## 9925      0      0      135000      2      2      2
## 9926      0      0      135000      2      2      2
## 9927      0      0      135000      2      2      2
## 9928      0      0      135000      2      2      2
## 9929      0      0      135000      2      2      2
## 9930      0      0      135000      2      2      2
## 9984      0      1      810000      4      2      2
## 9985      0      1      810000      4      2      2
## 9986      0      1      810000      4      2      2
##
## $`Location of Outlier`
## [1] 268 269 270 271 285 286 287 288 289 290 291 292 293 294 295
## [16] 296 297 298 299 338 339 340 341 342 343 344 345 487 488 489
## [31] 490 493 494 555 556 642 643 793 794 795 796 797 798 799 929
## [46] 930 931 932 933 934 935 936 937 938 1042 1043 1133 1193 1194 1228
## [61] 1229 1230 1231 1232 1233 1234 1235 1236 1237 1277 1278 1279 1280 1281 1282
## [76] 1283 1284 1285 1286 1287 1288 1289 1290 1291 1292 1293 1294 1295 1296 1297
## [91] 1298 1299 1300 1476 1477 1478 1479 1516 1517 1518 1519 1520 1521 1522 1523
## [106] 1524 1525 1526 1527 1528 1529 1677 1678 1679 1680 1958 1959 1960 1961 1962
## [121] 1963 1964 1967 1968 1969 1982 1983 2004 2005 2006 2007 2008 2009 2010 2011
## [136] 2042 2043 2044 2068 2069 2070 2071 2072 2073 2074 2075 2076 2162 2210 2211
## [151] 2212 2213 2331 2332 2516 2517 2518 2519 2520 2526 2527 2528 2529 2530 2531
## [166] 2532 2533 2534 2535 2536 2811 2812 2813 2919 2954 2955 3012 3197 3198 3199
## [181] 3416 3417 3418 3419 3420 3421 3422 3423 3424 3570 3583 3584 3677 3678 3915
## [196] 3916 3917 3918 3919 3981 3982 3983 3984 3985 4617 4618 4619 4620 4755 4806
## [211] 4874 4875 4876 4877 4878 4879 4880 4881 4882 4883 5064 5104 5105 5106 5107
## [226] 5108 5109 5288 5289 5290 5291 5292 5293 5294 5295 5313 5314 5315 5347 5348
## [241] 5349 5350 5351 5352 5353 5379 5380 5381 5382 5383 5384 5461 5584 5585 5586
## [256] 5587 5588 5589 5722 5723 5724 5725 5726 5727 5728 5729 5730 5975 5976 6176
## [271] 6177 6178 6179 6180 6181 6182 6183 6184 6185 6186 6238 6239 6240 6241 6494
## [286] 6495 6496 6497 6498 6499 6500 6780 6781 6782 7009 7010 7011 7112 7113 7114
## [301] 7115 7138 7139 7140 7141 7142 7143 7144 7145 7146 7147 7148 7210 7211 7212
## [316] 7302 7303 7304 7305 7306 7307 7311 7312 7313 7314 7315 7316 7326 7639 7640
## [331] 7641 7642 7643 7644 7645 7646 7647 7648 7656 7657 7658 7659 7660 7661 7662
## [346] 7663 7664 7665 7666 7667 7668 7669 7743 7744 7745 7793 7794 7795 7796 7797
## [361] 7798 7799 7800 7801 7802 7803 7804 7952 7953 7954 7955 7956 7957 8427 8463
## [376] 8482 8483 8484 8485 8486 8537 8538 8539 8540 8541 8542 8543 8544 8545 8546

```

```
## [391] 8547 8548 8606 8706 8707 8708 8709 8710 8711 8712 8713 8714 8715 8716 8735
## [406] 8736 8737 8738 8739 8750 8751 8752 8753 8754 8755 8756 8757 8910 8911 8912
## [421] 8913 8914 8915 8916 8917 8918 8919 8969 8970 8971 8972 9119 9120 9121 9122
## [436] 9123 9124 9125 9130 9131 9132 9133 9134 9135 9136 9137 9138 9139 9140 9141
## [451] 9142 9310 9311 9312 9313 9314 9315 9316 9317 9318 9319 9320 9321 9469 9470
## [466] 9471 9472 9473 9478 9479 9480 9481 9482 9483 9663 9664 9753 9754 9755 9756
## [481] 9757 9925 9926 9927 9928 9929 9930 9984 9985 9986
##
## $`Outlier Probability`
## [1] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [16] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.75 0.75 0.75
## [31] 0.75 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [46] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.90 0.98 0.98 1.00
## [61] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [76] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [91] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [106] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.99 0.99 0.99 0.99 0.99
## [121] 0.99 0.99 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [136] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [151] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [166] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [181] 0.99 0.99 0.99 0.99 0.99 0.99 0.99 0.99 0.99 0.99 1.00 0.98 0.98 1.00 1.00 1.00
## [196] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.98 0.98 0.98 0.98 0.98 0.65
## [211] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [226] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.92 0.92 0.92 1.00 1.00
## [241] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [256] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [271] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [286] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [301] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [316] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.98 0.98 0.98 0.98 0.98 0.98 1.00 1.00 1.00
## [331] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [346] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [361] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.92 0.99
## [376] 0.96 0.96 0.96 0.96 0.96 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [391] 1.00 1.00 0.98 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.85
## [406] 0.85 0.85 0.85 0.85 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 0.75 0.75 0.99
## [421] 0.99 0.99 0.99 0.99 0.99 0.99 0.99 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [436] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [451] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [466] 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
## [481] 1.00 0.65 0.65 0.65 0.65 0.65 0.65 1.00 1.00 1.00
```

When the threshold is 0.99, there are 490 outliers.

6. Join assessment of outlier detection methods using techniques described under 2 to 5.

```
x<-newdata[,2:7]
OutlierDetection(x)
```

```
## $`Outlier Observations`
```

```
##      gender num_child ann_income education marital housing
## 1         0         0    427500          5         1         1
## 2         0         0    427500          5         1         1
## 28        0         3    270000          4         2         2
## 29        0         3    270000          4         2         2
## 217       1         0    255150          3         1         1
## 218       1         0    255150          3         1         1
## 219       1         0    255150          3         1         1
## 220       1         0    255150          3         1         1
## 221       1         0    255150          3         1         1
## 222       1         0    255150          3         1         1
## 250       1         0    270000          3         1         3
## 251       1         0    270000          3         1         3
## 252       1         0    270000          3         1         3
## 255       0         1    180000          4         2         4
## 268       0         1    765000          5         2         2
## 269       0         1    765000          5         2         2
## 270       0         1    765000          5         2         2
## 271       0         1    765000          5         2         2
## 277       0         2    157500          4         2         4
## 278       0         2    157500          4         2         4
## 279       0         2    157500          4         2         4
## 280       0         2    157500          4         2         4
## 281       0         2    157500          4         2         4
## 285       1         0    157500          5         4         4
## 286       1         0    157500          5         4         4
## 287       1         0    157500          5         4         4
## 288       1         0    157500          5         4         4
## 289       1         0    157500          5         4         4
## 290       1         0    157500          5         4         4
## 291       1         0    157500          5         4         4
## 292       1         0    157500          5         4         4
## 293       1         0    157500          5         4         4
## 294       1         0    157500          5         4         4
## 295       1         0    157500          5         4         4
## 296       1         0    157500          5         4         4
## 297       1         0    157500          5         4         4
## 298       1         0    157500          5         4         4
## 299       1         0    157500          5         4         4
## 300       0         0    382500          4         5         2
## 301       0         0    382500          4         5         2
## 302       0         0    382500          4         5         2
## 303       0         0    382500          4         5         2
## 304       0         0    382500          4         5         2
## 305       0         0    382500          4         5         2
## 306       0         0    382500          4         5         2
## 307       0         0    382500          4         5         2
## 338       0         0    229500          3         2         5
## 339       0         0    229500          3         2         5
## 340       0         0    229500          3         2         5
## 341       0         0    229500          3         2         5
```

## 342	0	0	229500	3	2	5
## 343	0	0	229500	3	2	5
## 344	0	0	229500	3	2	5
## 345	0	0	229500	3	2	5
## 389	0	0	157500	3	2	4
## 390	0	0	157500	3	2	4
## 391	0	0	157500	3	2	4
## 392	0	0	157500	3	2	4
## 393	0	0	157500	3	2	4
## 409	1	0	202500	5	2	4
## 410	1	0	202500	5	2	4
## 411	1	0	202500	5	2	4
## 412	1	0	202500	5	2	4
## 413	1	0	202500	5	2	4
## 415	0	0	337500	5	2	4
## 416	0	0	337500	5	2	4
## 417	0	0	337500	5	2	4
## 418	0	0	337500	5	2	4
## 419	0	0	337500	5	2	4
## 487	0	0	180000	2	2	2
## 488	0	0	180000	2	2	2
## 489	0	0	180000	2	2	2
## 490	0	0	180000	2	2	2
## 493	1	0	900000	5	3	2
## 494	1	0	900000	5	3	2
## 555	0	0	108000	4	3	5
## 556	0	0	108000	4	3	5
## 559	0	0	198000	4	3	4
## 560	0	0	198000	4	3	4
## 577	0	0	81000	4	2	4
## 578	0	0	81000	4	2	4
## 579	0	0	81000	4	2	4
## 642	0	1	112500	4	4	5
## 643	0	1	112500	4	4	5
## 746	0	0	202500	4	3	4
## 747	0	0	202500	4	3	4
## 793	0	0	1350000	5	2	3
## 794	0	0	1350000	5	2	3
## 795	0	0	1350000	5	2	3
## 796	0	0	1350000	5	2	3
## 797	0	0	1350000	5	2	3
## 798	0	0	1350000	5	2	3
## 799	0	0	1350000	5	2	3
## 809	1	0	135000	4	1	4
## 810	1	0	135000	4	1	4
## 864	0	2	445500	5	2	3
## 865	0	2	445500	5	2	3
## 911	0	0	166500	5	2	4
## 912	0	0	166500	5	2	4
## 913	0	0	166500	5	2	4
## 914	0	0	166500	5	2	4
## 915	0	0	166500	5	2	4

## 916	0	0	166500	5	2	4
## 917	0	0	166500	5	2	4
## 929	0	0	360000	4	4	4
## 930	0	0	360000	4	4	4
## 931	0	0	360000	4	4	4
## 932	0	0	360000	4	4	4
## 933	0	0	360000	4	4	4
## 934	0	0	360000	4	4	4
## 935	0	0	360000	4	4	4
## 936	0	0	360000	4	4	4
## 937	0	0	360000	4	4	4
## 938	0	0	360000	4	4	4
## 1042	0	2	157500	4	2	6
## 1043	0	2	157500	4	2	6
## 1072	1	0	99000	5	3	4
## 1073	1	0	99000	5	3	4
## 1115	1	0	360000	4	5	2
## 1116	1	0	360000	4	5	2
## 1133	1	0	112500	3	3	4
## 1193	0	0	202500	2	2	2
## 1194	0	0	202500	2	2	2
## 1228	0	0	135000	2	2	4
## 1229	0	0	135000	2	2	4
## 1230	0	0	135000	2	2	4
## 1231	0	0	135000	2	2	4
## 1232	0	0	135000	2	2	4
## 1233	0	0	135000	2	2	4
## 1234	0	0	135000	2	2	4
## 1235	0	0	135000	2	2	4
## 1236	0	0	135000	2	2	4
## 1237	0	0	135000	2	2	4
## 1277	0	1	562500	3	2	2
## 1278	0	1	562500	3	2	2
## 1279	0	1	562500	3	2	2
## 1280	0	1	562500	3	2	2
## 1281	0	1	562500	3	2	2
## 1282	0	1	562500	3	2	2
## 1283	0	1	562500	3	2	2
## 1284	0	1	562500	3	2	2
## 1285	0	1	562500	3	2	2
## 1286	0	1	562500	3	2	2
## 1287	0	1	562500	3	2	2
## 1288	0	1	562500	3	2	2
## 1289	0	1	562500	3	2	2
## 1290	0	1	562500	3	2	2
## 1291	0	1	562500	3	2	2
## 1292	0	1	562500	3	2	2
## 1293	0	1	562500	3	2	2
## 1294	0	1	562500	3	2	2
## 1295	0	1	562500	3	2	2
## 1296	0	1	562500	3	2	2
## 1297	0	1	562500	3	2	2

## 1298	0	1	562500	3	2	2
## 1299	0	1	562500	3	2	2
## 1300	0	1	562500	3	2	2
## 1367	1	0	126000	4	3	4
## 1368	0	1	180000	3	2	4
## 1369	0	1	180000	3	2	4
## 1399	1	0	540000	5	2	2
## 1400	1	0	540000	5	2	2
## 1401	1	0	540000	5	2	2
## 1402	1	0	540000	5	2	2
## 1403	1	0	540000	5	2	2
## 1404	1	0	540000	5	2	2
## 1405	1	0	540000	5	2	2
## 1406	1	0	540000	5	2	2
## 1407	1	0	540000	5	2	2
## 1476	0	0	675000	5	2	2
## 1477	0	0	675000	5	2	2
## 1478	0	0	675000	5	2	2
## 1479	0	0	675000	5	2	2
## 1516	0	1	450000	5	2	6
## 1517	0	1	450000	5	2	6
## 1518	0	1	450000	5	2	6
## 1519	0	1	450000	5	2	6
## 1520	0	1	450000	5	2	6
## 1521	0	1	450000	5	2	6
## 1522	0	1	450000	5	2	6
## 1523	0	1	450000	5	2	6
## 1524	0	1	450000	5	2	6
## 1525	0	1	450000	5	2	6
## 1526	0	1	450000	5	2	6
## 1527	0	1	450000	5	2	6
## 1528	0	1	450000	5	2	6
## 1529	0	1	450000	5	2	6
## 1677	0	0	202500	3	1	4
## 1678	0	0	202500	3	1	4
## 1679	0	0	202500	3	1	4
## 1680	0	0	202500	3	1	4
## 1744	1	0	135000	5	2	4
## 1745	1	0	135000	5	2	4
## 1746	1	0	135000	5	2	4
## 1811	1	0	54000	2	2	2
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## 1868	1	0	94500	4	5	1
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## 1959	0	2	99000	4	2	4
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## 1961	0	2	99000	4	2	4
## 1962	0	2	99000	4	2	4
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## 1967	1	1	135000	1	1	2

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## 1983	0	2	697500	5	4	2
## 2004	1	1	675000	5	2	2
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## 2044	0	1	675000	5	2	2
## 2063	1	0	225000	5	3	4
## 2068	1	0	675000	4	1	2
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## 2070	1	0	675000	4	1	2
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## 2211	1	2	67500	3	2	4
## 2212	1	2	67500	3	2	4
## 2213	1	2	67500	3	2	4
## 2241	1	0	189000	3	5	2
## 2242	1	0	189000	3	5	2
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## 2502	0	2	337500	3	2	2
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## 2812	0	0	135000	4	2	6
## 2813	0	0	135000	4	2	6
## 2830	1	0	216000	5	2	4
## 2919	0	0	45000	2	2	2
## 2941	0	3	135000	4	2	2
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## 3012	1	0	166500	4	3	6
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## 6239	0	3	90000	2	4	4
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## 7136	1	2	360000	3	2	2
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## 7312	1	0	220500	2	2	2
## 7313	1	0	220500	2	2	2
## 7314	1	0	220500	2	2	2
## 7315	1	0	220500	2	2	2
## 7316	1	0	220500	2	2	2
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## 7419	0	0	225000	5	3	4
## 7420	0	0	225000	5	3	4
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## 7500	1	0	139500	5	2	4
## 7501	1	0	139500	5	2	4
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## 7745	1	2	81000	2	3	2
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## 8511	1	1	180000	4	2	4
## 8512	1	1	180000	4	2	4
## 8537	1	0	630000	5	4	2
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## 8712	1	0	315000	3	3	4
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## 8714	1	0	315000	3	3	4
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## 8716	1	0	315000	3	3	4

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## 8736	1	1	270000	4	4	4
## 8737	1	1	270000	4	4	4
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## 8739	1	1	270000	4	4	4
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## 8755	1	0	135000	4	3	6
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## 8792	0	3	225000	5	2	2
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## 8794	0	3	225000	5	2	2
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## 8908	0	0	270000	4	2	4
## 8909	0	0	270000	4	2	4
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## 8911	0	0	180000	2	2	2
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## 8919	1	2	90000	4	2	4
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## 8921	1	0	153000	4	4	4
## 8922	1	0	153000	4	4	4
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## 9312	1	2	270000	5	4	4
## 9313	1	2	270000	5	4	4
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## 9315	1	2	270000	5	4	4
## 9316	1	2	270000	5	4	4
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## 9415	0	0	157500	4	5	2
## 9416	0	0	157500	4	5	2
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## 9470	0	0	135000	5	2	6

## 9471	0	0	135000	5	2	6
## 9472	0	0	135000	5	2	6
## 9473	0	0	135000	5	2	6
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## 9482	1	1	157500	2	1	2
## 9483	1	1	157500	2	1	2
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## 9507	1	1	202500	5	1	4
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## 9563	1	1	405000	5	5	2
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## 9664	0	2	405000	4	2	6
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## 9754	0	0	900000	5	2	2
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## 9757	0	0	900000	5	2	2
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## 9827	0	2	180000	4	4	2
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## 9991	1	0	90000	2	3	2
## 9992	1	0	90000	2	3	2
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## 9995      1      0      90000      2      3      2
## 9996      1      0      90000      2      3      2
##
## $`Location of Outlier`
##      [1]      1      2      28      29      217      218      219      220      221      222      250      251      252      255
##     [15]      268      269      270      271      277      278      279      280      281      285      286      287      288      289
##     [29]      290      291      292      293      294      295      296      297      298      299      300      301      302      303
##     [43]      304      305      306      307      338      339      340      341      342      343      344      345      389      390
##     [57]      391      392      393      409      410      411      412      413      415      416      417      418      419      487
##     [71]      488      489      490      493      494      555      556      559      560      577      578      579      642      643
##     [85]      746      747      793      794      795      796      797      798      799      809      810      864      865      911
##     [99]      912      913      914      915      916      917      929      930      931      932      933      934      935      936
##    [113]      937      938     1042     1043     1072     1073     1115     1116     1133     1193     1194     1228     1229     1230
##    [127]     1231     1232     1233     1234     1235     1236     1237     1277     1278     1279     1280     1281     1282     1283
##    [141]     1284     1285     1286     1287     1288     1289     1290     1291     1292     1293     1294     1295     1296     1297
##    [155]     1298     1299     1300     1367     1368     1369     1399     1400     1401     1402     1403     1404     1405     1406
##    [169]     1407     1476     1477     1478     1479     1516     1517     1518     1519     1520     1521     1522     1523     1524
##    [183]     1525     1526     1527     1528     1529     1677     1678     1679     1680     1744     1745     1746     1811     1812
##    [197]     1868     1869     1958     1959     1960     1961     1962     1963     1964     1967     1968     1969     1982     1983
##    [211]     2004     2005     2006     2007     2008     2009     2010     2011     2034     2035     2036     2037     2038     2039
##    [225]     2040     2041     2042     2043     2044     2063     2068     2069     2070     2071     2072     2073     2074     2075
##    [239]     2076     2162     2191     2192     2193     2194     2195     2210     2211     2212     2213     2241     2242     2243
##    [253]     2244     2245     2246     2247     2248     2249     2250     2251     2278     2279     2280     2281     2319     2320
##    [267]     2321     2331     2332     2355     2356     2357     2358     2437     2438     2439     2440     2500     2501     2502
##    [281]     2516     2517     2518     2519     2520     2526     2527     2528     2529     2530     2531     2532     2533     2534
##    [295]     2535     2536     2539     2560     2561     2562     2563     2564     2565     2566     2567     2568     2569     2633
##    [309]     2634     2635     2636     2637     2638     2639     2640     2641     2644     2645     2646     2647     2648     2649
##    [323]     2650     2651     2652     2653     2654     2655     2656     2700     2723     2724     2725     2726     2811     2812
##    [337]     2813     2830     2919     2941     2942     2943     2944     2954     2955     3012     3111     3112     3113     3114
##    [351]     3115     3116     3117     3197     3198     3199     3218     3219     3220     3297     3298     3299     3300     3301
##    [365]     3302     3303     3304     3334     3352     3353     3354     3384     3385     3416     3417     3418     3419     3420
##    [379]     3421     3422     3423     3424     3429     3430     3431     3432     3570     3583     3584     3593     3594     3595
##    [393]     3652     3666     3667     3677     3678     3695     3696     3711     3712     3713     3714     3766     3767     3915
##    [407]     3916     3917     3918     3919     3981     3982     3983     3984     3985     4101     4102     4239     4279     4280
##    [421]     4281     4282     4283     4284     4285     4286     4287     4288     4289     4290     4291     4371     4372     4373
##    [435]     4374     4375     4376     4377     4378     4379     4380     4617     4618     4619     4620     4644     4645     4646
##    [449]     4652     4653     4713     4714     4715     4716     4717     4718     4719     4728     4729     4730     4731     4732
##    [463]     4755     4773     4774     4775     4776     4777     4778     4779     4780     4781     4782     4783     4784     4806
##    [477]     4807     4830     4831     4843     4844     4874     4875     4876     4877     4878     4879     4880     4881     4882
##    [491]     4883     4922     4923     4924     4937     4938     4939     4940     5064     5076     5077     5078     5079     5080
##    [505]     5081     5082     5083     5084     5085     5086     5093     5094     5095     5096     5097     5098     5099     5100
##    [519]     5101     5104     5105     5106     5107     5108     5109     5161     5162     5163     5164     5165     5185     5186
##    [533]     5187     5188     5189     5190     5191     5192     5193     5194     5195     5196     5235     5288     5289     5290
##    [547]     5291     5292     5293     5294     5295     5313     5314     5315     5335     5336     5337     5338     5347     5348
##    [561]     5349     5350     5351     5352     5353     5379     5380     5381     5382     5383     5384     5385     5386     5387
##    [575]     5388     5389     5390     5391     5392     5393     5399     5400     5401     5402     5403     5461     5478     5479
##    [589]     5480     5481     5482     5483     5484     5485     5486     5487     5488     5523     5524     5584     5585     5586
##    [603]     5587     5588     5589     5722     5723     5724     5725     5726     5727     5728     5729     5730     5833     5834
##    [617]     5835     5836     5837     5838     5839     5840     5841     5842     5843     5844     5845     5846     5847     5848
##    [631]     5849     5850     5851     5852     5853     5854     5855     5856     5975     5976     6066     6067     6068     6069
##    [645]     6070     6071     6087     6088     6089     6090     6125     6126     6127     6128     6129     6130     6131     6132
##    [659]     6148     6149     6150     6151     6176     6177     6178     6179     6180     6181     6182     6183     6184     6185

```

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## [673] 6186 6221 6222 6223 6238 6239 6240 6241 6396 6397 6398 6399 6400 6401
## [687] 6402 6471 6494 6495 6496 6497 6498 6499 6500 6540 6541 6542 6543 6544
## [701] 6626 6627 6628 6629 6630 6685 6705 6706 6707 6708 6709 6710 6711 6712
## [715] 6713 6714 6715 6716 6780 6781 6782 6846 6847 6848 6849 6850 6903 6904
## [729] 6905 6906 6907 6908 6909 7009 7010 7011 7082 7083 7084 7085 7086 7112
## [743] 7113 7114 7115 7132 7133 7134 7135 7136 7137 7138 7139 7140 7141 7142
## [757] 7143 7144 7145 7146 7147 7148 7186 7187 7188 7189 7190 7191 7192 7193
## [771] 7210 7211 7212 7225 7226 7227 7228 7229 7230 7231 7232 7233 7234 7267
## [785] 7268 7269 7302 7303 7304 7305 7306 7307 7311 7312 7313 7314 7315 7316
## [799] 7326 7367 7368 7369 7418 7419 7420 7421 7422 7423 7424 7425 7435 7436
## [813] 7499 7500 7501 7633 7634 7635 7636 7639 7640 7641 7642 7643 7644 7645
## [827] 7646 7647 7648 7656 7657 7658 7659 7660 7661 7662 7663 7664 7665 7666
## [841] 7667 7668 7669 7727 7728 7729 7730 7731 7732 7733 7734 7735 7736 7743
## [855] 7744 7745 7775 7776 7777 7793 7794 7795 7796 7797 7798 7799 7800 7801
## [869] 7802 7803 7804 7951 7952 7953 7954 7955 7956 7957 8236 8237 8238 8315
## [883] 8316 8317 8318 8427 8463 8482 8483 8484 8485 8486 8509 8510 8511 8512
## [897] 8537 8538 8539 8540 8541 8542 8543 8544 8545 8546 8547 8548 8590 8591
## [911] 8592 8606 8661 8662 8663 8664 8665 8666 8667 8668 8669 8670 8671 8706
## [925] 8707 8708 8709 8710 8711 8712 8713 8714 8715 8716 8735 8736 8737 8738
## [939] 8739 8750 8751 8752 8753 8754 8755 8756 8757 8788 8789 8790 8791 8792
## [953] 8793 8794 8907 8908 8909 8910 8911 8912 8913 8914 8915 8916 8917 8918
## [967] 8919 8920 8921 8922 8954 8955 8956 8957 8958 8959 8960 8961 8962 8963
## [981] 8964 8965 8966 8967 8968 8969 8970 8971 8972 8974 8975 8976 8977 8978
## [995] 9051 9052 9053 9054 9119 9120 9121 9122 9123 9124 9125 9130 9131 9132
## [1009] 9133 9134 9135 9136 9137 9138 9139 9140 9141 9142 9228 9229 9230 9310
## [1023] 9311 9312 9313 9314 9315 9316 9317 9318 9319 9320 9321 9414 9415 9416
## [1037] 9469 9470 9471 9472 9473 9478 9479 9480 9481 9482 9483 9504 9505 9506
## [1051] 9507 9508 9509 9510 9562 9563 9564 9634 9635 9636 9637 9638 9639 9663
## [1065] 9664 9753 9754 9755 9756 9757 9824 9825 9826 9827 9828 9829 9925 9926
## [1079] 9927 9928 9929 9930 9984 9985 9986 9990 9991 9992 9993 9994 9995 9996
```

```
edit(OutlierDetection)
```

```

## function (x, k = 0.05 * nrow(x), cutoff = 0.95, Method = "euclidean",
##      rnames = FALSE, depth = FALSE, dense = FALSE, distance = FALSE,
##      dispersion = FALSE)
## {
##     data = x
##     out = OutlierDetection::maha(x, cutoff = 0.95)$"Location of Outlier"
##     if (dispersion == FALSE) {
##         out = out
##     }
##     else {
##         out2 = OutlierDetection::disp(x, cutoff = 0.95)$"Location of Outlier"
##         out = intersect(out2, out)
##     }
##     if (distance == FALSE) {
##         out = out
##     }
##     else {
##         out3 = OutlierDetection::nn(x, k = 0.05 * nrow(x), cutoff = 0.95,
##             Method = "euclidean", rnames = F)$"Location of Outlier"
##         out4 = OutlierDetection::nnk(x, k = 0.05 * nrow(x), cutoff = 0.95,
##             Method = "euclidean", rnames = F)$"Location of Outlier"
##         out = intersect(intersect(out3, out), intersect(out4,
##             out))
##     }
##     if (depth == FALSE) {
##         out = out
##     }
##     else {
##         out5 = OutlierDetection::depthout(x)$"Location of Outlier"
##         out = intersect(out5, out)
##     }
##     if (dense == FALSE) {
##         out = out
##     }
##     else {
##         out5 = OutlierDetection::dens(x)$"Location of Outlier"
##         out = intersect(out5, out)
##     }
##     if (ncol(x) == 2) {
##         d = 1:nrow(data)
##         Class = c()
##         Class = rep("Normal", length(d))
##         for (i in 1:length(out)) {
##             Class[d == out[i]] = "Outlier"
##         }
##         cols <- c(Outlier = "red", Normal = "blue")
##         if (rnames == T) {
##             s = subset(data, Class == "Outlier")
##             gplot = ggplot2::ggplot(data, aes(data[, 1], data[,
##                 2])) + geom_point(aes(colour = Class, pch = Class)) +
##                 geom_text(data = s, aes(x = s[, 1], y = s[, 2],
##                     label = rownames(s)), colour = "Red", hjust = "inward",

```

```
##           check_overlap = T) + ggtitle("Outlier plot") +
##           xlab("Variable1") + ylab("Variable2") + scale_color_manual(values = c
ols)
##       }
##       else {
##           dd = cbind(data, 1:nrow(data))
##           s = subset(dd, Class == "Outlier")
##           gplot = ggplot2::ggplot(data, aes(data[, 1], data[,
##           2])) + geom_point(aes(colour = Class, pch = Class)) +
##           geom_text(data = s, aes(x = s[, 1], y = s[, 2],
##           label = s[, 3]), colour = "Red", hjust = "inward",
##           check_overlap = T) + ggtitle("Outlier plot") +
##           xlab("Variable1") + ylab("Variable2") + scale_color_manual(values = c
ols)
##       }
##       Out = x[out, ]
##       l = list(`Outlier Observations` = Out, `Location of Outlier` = out,
##       `Scatter plot` = gplot)
##   }
##   else {
##       Out = x[out, ]
##       l = list(`Outlier Observations` = Out, `Location of Outlier` = out)
##   }
##   return(l)
## }
## <environment: namespace:OutlierDetection>
```