

Loan_german_data_for_classification_regression

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LOAN DATASET

#LOAD NECESSARY LIBRARIES

```
library(tidyverse)

## — Attaching core tidyverse packages ————— tidyverse
2.0.0 —
## ✓ dplyr     1.1.4    ✓ readr     2.1.5
## ✓forcats   1.0.0    ✓ stringr   1.5.1
## ✓ ggplot2   3.5.1    ✓ tibble    3.2.1
## ✓ lubridate 1.9.3    ✓ tidyverse  1.3.1
## ✓ purrr    1.0.2
## — Conflicts —
tidyverse_conflicts() —
## ✗ dplyr::filter() masks stats::filter()
## ✗ dplyr::lag()   masks stats::lag()
## [i] Use the conflicted package (<http://conflicted.r-lib.org/>) to force
all conflicts to become errors

library(caret)

## Loading required package: lattice
##
## Attaching package: 'caret'
##
## The following object is masked from 'package:purrr':
##
##     lift

library(randomForest)

## randomForest 4.7-1.1
## Type rfNews() to see new features/changes/bug fixes.
##
## Attaching package: 'randomForest'
##
## The following object is masked from 'package:dplyr':
##
##     combine

## The following object is masked from 'package:ggplot2':
```

```

## margin
library(ggplot2)

#LOAD THE DATASET

loandata<-  

read.csv("C:\\\\Users\\\\HP\\\\Downloads\\\\ComponentII_Datasets\\\\ComponentII_Datasets\\\\loan_data_set.csv")

#DATA PREPROCESSING

#Check the missing values

summary(loandata)

##      Loan_ID              Gender            Married        Dependents
##  Length:614    Length:614    Length:614    Length:614
##  Class :character  Class :character  Class :character  Class :character
##  Mode  :character  Mode  :character  Mode  :character  Mode  :character
##
##      Education          Self_Employed   ApplicantIncome CoapplicantIncome
##  Length:614    Length:614      Min.   : 150      Min.   :  0
##  Class :character  Class :character  1st Qu.: 2878    1st Qu.:  0
##  Mode  :character  Mode  :character  Median : 3812    Median : 1188
##                                         Mean   : 5403    Mean   : 1621
##                                         3rd Qu.: 5795    3rd Qu.: 2297
##                                         Max.   :81000    Max.   :41667
##
##      LoanAmount     Loan_Amount_Term Credit_History  Property_Area
##  Min.   : 9.0    Min.   : 12    Min.   :0.0000  Length:614
##  1st Qu.:100.0   1st Qu.:360   1st Qu.:1.0000  Class :character
##  Median :128.0   Median :360   Median :1.0000  Mode  :character
##  Mean   :146.4   Mean   :342   Mean   :0.8422
##  3rd Qu.:168.0   3rd Qu.:360   3rd Qu.:1.0000
##  Max.   :700.0   Max.   :480   Max.   :1.0000
##  NA's   :22      NA's   :14    NA's   :50
##
##      Loan_Status
##  Length:614
##  Class :character
##  Mode  :character
##
##      
```

#structure of the data

```

str(loandata)

## 'data.frame': 614 obs. of 13 variables:
## $ Loan_ID : chr "LP001002" "LP001003" "LP001005" "LP001006" ...
## $ Gender : chr "Male" "Male" "Male" "Male" ...
## $ Married : chr "No" "Yes" "Yes" "Yes" ...
## $ Dependents : chr "0" "1" "0" "0" ...
## $ Education : chr "Graduate" "Graduate" "Graduate" "Not Graduate"
...
## $ Self_Employed : chr "No" "No" "Yes" "No" ...
## $ ApplicantIncome : int 5849 4583 3000 2583 6000 5417 2333 3036 4006
12841 ...
## $ CoapplicantIncome: num 0 1508 0 2358 0 ...
## $ LoanAmount : int NA 128 66 120 141 267 95 158 168 349 ...
## $ Loan_Amount_Term : int 360 360 360 360 360 360 360 360 360 360 ...
## $ Credit_History : int 1 1 1 1 1 1 0 1 1 ...
## $ Property_Area : chr "Urban" "Rural" "Urban" "Urban" ...
## $ Loan_Status : chr "Y" "N" "Y" "Y" ...

```

#checking missing values in loan data

```

missing <- colSums(is.na(loandata))
print(missing)

##          Loan_ID        Gender       Married      Dependents
##                 0                 0                 0                 0
##          Education    Self_Employed ApplicantIncome CoapplicantIncome
##                  0                  0                  0                  0
##          LoanAmount   Loan_Amount_Term   Credit_History   Property_Area
##                 22                  14                  50                  0
##          Loan_Status
##                  0

```

DATA PREPROCESSING

#Handling Missing Values

```

# Replace missing values in numeric columns with the mean
num_cols <- sapply(loandata, is.numeric)
loandata[num_cols] <- lapply(loandata[num_cols], function(x) {
  x[is.na(x)] <- mean(x, na.rm = TRUE)
  return(x)
})

# Function to calculate mode
get_mode <- function(v) {
  uniq_v <- unique(v)
  uniq_v[which.max(tabulate(match(v, uniq_v)))]
}

# Replace missing values in categorical columns with the mode

```

```

categorical_cols <- sapply(loandata, function(x) is.factor(x) ||  

is.character(x))  

loandata[categorical_cols] <- lapply(loandata[categorical_cols], function(x)  

{  

  mode_value <- get_mode(x)  

  x[is.na(x)] <- mode_value  

  return(x)
})

```

#Converting Target Variable to Factor

```

# Convert target variable to factor  

loandata$Loan_Status <- as.factor(loandata$Loan_Status)

```

Data Visualization

#Visualize Target Variable Distribution

```

# Plot the distribution of the target variable 'Loan_Status'  

ggplot(loandata, aes(x = Loan_Status)) +  

  geom_bar(fill = "green") +  

  labs(title = "Distribution of Loan Status", x = "Loan Status", y = "Count")

```



#Visualize

Relationship Between Numeric Variables

```

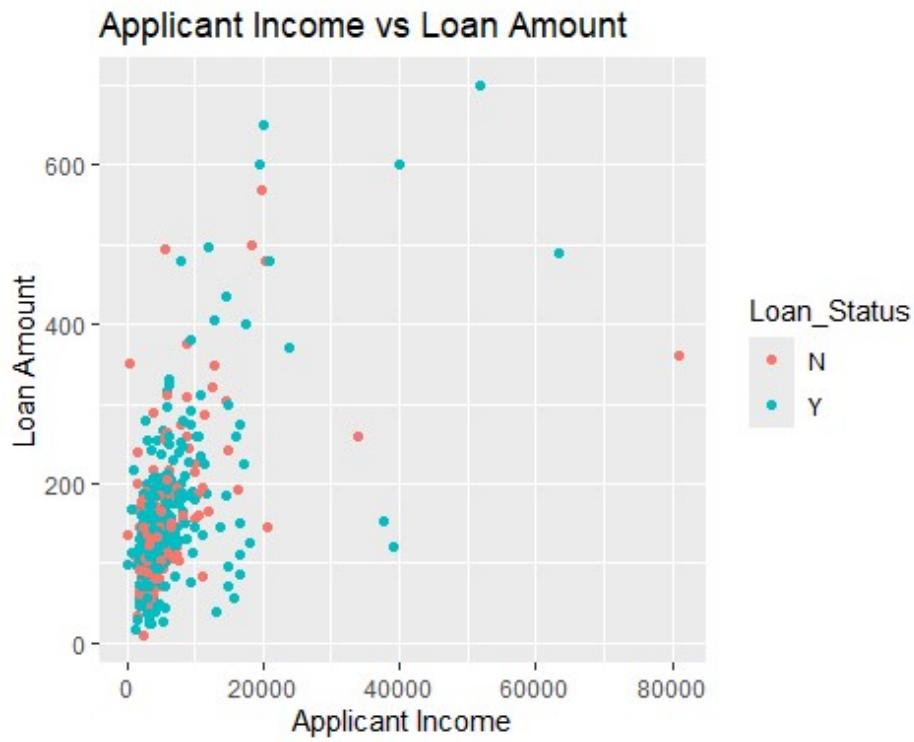
ggplot(loandata, aes(x = ApplicantIncome, y = LoanAmount, color =  

Loan_Status)) +  

  geom_point() +

```

```
  labs(title = "Applicant Income vs Loan Amount", x = "Applicant Income", y =  
    "Loan Amount")
```



Model Development

```
# Split the data into training and testing sets (80-20 )  
set.seed(123)  
train_index <- createDataPartition(loandata$Loan_Status, p = 0.8, list =  
FALSE)  
train_data <- loandata[train_index, ]  
test_data <- loandata[-train_index, ]
```

#Normalizing Numeric Variables

```
# Normalize numerical variables  
preprocess_params <- preprocess(train_data[, sapply(train_data, is.numeric)],  
method = c("center", "scale"))  
train_data[, sapply(train_data, is.numeric)] <- predict(preprocess_params,  
train_data[, sapply(train_data, is.numeric)])  
test_data[, sapply(test_data, is.numeric)] <- predict(preprocess_params,  
test_data[, sapply(test_data, is.numeric)])
```

#Building the Random Forest Model

```
# Random Forest Classification model  
rf_class_model <- randomForest(Loan_Status ~ ., data = train_data)
```

Model Evaluation

```

# Predict on test data
rf_class_predictions <- predict(rf_class_model, newdata = test_data)
rf_class_predictions

##   1   3   8  12  17  20  22  25  27  28  35  45  49  56  70  72  75  79
95 101
##   Y   Y   N   Y   Y   Y   Y   Y   Y   Y   N   Y   N   Y   N   Y   Y   N
Y   Y
## 104 105 118 122 126 131 132 133 137 139 145 146 148 150 151 171 174 175
178 180
##   Y   Y   Y   Y   N   N   Y   Y   N   N   Y   Y   Y   Y   N   Y   Y   Y
N   N
## 182 186 190 193 197 199 202 203 206 219 226 233 234 239 251 254 269 278
286 293
##   Y   Y   Y   Y   Y   Y   N   Y   Y   N   Y   Y   Y   Y   N   N   N   Y   Y
Y   Y
## 296 303 308 315 316 334 347 352 363 366 369 376 377 380 382 396 400 406
408 409
##   Y   Y   N   Y   Y   Y   N   N   Y   N   Y   Y   Y   Y   Y   Y   Y   N   Y
N   N
## 410 411 412 416 420 423 428 436 447 448 459 465 468 471 472 478 481 484
495 497
##   Y   Y   N   Y   Y   Y   Y   Y   Y   N   Y   Y   N   Y   Y   N   N   Y   Y
N   Y
## 506 507 512 515 519 523 524 536 537 540 542 543 551 556 557 578 591 595
599 606
##   Y   N   Y   Y   Y   Y   Y   Y   Y   N   Y   N   Y   Y   Y   Y   Y   Y   Y
Y   Y
## 608 612
##   Y   Y
## Levels: N Y

```

#Confusion Matrix and Accuracy

```

# Evaluate model performance (Confusion Matrix, Accuracy)
conf_matrix <- confusionMatrix(rf_class_predictions, test_data$Loan_Status)

# Print accuracy and other metrics
cat("Random Forest Accuracy:", conf_matrix$overall['Accuracy'], "\n")

## Random Forest Accuracy: 0.8114754

print(conf_matrix$byClass)

##           Sensitivity          Specificity          Pos Pred Value
##           0.6315789          0.8928571          0.7272727
## Neg Pred Value          Precision          Recall
##           0.8426966          0.7272727          0.6315789
##                   F1          Prevalence        Detection Rate
##           0.6760563          0.3114754          0.1967213

```

```
## Detection Prevalence      Balanced Accuracy
##          0.2704918           0.7622180
```

GERMAN DATASET

IMPORT THE NECESSARY LIBRARIES

```
library(tidyverse)
library(caret)
library(randomForest)
library(MASS)

##
## Attaching package: 'MASS'

## The following object is masked from 'package:dplyr':
##
##     select

library(ggplot2)
```

LOAD THE DATASET

```
german_data<-
read.csv('C:\\\\Users\\\\HP\\\\Downloads\\\\ComponentII_Datasets\\\\ComponentII_Datasets\\\\german_credit_data.csv')

german_data

##      X Age    Sex Job Housing Saving.accounts Checking.account
Credit.amount
## 1   0  67 male   2    own             <NA>       little
1169
## 2   1  22 female  2    own            little   moderate
5951
## 3   2  49 male   1    own            little        <NA>
2096
## 4   3  45 male   2    free            little       little
7882
## 5   4  53 male   2    free            little       little
4870
## 6   5  35 male   1    free             <NA>        <NA>
9055
## 7   6  53 male   2    own            quite rich        <NA>
2835
## 8   7  35 male   3    rent            little   moderate
6948
## 9   8  61 male   1    own            rich        <NA>
3059
## 10  9  28 male   3    own            little   moderate
5234
## 11 10  25 female  2    rent            little   moderate
```

1295							
## 12	11	24	female	2	rent	little	little
4308							
## 13	12	22	female	2	own	little	moderate
1567							
## 14	13	60	male	1	own	little	little
1199							
## 15	14	28	female	2	rent	little	little
1403							
## 16	15	32	female	1	own	moderate	little
1282							
## 17	16	53	male	2	own	<NA>	<NA>
2424							
## 18	17	25	male	2	own	<NA>	little
8072							
## 19	18	44	female	3	free	little	moderate
12579							
## 20	19	31	male	2	own	quite rich	<NA>
3430							
## 21	20	48	male	2	own	little	<NA>
2134							
## 22	21	44	male	2	rent	quite rich	little
2647							
## 23	22	48	male	1	rent	little	little
2241							
## 24	23	44	male	2	own	moderate	moderate
1804							
## 25	24	26	male	2	own	<NA>	<NA>
2069							
## 26	25	36	male	1	own	little	little
1374							
## 27	26	39	male	1	own	little	<NA>
426							
## 28	27	42	female	2	rent	rich	rich
409							
## 29	28	34	male	2	own	little	moderate
2415							
## 30	29	63	male	2	own	little	little
6836							
## 31	30	36	male	2	own	rich	moderate
1913							
## 32	31	27	male	2	own	little	little
4020							
## 33	32	30	male	2	own	moderate	moderate
5866							
## 34	33	57	male	1	rent	<NA>	<NA>
1264							
## 35	34	33	female	3	own	little	rich
1474							
## 36	35	25	male	1	own	little	moderate

4746							
## 37	36	31	male	2	free	little	<NA>
6110							
## 38	37	37	male	2	own	little	rich
2100							
## 39	38	37	male	2	own	little	rich
1225							
## 40	39	24	male	2	own	little	moderate
458							
## 41	40	30	male	3	own	quite rich	<NA>
2333							
## 42	41	26	male	2	own	quite rich	moderate
1158							
## 43	42	44	male	1	own	little	moderate
6204							
## 44	43	24	male	2	rent	moderate	little
6187							
## 45	44	58	female	1	free	little	little
6143							
## 46	45	35	female	3	own	little	<NA>
1393							
## 47	46	39	male	2	own	quite rich	<NA>
2299							
## 48	47	23	female	0	rent	quite rich	little
1352							
## 49	48	39	male	1	own	little	<NA>
7228							
## 50	49	28	female	2	own	moderate	<NA>
2073							
## 51	50	29	male	1	own	<NA>	moderate
2333							
## 52	51	30	male	3	own	little	moderate
5965							
## 53	52	25	male	2	own	little	<NA>
1262							
## 54	53	31	male	2	own	<NA>	<NA>
3378							
## 55	54	57	male	2	free	little	moderate
2225							
## 56	55	26	male	1	own	<NA>	<NA>
783							
## 57	56	52	male	3	own	<NA>	moderate
6468							
## 58	57	31	female	2	own	little	<NA>
9566							
## 59	58	23	female	3	own	little	rich
1961							
## 60	59	23	female	1	rent	little	little
6229							
## 61	60	27	male	2	own	little	moderate

1391							
## 62	61	50	male	2	own	<NA>	moderate
1537							
## 63	62	61	male	3	free	little	moderate
1953							
## 64	63	25	male	2	own	little	moderate
14421							
## 65	64	26	female	2	own	little	<NA>
3181							
## 66	65	48	male	2	own	<NA>	<NA>
5190							
## 67	66	29	female	2	own	little	<NA>
2171							
## 68	67	22	male	2	own	rich	moderate
1007							
## 69	68	37	male	2	free	little	<NA>
1819							
## 70	69	25	female	2	own	<NA>	<NA>
2394							
## 71	70	30	female	2	own	little	<NA>
8133							
## 72	71	46	male	1	rent	<NA>	<NA>
730							
## 73	72	51	male	3	free	little	little
1164							
## 74	73	41	female	1	own	little	moderate
5954							
## 75	74	40	male	3	own	<NA>	little
1977							
## 76	75	66	male	3	free	little	little
1526							
## 77	76	34	male	2	own	little	little
3965							
## 78	77	51	male	2	own	little	moderate
4771							
## 79	78	39	male	1	own	<NA>	<NA>
9436							
## 80	79	22	male	2	own	little	moderate
3832							
## 81	80	44	female	2	own	<NA>	<NA>
5943							
## 82	81	47	male	2	own	quite rich	<NA>
1213							
## 83	82	24	female	1	rent	moderate	<NA>
1568							
## 84	83	58	female	1	own	little	little
1755							
## 85	84	52	male	1	own	little	little
2315							
## 86	85	29	female	3	own	little	<NA>

1412							
## 87	86	27	female	2	own	little	moderate
1295							
## 88	87	47	male	2	free	moderate	moderate
12612							
## 89	88	30	male	3	own	moderate	little
2249							
## 90	89	28	male	2	own	little	little
1108							
## 91	90	56	male	2	own	little	<NA>
618							
## 92	91	54	male	2	own	little	little
1409							
## 93	92	33	female	1	own	<NA>	<NA>
797							
## 94	93	20	male	2	rent	<NA>	rich
3617							
## 95	94	54	male	2	own	rich	moderate
1318							
## 96	95	58	male	2	rent	little	moderate
15945							
## 97	96	61	female	2	own	<NA>	<NA>
2012							
## 98	97	34	male	2	own	moderate	moderate
2622							
## 99	98	36	male	2	own	little	moderate
2337							
## 100	99	36	male	3	rent	<NA>	moderate
7057							
## 101	100	41	male	1	rent	moderate	<NA>
1469							
## 102	101	24	male	2	rent	little	moderate
2323							
## 103	102	24	female	2	own	little	<NA>
932							
## 104	103	35	male	2	rent	little	moderate
1919							
## 105	104	26	male	2	rent	<NA>	<NA>
2445							
## 106	105	39	male	3	own	little	moderate
11938							
## 107	106	39	male	3	own	little	<NA>
6458							
## 108	107	32	male	2	own	little	moderate
6078							
## 109	108	30	female	2	own	<NA>	little
7721							
## 110	109	35	male	2	own	quite rich	moderate
1410							
## 111	110	31	male	2	own	moderate	moderate

1449							
## 112	111	23	female	2	rent	little	rich
392							
## 113	112	28	male	1	rent	little	moderate
6260							
## 114	113	25	female	2	own	little	<NA>
7855							
## 115	114	35	male	2	own	quite rich	little
1680							
## 116	115	47	male	2	own	<NA>	<NA>
3578							
## 117	116	30	female	3	own	<NA>	little
7174							
## 118	117	27	female	2	rent	<NA>	little
2132							
## 119	118	23	female	2	own	quite rich	little
4281							
## 120	119	36	male	3	own	quite rich	moderate
2366							
## 121	120	25	female	2	own	little	little
1835							
## 122	121	41	female	3	rent	little	<NA>
3868							
## 123	122	24	male	1	rent	little	<NA>
1768							
## 124	123	63	male	2	free	little	rich
781							
## 125	124	27	female	2	rent	<NA>	moderate
1924							
## 126	125	30	male	2	own	little	little
2121							
## 127	126	40	male	1	own	little	little
701							
## 128	127	30	male	2	own	little	moderate
639							
## 129	128	34	male	3	own	little	moderate
1860							
## 130	129	29	female	2	own	little	little
3499							
## 131	130	24	female	2	own	<NA>	moderate
8487							
## 132	131	29	male	2	own	little	little
6887							
## 133	132	27	male	1	own	little	<NA>
2708							
## 134	133	47	male	2	free	little	<NA>
1984							
## 135	134	21	female	2	own	moderate	<NA>
10144							
## 136	135	38	female	2	own	<NA>	<NA>

1240								
## 137	136	27	male	2	own	rich	<NA>	
8613								
## 138	137	66	male	1	own	quite rich	moderate	
766								
## 139	138	35	male	2	own	<NA>	moderate	
2728								
## 140	139	44	female	1	rent	little	rich	
1881								
## 141	140	27	male	0	own	rich	rich	
709								
## 142	141	30	female	3	own	little	moderate	
4795								
## 143	142	27	male	3	own	little	little	
3416								
## 144	143	22	male	2	own	little	little	
2462								
## 145	144	23	female	2	own	little	<NA>	
2288								
## 146	145	30	male	2	own	moderate	moderate	
3566								
## 147	146	39	female	2	own	little	little	
860								
## 148	147	51	female	2	own	moderate	<NA>	
682								
## 149	148	28	male	2	own	little	little	
5371								
## 150	149	46	male	2	own	rich	<NA>	
1582								
## 151	150	42	male	2	free	moderate	<NA>	
1346								
## 152	151	38	male	2	own	little	<NA>	
1924								
## 153	152	24	male	2	own	little	rich	
5848								
## 154	153	29	female	2	rent	rich	moderate	
7758								
## 155	154	36	male	3	rent	moderate	moderate	
6967								
## 156	155	20	female	2	rent	little	little	
1282								
## 157	156	48	male	2	own	moderate	little	
1288								
## 158	157	45	male	1	own	little	little	
339								
## 159	158	38	male	2	own	moderate	moderate	
3512								
## 160	159	34	male	1	own	<NA>	<NA>	
1898								
## 161	160	36	male	2	own	moderate	<NA>	

2872								
## 162	161	30	female	2	own	little	<NA>	
1055								
## 163	162	36	male	2	own	quite rich	<NA>	
1262								
## 164	163	70	male	3	free	little	moderate	
7308								
## 165	164	36	male	2	own	quite rich	<NA>	
909								
## 166	165	32	male	2	own	quite rich	<NA>	
2978								
## 167	166	33	female	2	own	little	little	
1131								
## 168	167	20	female	2	own	rich	moderate	
1577								
## 169	168	25	female	2	rent	little	<NA>	
3972								
## 170	169	31	male	2	own	little	moderate	
1935								
## 171	170	33	male	2	rent	little	little	
950								
## 172	171	26	female	2	own	little	<NA>	
763								
## 173	172	34	female	3	own	little	moderate	
2064								
## 174	173	33	male	2	own	little	moderate	
1414								
## 175	174	26	male	2	own	little	little	
3414								
## 176	175	53	female	3	own	<NA>	<NA>	
7485								
## 177	176	42	male	2	own	little	little	
2577								
## 178	177	52	male	2	own	quite rich	little	
338								
## 179	178	31	male	3	rent	little	<NA>	
1963								
## 180	179	65	male	2	own	little	little	
571								
## 181	180	28	male	2	own	little	<NA>	
9572								
## 182	181	30	male	3	own	little	moderate	
4455								
## 183	182	40	male	1	own	<NA>	little	
1647								
## 184	183	50	male	2	own	rich	<NA>	
3777								
## 185	184	36	male	2	own	little	moderate	
884								
## 186	185	31	male	2	own	little	<NA>	

1360								
## 187	186	74	female	3	free	little	moderate	
5129								
## 188	187	68	male	0	free	little	moderate	
1175								
## 189	188	20	male	2	own	moderate	little	
674								
## 190	189	33	female	2	own	little	moderate	
3244								
## 191	190	54	male	3	own	rich	<NA>	
4591								
## 192	191	34	male	1	free	moderate	moderate	
3844								
## 193	192	36	male	2	own	little	moderate	
3915								
## 194	193	29	male	2	rent	little	<NA>	
2108								
## 195	194	21	male	2	rent	moderate	moderate	
3031								
## 196	195	34	female	3	own	little	moderate	
1501								
## 197	196	28	female	2	own	little	<NA>	
1382								
## 198	197	27	female	2	rent	moderate	moderate	
951								
## 199	198	36	male	2	free	<NA>	moderate	
2760								
## 200	199	40	male	3	own	little	moderate	
4297								
## 201	200	52	male	2	own	quite rich	<NA>	
936								
## 202	201	27	male	1	own	little	little	
1168								
## 203	202	26	male	2	own	little	<NA>	
5117								
## 204	203	21	male	2	rent	little	little	
902								
## 205	204	38	male	1	own	little	<NA>	
1495								
## 206	205	38	male	3	free	little	little	
10623								
## 207	206	43	male	2	own	little	<NA>	
1935								
## 208	207	26	male	2	own	little	moderate	
1424								
## 209	208	21	male	1	own	little	little	
6568								
## 210	209	55	male	2	own	rich	<NA>	
1413								
## 211	210	33	male	2	own	<NA>	<NA>	

3074								
## 212	211	45	female	1	own	<NA>	<NA>	
3835								
## 213	212	50	male	2	own	little	little	
5293								
## 214	213	66	male	3	own	little	rich	
1908								
## 215	214	51	male	2	own	<NA>	<NA>	
3342								
## 216	215	39	female	1	own	<NA>	moderate	
932								
## 217	216	31	male	2	own	little	little	
3104								
## 218	217	23	male	2	own	little	rich	
3913								
## 219	218	24	male	1	rent	little	little	
3021								
## 220	219	64	female	2	own	little	<NA>	
1364								
## 221	220	26	male	1	own	little	moderate	
625								
## 222	221	23	female	2	rent	<NA>	little	
1200								
## 223	222	30	male	2	own	little	<NA>	
707								
## 224	223	32	male	2	own	<NA>	<NA>	
2978								
## 225	224	30	male	2	own	little	<NA>	
4657								
## 226	225	27	male	2	own	little	<NA>	
2613								
## 227	226	27	male	2	own	rich	moderate	
10961								
## 228	227	53	male	3	free	little	little	
7865								
## 229	228	22	male	2	own	little	<NA>	
1478								
## 230	229	22	male	2	free	little	little	
3149								
## 231	230	26	male	2	own	little	rich	
4210								
## 232	231	51	male	1	free	quite rich	<NA>	
2507								
## 233	232	35	male	2	own	moderate	<NA>	
2141								
## 234	233	25	male	1	own	little	moderate	
866								
## 235	234	42	male	1	own	little	<NA>	
1544								
## 236	235	30	male	3	own	little	little	

1823								
## 237	236	23	male	0	own	<NA>	moderate	
14555								
## 238	237	61	male	1	rent	moderate	moderate	
2767								
## 239	238	35	female	2	own	little	<NA>	
1291								
## 240	239	39	male	2	own	little	little	
2522								
## 241	240	29	female	2	own	<NA>	little	
915								
## 242	241	51	male	2	own	little	<NA>	
1595								
## 243	242	24	male	2	free	little	little	
4605								
## 244	243	27	female	2	own	little	<NA>	
1185								
## 245	244	35	female	1	own	quite rich	<NA>	
3447								
## 246	245	25	male	2	own	little	<NA>	
1258								
## 247	246	52	male	2	own	little	<NA>	
717								
## 248	247	35	male	2	rent	moderate	<NA>	
1204								
## 249	248	26	male	2	own	little	rich	
1925								
## 250	249	22	female	2	rent	little	<NA>	
433								
## 251	250	39	female	1	own	rich	little	
666								
## 252	251	46	female	1	own	little	rich	
2251								
## 253	252	24	female	2	own	little	moderate	
2150								
## 254	253	35	male	2	own	moderate	<NA>	
4151								
## 255	254	24	male	2	own	<NA>	moderate	
2030								
## 256	255	27	male	1	own	<NA>	moderate	
7418								
## 257	256	35	male	1	own	little	<NA>	
2684								
## 258	257	29	male	2	free	little	little	
2149								
## 259	258	23	female	2	own	moderate	<NA>	
3812								
## 260	259	57	female	1	own	moderate	<NA>	
1154								
## 261	260	27	male	2	own	little	little	

1657							
## 262	261	55	female	2	own	little	little
1603							
## 263	262	36	male	3	free	little	little
5302							
## 264	263	57	female	1	free	little	<NA>
2748							
## 265	264	32	male	1	own	little	<NA>
1231							
## 266	265	37	male	2	own	little	moderate
802							
## 267	266	36	male	2	own	<NA>	<NA>
6304							
## 268	267	38	female	2	own	little	<NA>
1533							
## 269	268	45	male	3	own	little	little
8978							
## 270	269	25	male	2	own	<NA>	<NA>
999							
## 271	270	32	male	2	own	<NA>	<NA>
2662							
## 272	271	37	female	2	rent	quite rich	<NA>
1402							
## 273	272	36	male	3	free	<NA>	moderate
12169							
## 274	273	28	male	2	own	little	moderate
3060							
## 275	274	34	male	1	own	little	little
11998							
## 276	275	32	male	2	own	little	<NA>
2697							
## 277	276	26	female	2	own	little	<NA>
2404							
## 278	277	49	male	1	own	<NA>	little
1262							
## 279	278	32	female	2	own	little	<NA>
4611							
## 280	279	29	male	3	rent	moderate	<NA>
1901							
## 281	280	23	male	2	rent	rich	<NA>
3368							
## 282	281	50	male	2	own	little	<NA>
1574							
## 283	282	49	male	1	own	<NA>	rich
1445							
## 284	283	63	male	2	own	<NA>	<NA>
1520							
## 285	284	37	male	2	own	moderate	moderate
3878							
## 286	285	35	female	1	own	little	little

10722								
## 287	286	26	male	2	own	little	little	
4788								
## 288	287	31	male	3	free	moderate	moderate	
7582								
## 289	288	49	female	2	own	little	moderate	
1092								
## 290	289	48	male	2	own	little	little	
1024								
## 291	290	26	male	2	own	little	<NA>	
1076								
## 292	291	28	male	3	rent	little	moderate	
9398								
## 293	292	44	female	3	free	little	little	
6419								
## 294	293	56	male	2	free	little	rich	
4796								
## 295	294	46	male	3	own	<NA>	<NA>	
7629								
## 296	295	26	female	2	own	little	moderate	
9960								
## 297	296	20	female	2	rent	<NA>	<NA>	
4675								
## 298	297	45	male	1	own	<NA>	<NA>	
1287								
## 299	298	43	male	2	own	little	<NA>	
2515								
## 300	299	32	male	2	own	rich	moderate	
2745								
## 301	300	54	female	0	own	little	<NA>	
672								
## 302	301	42	female	2	own	little	moderate	
3804								
## 303	302	37	male	1	own	<NA>	rich	
1344								
## 304	303	49	male	2	own	little	little	
1038								
## 305	304	44	male	2	free	quite rich	<NA>	
10127								
## 306	305	33	male	2	own	rich	<NA>	
1543								
## 307	306	24	female	1	rent	<NA>	<NA>	
4811								
## 308	307	33	male	1	own	moderate	little	
727								
## 309	308	24	female	2	own	little	moderate	
1237								
## 310	309	22	male	1	rent	little	moderate	
276								
## 311	310	40	male	0	free	<NA>	moderate	

5381								
## 312	311	25	male	2	own	moderate	<NA>	
5511								
## 313	312	26	female	2	own	little	rich	
3749								
## 314	313	25	male	1	own	little	moderate	
685								
## 315	314	29	male	1	own	<NA>	rich	
1494								
## 316	315	31	male	2	own	little	little	
2746								
## 317	316	38	male	1	own	little	little	
708								
## 318	317	48	female	1	own	<NA>	moderate	
4351								
## 319	318	32	male	2	own	little	<NA>	
701								
## 320	319	27	female	1	own	little	little	
3643								
## 321	320	28	male	3	own	little	moderate	
4249								
## 322	321	32	male	2	own	little	little	
1938								
## 323	322	34	male	3	free	little	little	
2910								
## 324	323	28	male	2	own	rich	little	
2659								
## 325	324	36	female	2	own	little	<NA>	
1028								
## 326	325	39	male	1	own	little	little	
3398								
## 327	326	49	male	2	rent	<NA>	<NA>	
5801								
## 328	327	34	female	2	own	rich	<NA>	
1525								
## 329	328	31	male	2	own	little	rich	
4473								
## 330	329	28	male	2	own	little	moderate	
1068								
## 331	330	75	male	3	free	little	little	
6615								
## 332	331	30	female	2	own	moderate	<NA>	
1864								
## 333	332	24	female	3	own	moderate	moderate	
7408								
## 334	333	24	female	1	rent	moderate	<NA>	
11590								
## 335	334	23	male	2	rent	little	little	
4110								
## 336	335	44	male	3	rent	little	little	

3384								
## 337	336	23	female	1	own	little	moderate	
2101								
## 338	337	24	female	2	rent	<NA>	little	
1275								
## 339	338	28	male	2	own	little	little	
4169								
## 340	339	31	male	1	own	little	moderate	
1521								
## 341	340	24	female	2	free	little	moderate	
5743								
## 342	341	26	female	1	rent	little	little	
3599								
## 343	342	25	male	2	rent	quite rich	moderate	
3213								
## 344	343	33	male	3	own	little	moderate	
4439								
## 345	344	37	male	1	own	little	rich	
3949								
## 346	345	43	female	1	own	little	<NA>	
1459								
## 347	346	23	male	2	own	little	moderate	
882								
## 348	347	23	female	0	rent	quite rich	moderate	
3758								
## 349	348	34	male	1	own	moderate	<NA>	
1743								
## 350	349	32	male	2	free	rich	moderate	
1136								
## 351	350	23	female	2	rent	little	<NA>	
1236								
## 352	351	29	female	2	own	little	moderate	
959								
## 353	352	38	male	3	own	<NA>	<NA>	
3229								
## 354	353	28	male	2	rent	little	little	
6199								
## 355	354	46	male	2	free	quite rich	<NA>	
727								
## 356	355	23	male	1	own	little	moderate	
1246								
## 357	356	49	male	2	own	<NA>	<NA>	
2331								
## 358	357	26	male	3	own	little	<NA>	
4463								
## 359	358	28	male	2	own	little	<NA>	
776								
## 360	359	23	female	2	rent	little	little	
2406								
## 361	360	61	male	2	free	<NA>	moderate	

1239								
## 362	361	37	male	3	own	<NA>	rich	
3399								
## 363	362	36	female	2	own	little	rich	
2247								
## 364	363	21	male	2	rent	little	<NA>	
1766								
## 365	364	25	male	0	own	little	little	
2473								
## 366	365	36	male	2	own	little	<NA>	
1542								
## 367	366	27	male	2	own	little	<NA>	
3850								
## 368	367	22	female	2	rent	little	little	
3650								
## 369	368	42	male	2	own	little	little	
3446								
## 370	369	40	female	2	rent	little	moderate	
3001								
## 371	370	36	male	2	own	<NA>	<NA>	
3079								
## 372	371	33	male	2	own	little	<NA>	
6070								
## 373	372	23	female	2	rent	little	<NA>	
2146								
## 374	373	63	male	3	free	<NA>	<NA>	
13756								
## 375	374	60	female	3	free	moderate	moderate	
14782								
## 376	375	37	female	2	rent	little	little	
7685								
## 377	376	34	male	2	own	little	<NA>	
2320								
## 378	377	36	male	2	free	<NA>	<NA>	
846								
## 379	378	57	male	3	free	little	moderate	
14318								
## 380	379	52	female	1	own	moderate	<NA>	
362								
## 381	380	39	male	2	own	<NA>	little	
2212								
## 382	381	38	female	3	free	little	moderate	
12976								
## 383	382	25	female	2	rent	<NA>	<NA>	
1283								
## 384	383	26	male	2	own	little	rich	
1330								
## 385	384	26	male	1	own	moderate	<NA>	
4272								
## 386	385	25	female	2	own	little	<NA>	

2238								
## 387	386	21	female	2	rent	<NA>	<NA>	
1126								
## 388	387	40	male	3	own	little	moderate	
7374								
## 389	388	27	male	2	own	quite rich	moderate	
2326								
## 390	389	27	female	2	own	little	<NA>	
1449								
## 391	390	30	male	3	own	little	<NA>	
1820								
## 392	391	19	female	1	rent	rich	moderate	
983								
## 393	392	39	male	3	free	little	little	
3249								
## 394	393	31	female	2	own	little	little	
1957								
## 395	394	31	male	3	own	little	<NA>	
2406								
## 396	395	32	male	2	rent	moderate	moderate	
11760								
## 397	396	55	female	3	free	little	little	
2578								
## 398	397	46	male	2	own	little	little	
2348								
## 399	398	46	male	2	rent	little	moderate	
1223								
## 400	399	43	female	1	own	rich	<NA>	
1516								
## 401	400	39	male	2	own	little	<NA>	
1473								
## 402	401	28	male	2	own	<NA>	moderate	
1887								
## 403	402	27	male	2	own	little	<NA>	
8648								
## 404	403	27	male	1	own	little	<NA>	
802								
## 405	404	43	male	2	own	<NA>	moderate	
2899								
## 406	405	22	male	2	own	little	moderate	
2039								
## 407	406	43	male	2	own	<NA>	<NA>	
2197								
## 408	407	27	male	2	own	little	little	
1053								
## 409	408	26	male	3	own	quite rich	<NA>	
3235								
## 410	409	28	male	2	own	quite rich	rich	
939								
## 411	410	20	female	2	own	little	moderate	

1967								
## 412	411	35	male	3	own	little	<NA>	
7253								
## 413	412	42	male	3	own	little	<NA>	
2292								
## 414	413	40	male	1	rent	quite rich	<NA>	
1597								
## 415	414	35	female	2	own	<NA>	little	
1381								
## 416	415	35	male	2	own	little	<NA>	
5842								
## 417	416	33	male	1	own	little	little	
2579								
## 418	417	23	female	2	rent	<NA>	little	
8471								
## 419	418	31	female	3	own	quite rich	<NA>	
2782								
## 420	419	33	female	2	own	<NA>	moderate	
1042								
## 421	420	20	female	2	rent	rich	<NA>	
3186								
## 422	421	30	male	2	own	<NA>	moderate	
2028								
## 423	422	47	male	1	own	little	moderate	
958								
## 424	423	34	male	3	own	moderate	<NA>	
1591								
## 425	424	25	female	2	own	<NA>	moderate	
2762								
## 426	425	21	male	2	rent	little	moderate	
2779								
## 427	426	29	male	2	own	little	<NA>	
2743								
## 428	427	46	male	2	own	rich	<NA>	
1149								
## 429	428	20	male	2	own	little	<NA>	
1313								
## 430	429	55	female	0	free	little	little	
1190								
## 431	430	74	male	1	own	little	<NA>	
3448								
## 432	431	29	male	3	own	little	moderate	
11328								
## 433	432	36	male	3	free	little	little	
1872								
## 434	433	33	male	2	own	little	<NA>	
2058								
## 435	434	25	male	2	own	little	little	
2136								
## 436	435	25	male	2	own	<NA>	moderate	

1484								
## 437	436	23	male	1	rent	quite rich	<NA>	
660								
## 438	437	37	female	2	own	rich	<NA>	
1287								
## 439	438	65	male	0	own	little	little	
3394								
## 440	439	26	female	0	own	little	rich	
609								
## 441	440	39	male	3	own	little	<NA>	
1884								
## 442	441	30	female	2	own	little	little	
1620								
## 443	442	29	male	2	own	little	moderate	
2629								
## 444	443	41	male	1	own	little	<NA>	
719								
## 445	444	30	female	3	own	little	moderate	
5096								
## 446	445	41	female	1	rent	<NA>	<NA>	
1244								
## 447	446	34	female	2	own	little	little	
1842								
## 448	447	35	male	2	own	little	moderate	
2576								
## 449	448	55	female	3	own	<NA>	rich	
1424								
## 450	449	61	male	2	own	rich	moderate	
1512								
## 451	450	30	male	3	own	<NA>	<NA>	
11054								
## 452	451	29	female	2	own	little	<NA>	
518								
## 453	452	34	male	2	own	little	<NA>	
2759								
## 454	453	35	male	3	own	little	<NA>	
2670								
## 455	454	31	male	2	own	little	little	
4817								
## 456	455	29	female	3	own	little	<NA>	
2679								
## 457	456	36	male	2	rent	little	little	
3905								
## 458	457	35	male	2	free	little	little	
3386								
## 459	458	27	female	2	own	little	little	
343								
## 460	459	32	male	2	own	little	<NA>	
4594								
## 461	460	37	male	2	own	little	little	

3620								
## 462	461	36	male	2	own	little	little	
1721								
## 463	462	34	female	3	rent	little	moderate	
3017								
## 464	463	38	male	2	own	<NA>	moderate	
754								
## 465	464	34	male	2	own	little	<NA>	
1950								
## 466	465	63	male	2	own	little	little	
2924								
## 467	466	29	female	1	rent	little	little	
1659								
## 468	467	32	male	2	own	<NA>	<NA>	
7238								
## 469	468	26	female	2	own	little	<NA>	
2764								
## 470	469	35	male	1	own	little	<NA>	
4679								
## 471	470	22	male	2	rent	moderate	moderate	
3092								
## 472	471	23	female	2	own	little	little	
448								
## 473	472	28	male	1	own	little	little	
654								
## 474	473	36	male	3	own	<NA>	<NA>	
1238								
## 475	474	33	male	2	own	little	moderate	
1245								
## 476	475	26	female	2	rent	little	little	
3114								
## 477	476	24	male	2	own	quite rich	<NA>	
2569								
## 478	477	25	male	2	own	little	rich	
5152								
## 479	478	39	male	1	own	moderate	moderate	
1037								
## 480	479	44	male	2	own	little	little	
1478								
## 481	480	23	female	1	own	little	moderate	
3573								
## 482	481	26	male	2	own	little	moderate	
1201								
## 483	482	57	female	2	rent	rich	little	
3622								
## 484	483	30	female	2	own	rich	<NA>	
960								
## 485	484	44	male	2	own	quite rich	<NA>	
1163								
## 486	485	47	male	3	own	little	moderate	

1209								
## 487	486	52	male	2	own	little	<NA>	
3077								
## 488	487	62	female	2	free	little	<NA>	
3757								
## 489	488	35	male	1	rent	moderate	<NA>	
1418								
## 490	489	26	male	2	rent	little	<NA>	
3518								
## 491	490	26	male	2	own	little	<NA>	
1934								
## 492	491	42	female	3	free	little	moderate	
8318								
## 493	492	27	female	2	own	moderate	<NA>	
1237								
## 494	493	38	male	2	own	<NA>	moderate	
368								
## 495	494	39	male	1	rent	little	little	
2122								
## 496	495	20	male	2	own	<NA>	little	
2996								
## 497	496	29	male	3	rent	moderate	moderate	
9034								
## 498	497	40	male	2	own	little	<NA>	
1585								
## 499	498	32	male	1	own	little	moderate	
1301								
## 500	499	28	male	2	own	moderate	rich	
1323								
## 501	500	27	female	2	own	little	little	
3123								
## 502	501	42	male	2	free	little	little	
5493								
## 503	502	49	male	2	own	moderate	rich	
1126								
## 504	503	38	male	2	own	moderate	moderate	
1216								
## 505	504	24	female	2	rent	little	little	
1207								
## 506	505	27	male	1	own	<NA>	<NA>	
1309								
## 507	506	36	male	2	own	quite rich	rich	
2360								
## 508	507	34	male	3	own	moderate	moderate	
6850								
## 509	508	28	male	2	own	little	<NA>	
1413								
## 510	509	45	male	3	own	moderate	<NA>	
8588								
## 511	510	26	male	2	own	little	little	

759								
## 512	511	32	male	3	free	little	<NA>	
4686								
## 513	512	26	male	2	rent	little	rich	
2687								
## 514	513	20	male	2	rent	little	moderate	
585								
## 515	514	54	male	2	own	<NA>	<NA>	
2255								
## 516	515	37	female	2	own	little	little	
609								
## 517	516	40	male	1	own	little	little	
1361								
## 518	517	23	female	2	rent	little	<NA>	
7127								
## 519	518	43	male	2	own	moderate	little	
1203								
## 520	519	36	male	2	free	<NA>	<NA>	
700								
## 521	520	44	male	2	free	little	<NA>	
5507								
## 522	521	24	female	2	own	little	little	
3190								
## 523	522	53	male	2	free	little	little	
7119								
## 524	523	23	female	2	own	moderate	<NA>	
3488								
## 525	524	26	female	1	own	little	moderate	
1113								
## 526	525	30	male	2	own	little	moderate	
7966								
## 527	526	31	female	2	own	moderate	<NA>	
1532								
## 528	527	42	male	1	own	little	<NA>	
1503								
## 529	528	31	male	2	rent	little	little	
2302								
## 530	529	41	male	1	own	little	little	
662								
## 531	530	32	male	2	own	little	moderate	
2273								
## 532	531	28	female	2	rent	moderate	moderate	
2631								
## 533	532	41	male	2	rent	little	<NA>	
1503								
## 534	533	26	male	2	own	moderate	<NA>	
1311								
## 535	534	25	male	2	own	<NA>	<NA>	
3105								
## 536	535	33	male	2	rent	little	rich	

2319								
## 537	536	75	female	3	own	<NA>	little	
1374								
## 538	537	37	female	2	own	little	moderate	
3612								
## 539	538	42	male	3	free	little	little	
7763								
## 540	539	45	female	1	own	little	rich	
3049								
## 541	540	23	male	2	rent	little	moderate	
1534								
## 542	541	60	male	2	free	little	<NA>	
2032								
## 543	542	31	male	2	own	<NA>	little	
6350								
## 544	543	34	male	1	own	little	rich	
2864								
## 545	544	61	male	1	own	little	<NA>	
1255								
## 546	545	43	male	2	free	little	little	
1333								
## 547	546	37	female	2	own	little	<NA>	
2022								
## 548	547	32	male	2	own	little	<NA>	
1552								
## 549	548	24	female	1	own	little	little	
626								
## 550	549	35	male	2	free	<NA>	<NA>	
8858								
## 551	550	23	female	2	own	<NA>	<NA>	
996								
## 552	551	45	male	1	own	quite rich	<NA>	
1750								
## 553	552	34	male	2	own	little	little	
6999								
## 554	553	27	male	2	own	moderate	moderate	
1995								
## 555	554	67	female	3	own	little	moderate	
1199								
## 556	555	22	male	2	own	little	moderate	
1331								
## 557	556	28	female	2	own	moderate	moderate	
2278								
## 558	557	29	female	2	own	<NA>	<NA>	
5003								
## 559	558	27	male	2	own	little	little	
3552								
## 560	559	31	male	1	own	little	moderate	
1928								
## 561	560	49	male	2	free	<NA>	little	

2964								
## 562	561	24	male	1	rent	little	little	
1546								
## 563	562	29	female	2	own	little	rich	
683								
## 564	563	37	male	2	free	<NA>	moderate	
12389								
## 565	564	37	male	3	own	<NA>	moderate	
4712								
## 566	565	23	female	2	rent	moderate	moderate	
1553								
## 567	566	36	male	2	own	little	little	
1372								
## 568	567	34	male	2	own	rich	<NA>	
2578								
## 569	568	41	male	2	own	<NA>	moderate	
3979								
## 570	569	31	female	2	own	little	little	
6758								
## 571	570	23	female	1	rent	little	little	
3234								
## 572	571	38	male	2	own	little	<NA>	
5954								
## 573	572	26	female	3	rent	<NA>	<NA>	
5433								
## 574	573	22	female	1	own	little	little	
806								
## 575	574	27	male	1	own	little	moderate	
1082								
## 576	575	24	female	2	own	little	<NA>	
2788								
## 577	576	27	female	2	own	little	moderate	
2930								
## 578	577	33	female	2	own	<NA>	<NA>	
1927								
## 579	578	27	male	2	own	little	moderate	
2820								
## 580	579	27	male	1	own	little	<NA>	
937								
## 581	580	30	male	2	own	little	moderate	
1056								
## 582	581	49	male	1	own	little	moderate	
3124								
## 583	582	26	female	2	rent	little	<NA>	
1388								
## 584	583	33	male	1	rent	little	moderate	
2384								
## 585	584	52	female	3	free	<NA>	<NA>	
2133								
## 586	585	20	female	2	rent	little	little	

2039								
## 587	586	36	male	2	rent	little	little	
2799								
## 588	587	21	male	1	own	little	little	
1289								
## 589	588	47	male	1	own	little	little	
1217								
## 590	589	60	male	2	own	little	little	
2246								
## 591	590	58	female	1	own	little	little	
385								
## 592	591	42	female	2	rent	<NA>	moderate	
1965								
## 593	592	36	female	1	own	rich	<NA>	
1572								
## 594	593	20	female	1	rent	little	moderate	
2718								
## 595	594	40	male	3	own	<NA>	little	
1358								
## 596	595	32	female	1	own	moderate	moderate	
931								
## 597	596	23	female	2	rent	little	little	
1442								
## 598	597	36	male	1	own	little	moderate	
4241								
## 599	598	31	male	2	own	little	<NA>	
2775								
## 600	599	32	male	2	free	little	<NA>	
3863								
## 601	600	45	female	2	own	little	moderate	
2329								
## 602	601	30	female	2	own	little	moderate	
918								
## 603	602	34	female	1	free	little	moderate	
1837								
## 604	603	28	female	3	own	little	<NA>	
3349								
## 605	604	23	female	2	own	little	rich	
1275								
## 606	605	22	male	2	own	quite rich	little	
2828								
## 607	606	74	male	3	own	little	<NA>	
4526								
## 608	607	50	female	2	free	moderate	moderate	
2671								
## 609	608	33	male	2	own	little	<NA>	
2051								
## 610	609	45	male	2	free	<NA>	<NA>	
1300								
## 611	610	22	female	2	own	moderate	little	

741								
## 612	611	48	female	1	free	moderate	rich	
1240								
## 613	612	29	female	2	own	rich	little	
3357								
## 614	613	22	female	2	rent	little	little	
3632								
## 615	614	22	female	2	own	little	<NA>	
1808								
## 616	615	48	male	3	own	<NA>	moderate	
12204								
## 617	616	27	male	3	free	<NA>	moderate	
9157								
## 618	617	37	male	2	rent	little	little	
3676								
## 619	618	21	female	2	rent	moderate	moderate	
3441								
## 620	619	49	male	1	own	little	<NA>	
640								
## 621	620	27	male	2	own	little	moderate	
3652								
## 622	621	32	male	2	own	little	<NA>	
1530								
## 623	622	38	male	2	own	<NA>	<NA>	
3914								
## 624	623	22	female	2	rent	little	little	
1858								
## 625	624	65	male	2	free	little	little	
2600								
## 626	625	35	male	2	own	<NA>	<NA>	
1979								
## 627	626	41	male	2	own	little	rich	
2116								
## 628	627	29	male	2	own	moderate	moderate	
1437								
## 629	628	36	male	2	own	quite rich	<NA>	
4042								
## 630	629	64	male	1	own	<NA>	<NA>	
3832								
## 631	630	28	female	2	own	little	little	
3660								
## 632	631	44	male	2	own	little	little	
1553								
## 633	632	23	male	2	own	<NA>	moderate	
1444								
## 634	633	19	female	2	rent	little	<NA>	
1980								
## 635	634	25	female	1	own	little	moderate	
1355								
## 636	635	47	male	2	own	little	<NA>	

1393								
## 637	636	28	female	2	own	quite rich	<NA>	
1376								
## 638	637	21	male	2	own	little	<NA>	
15653								
## 639	638	34	female	2	own	little	<NA>	
1493								
## 640	639	26	male	2	own	little	little	
4370								
## 641	640	27	female	0	own	little	little	
750								
## 642	641	38	male	1	own	little	moderate	
1308								
## 643	642	40	male	3	own	moderate	<NA>	
4623								
## 644	643	33	male	2	own	little	<NA>	
1851								
## 645	644	32	male	3	own	little	little	
1880								
## 646	645	27	male	2	rent	<NA>	<NA>	
7980								
## 647	646	32	male	2	own	little	little	
4583								
## 648	647	26	female	2	own	quite rich	<NA>	
1386								
## 649	648	38	male	2	free	little	rich	
947								
## 650	649	40	male	1	rent	little	little	
684								
## 651	650	50	male	3	free	little	little	
7476								
## 652	651	37	male	1	own	little	moderate	
1922								
## 653	652	45	male	2	own	little	little	
2303								
## 654	653	42	male	3	own	moderate	moderate	
8086								
## 655	654	35	male	2	own	little	<NA>	
2346								
## 656	655	22	male	2	free	little	little	
3973								
## 657	656	41	male	1	own	little	moderate	
888								
## 658	657	37	male	2	own	<NA>	<NA>	
10222								
## 659	658	28	female	2	own	little	moderate	
4221								
## 660	659	41	male	2	own	little	moderate	
6361								
## 661	660	23	male	2	rent	little	rich	

1297								
## 662	661	23	male	2	own	<NA>	little	
900								
## 663	662	50	male	2	own	little	<NA>	
2241								
## 664	663	35	male	3	own	little	moderate	
1050								
## 665	664	50	female	1	own	little	rich	
1047								
## 666	665	27	male	3	own	little	<NA>	
6314								
## 667	666	34	male	2	own	rich	moderate	
3496								
## 668	667	27	female	2	own	little	<NA>	
3609								
## 669	668	43	male	2	rent	little	little	
4843								
## 670	669	47	male	2	own	little	rich	
3017								
## 671	670	27	male	1	own	moderate	<NA>	
4139								
## 672	671	31	male	2	own	moderate	<NA>	
5742								
## 673	672	42	male	3	own	little	<NA>	
10366								
## 674	673	24	male	2	own	quite rich	<NA>	
2080								
## 675	674	41	male	1	own	quite rich	<NA>	
2580								
## 676	675	26	female	3	rent	little	<NA>	
4530								
## 677	676	33	male	2	own	little	<NA>	
5150								
## 678	677	24	male	2	own	moderate	moderate	
5595								
## 679	678	64	male	1	rent	little	little	
2384								
## 680	679	26	female	2	own	little	<NA>	
1453								
## 681	680	56	female	2	own	little	<NA>	
1538								
## 682	681	37	male	2	free	<NA>	<NA>	
2279								
## 683	682	33	male	2	own	little	<NA>	
1478								
## 684	683	47	male	2	free	little	<NA>	
5103								
## 685	684	31	male	1	own	moderate	moderate	
9857								
## 686	685	34	male	2	free	<NA>	<NA>	

6527								
## 687	686	27	male	2	own	<NA>	rich	
1347								
## 688	687	30	male	2	free	moderate	moderate	
2862								
## 689	688	35	male	2	own	moderate	<NA>	
2753								
## 690	689	31	male	2	own	rich	little	
3651								
## 691	690	25	male	2	own	little	little	
975								
## 692	691	25	female	1	own	moderate	moderate	
2631								
## 693	692	29	male	2	own	moderate	moderate	
2896								
## 694	693	44	male	1	own	<NA>	little	
4716								
## 695	694	28	male	2	own	little	<NA>	
2284								
## 696	695	50	male	2	rent	quite rich	<NA>	
1236								
## 697	696	29	male	2	own	little	moderate	
1103								
## 698	697	38	female	0	own	little	<NA>	
926								
## 699	698	24	male	2	own	little	<NA>	
1800								
## 700	699	40	male	3	rent	little	rich	
1905								
## 701	700	29	female	1	rent	quite rich	<NA>	
1123								
## 702	701	46	male	2	free	little	little	
6331								
## 703	702	47	female	2	free	moderate	rich	
1377								
## 704	703	41	male	2	own	moderate	moderate	
2503								
## 705	704	32	female	2	own	little	moderate	
2528								
## 706	705	35	female	2	free	quite rich	<NA>	
5324								
## 707	706	24	male	2	own	moderate	moderate	
6560								
## 708	707	25	female	2	rent	little	moderate	
2969								
## 709	708	25	female	2	own	little	moderate	
1206								
## 710	709	37	male	1	own	little	moderate	
2118								
## 711	710	32	male	3	own	quite rich	<NA>	

629								
## 712	711	35	female	2	free	little	little	
1198								
## 713	712	46	male	3	own	<NA>	<NA>	
2476								
## 714	713	25	male	1	own	little	little	
1138								
## 715	714	27	male	3	own	little	moderate	
14027								
## 716	715	63	male	2	own	<NA>	<NA>	
7596								
## 717	716	40	male	2	own	<NA>	<NA>	
3077								
## 718	717	32	male	3	free	little	<NA>	
1505								
## 719	718	31	male	2	own	<NA>	rich	
3148								
## 720	719	31	male	2	own	moderate	moderate	
6148								
## 721	720	34	male	3	own	little	rich	
1337								
## 722	721	24	female	2	rent	rich	moderate	
433								
## 723	722	24	female	1	own	little	little	
1228								
## 724	723	66	female	1	own	quite rich	moderate	
790								
## 725	724	21	female	2	rent	little	<NA>	
2570								
## 726	725	41	female	1	own	rich	<NA>	
250								
## 727	726	47	male	1	own	quite rich	<NA>	
1316								
## 728	727	25	female	2	rent	little	little	
1882								
## 729	728	59	female	2	rent	little	moderate	
6416								
## 730	729	36	male	2	own	rich	rich	
1275								
## 731	730	33	male	2	own	little	moderate	
6403								
## 732	731	21	male	1	rent	little	little	
1987								
## 733	732	44	female	1	own	little	moderate	
760								
## 734	733	28	female	2	rent	rich	<NA>	
2603								
## 735	734	37	female	2	own	little	<NA>	
3380								
## 736	735	29	female	0	own	<NA>	moderate	

3990								
## 737	736	23	female	3	rent	little	moderate	
11560								
## 738	737	35	male	1	own	moderate	little	
4380								
## 739	738	45	male	3	own	little	<NA>	
6761								
## 740	739	26	female	1	rent	moderate	moderate	
4280								
## 741	740	32	male	2	own	moderate	little	
2325								
## 742	741	23	male	1	own	little	moderate	
1048								
## 743	742	41	male	2	own	<NA>	<NA>	
3160								
## 744	743	22	male	2	own	quite rich	little	
2483								
## 745	744	30	male	3	own	<NA>	little	
14179								
## 746	745	28	male	1	own	little	little	
1797								
## 747	746	23	female	2	rent	little	little	
2511								
## 748	747	37	female	1	own	little	little	
1274								
## 749	748	26	male	2	own	<NA>	<NA>	
5248								
## 750	749	33	male	2	own	little	<NA>	
3029								
## 751	750	49	female	2	own	little	little	
428								
## 752	751	23	female	1	own	little	little	
976								
## 753	752	23	female	1	rent	moderate	moderate	
841								
## 754	753	25	female	2	own	little	<NA>	
5771								
## 755	754	55	male	2	free	rich	<NA>	
1555								
## 756	755	32	female	2	rent	<NA>	little	
1285								
## 757	756	74	male	0	own	little	rich	
1299								
## 758	757	39	male	2	free	<NA>	rich	
1271								
## 759	758	31	male	2	own	little	<NA>	
1393								
## 760	759	35	male	2	own	little	little	
691								
## 761	760	59	female	2	own	<NA>	<NA>	

5045								
## 762	761	24	female	2	rent	little	little	
2124								
## 763	762	24	male	1	own	little	little	
2214								
## 764	763	30	male	3	free	<NA>	<NA>	
12680								
## 765	764	27	male	2	own	moderate	<NA>	
2463								
## 766	765	40	male	1	own	little	moderate	
1155								
## 767	766	31	male	1	own	little	little	
3108								
## 768	767	31	female	2	rent	<NA>	<NA>	
2901								
## 769	768	28	male	2	rent	little	moderate	
3617								
## 770	769	63	male	1	own	little	<NA>	
1655								
## 771	770	26	female	2	rent	<NA>	little	
2812								
## 772	771	25	female	3	own	little	little	
8065								
## 773	772	36	male	3	own	little	<NA>	
3275								
## 774	773	52	male	2	own	moderate	<NA>	
2223								
## 775	774	66	male	0	free	quite rich	rich	
1480								
## 776	775	25	female	2	rent	<NA>	little	
1371								
## 777	776	37	male	2	own	little	<NA>	
3535								
## 778	777	25	female	2	own	little	little	
3509								
## 779	778	38	male	3	own	rich	<NA>	
5711								
## 780	779	67	female	2	own	little	moderate	
3872								
## 781	780	25	male	2	own	little	moderate	
4933								
## 782	781	60	male	2	own	rich	<NA>	
1940								
## 783	782	31	male	1	own	little	moderate	
1410								
## 784	783	23	female	1	own	moderate	moderate	
836								
## 785	784	60	male	3	own	<NA>	moderate	
6468								
## 786	785	35	male	1	own	rich	moderate	

1941								
## 787	786	40	male	2	own	quite rich	<NA>	
2675								
## 788	787	38	male	2	own	<NA>	<NA>	
2751								
## 789	788	50	male	2	free	little	moderate	
6224								
## 790	789	27	male	2	own	little	little	
5998								
## 791	790	39	female	2	own	little	moderate	
1188								
## 792	791	41	male	3	own	<NA>	<NA>	
6313								
## 793	792	27	male	2	own	<NA>	<NA>	
1221								
## 794	793	51	male	2	free	little	rich	
2892								
## 795	794	32	male	2	rent	quite rich	<NA>	
3062								
## 796	795	22	female	2	rent	moderate	<NA>	
2301								
## 797	796	51	male	2	free	<NA>	little	
7511								
## 798	797	22	female	1	rent	little	<NA>	
1258								
## 799	798	54	male	2	own	<NA>	<NA>	
717								
## 800	799	35	male	0	own	<NA>	moderate	
1549								
## 801	800	54	male	2	free	little	<NA>	
1597								
## 802	801	48	female	1	rent	little	moderate	
1795								
## 803	802	24	female	2	own	little	little	
4272								
## 804	803	35	male	2	own	<NA>	<NA>	
976								
## 805	804	24	female	0	rent	<NA>	moderate	
7472								
## 806	805	24	male	2	own	little	little	
9271								
## 807	806	26	male	1	own	little	moderate	
590								
## 808	807	65	male	2	own	<NA>	<NA>	
930								
## 809	808	55	male	3	free	little	moderate	
9283								
## 810	809	26	female	0	rent	little	moderate	
1778								
## 811	810	26	male	2	own	little	moderate	

907								
## 812	811	28	male	1	own	little	moderate	
484								
## 813	812	24	male	2	own	little	little	
9629								
## 814	813	54	male	2	own	little	little	
3051								
## 815	814	46	male	2	free	little	little	
3931								
## 816	815	54	female	2	rent	little	moderate	
7432								
## 817	816	62	male	2	own	quite rich	<NA>	
1338								
## 818	817	24	female	2	rent	little	<NA>	
1554								
## 819	818	43	male	3	own	little	little	
15857								
## 820	819	26	male	2	own	little	little	
1345								
## 821	820	27	male	2	own	little	<NA>	
1101								
## 822	821	24	male	2	own	little	rich	
3016								
## 823	822	41	male	2	own	little	little	
2712								
## 824	823	47	male	1	own	little	little	
731								
## 825	824	35	male	3	own	little	<NA>	
3780								
## 826	825	30	male	2	own	little	little	
1602								
## 827	826	33	female	2	rent	little	little	
3966								
## 828	827	36	male	2	own	little	<NA>	
4165								
## 829	828	47	male	2	free	<NA>	little	
8335								
## 830	829	38	male	2	free	<NA>	moderate	
6681								
## 831	830	44	male	2	own	quite rich	<NA>	
2375								
## 832	831	23	female	2	rent	little	little	
1216								
## 833	832	29	male	2	rent	little	little	
11816								
## 834	833	42	female	2	own	<NA>	moderate	
5084								
## 835	834	25	female	1	own	little	rich	
2327								
## 836	835	48	male	2	own	little	little	

1082								
## 837	836	21	female	2	own	<NA>	<NA>	
886								
## 838	837	23	female	1	rent	little	<NA>	
601								
## 839	838	63	male	2	own	little	little	
2957								
## 840	839	46	male	2	own	little	<NA>	
2611								
## 841	840	29	male	2	own	little	little	
5179								
## 842	841	28	male	1	own	little	<NA>	
2993								
## 843	842	23	female	2	own	little	<NA>	
1943								
## 844	843	50	male	2	own	little	<NA>	
1559								
## 845	844	47	male	2	own	little	<NA>	
3422								
## 846	845	35	male	2	own	<NA>	moderate	
3976								
## 847	846	68	male	2	rent	<NA>	<NA>	
6761								
## 848	847	28	male	2	own	little	<NA>	
1249								
## 849	848	59	male	2	own	little	little	
1364								
## 850	849	57	male	1	own	little	little	
709								
## 851	850	33	male	2	rent	little	little	
2235								
## 852	851	43	male	2	own	<NA>	<NA>	
4042								
## 853	852	35	male	2	free	little	<NA>	
1471								
## 854	853	32	male	1	free	little	little	
1442								
## 855	854	45	male	2	own	little	<NA>	
10875								
## 856	855	33	male	2	own	moderate	<NA>	
1474								
## 857	856	40	female	2	own	<NA>	<NA>	
894								
## 858	857	28	male	2	free	little	<NA>	
3343								
## 859	858	29	female	2	own	little	little	
3959								
## 860	859	26	male	2	rent	moderate	<NA>	
3577								
## 861	860	27	male	2	own	rich	<NA>	

5804								
## 862	861	28	male	2	own	little	<NA>	
2169								
## 863	862	35	female	2	own	little	little	
2439								
## 864	863	32	male	1	own	rich	<NA>	
4526								
## 865	864	25	male	1	rent	little	<NA>	
2210								
## 866	865	20	female	2	rent	quite rich	<NA>	
2221								
## 867	866	27	female	2	own	little	little	
2389								
## 868	867	42	male	2	own	little	<NA>	
3331								
## 869	868	37	male	2	own	<NA>	<NA>	
7409								
## 870	869	24	female	2	rent	little	little	
652								
## 871	870	40	female	2	own	quite rich	<NA>	
7678								
## 872	871	46	male	2	own	little	rich	
1343								
## 873	872	26	male	2	own	moderate	little	
1382								
## 874	873	24	female	2	own	<NA>	<NA>	
874								
## 875	874	29	male	1	own	little	little	
3590								
## 876	875	40	female	2	own	rich	moderate	
1322								
## 877	876	36	male	3	free	little	little	
1940								
## 878	877	28	male	2	own	little	<NA>	
3595								
## 879	878	27	male	3	free	little	little	
1422								
## 880	879	36	male	2	own	<NA>	<NA>	
6742								
## 881	880	38	male	3	own	little	<NA>	
7814								
## 882	881	48	male	2	free	<NA>	<NA>	
9277								
## 883	882	36	male	2	own	<NA>	moderate	
2181								
## 884	883	65	female	0	own	little	<NA>	
1098								
## 885	884	43	male	2	own	little	moderate	
4057								
## 886	885	53	female	2	own	little	little	

795								
## 887	886	34	male	2	own	<NA>	moderate	
2825								
## 888	887	23	male	2	own	little	moderate	
15672								
## 889	888	34	male	3	own	little	<NA>	
6614								
## 890	889	40	male	2	rent	<NA>	<NA>	
7824								
## 891	890	43	male	3	own	little	little	
2442								
## 892	891	46	male	2	own	little	<NA>	
1829								
## 893	892	38	male	1	own	little	little	
2171								
## 894	893	34	male	2	own	little	moderate	
5800								
## 895	894	29	male	2	own	<NA>	<NA>	
1169								
## 896	895	31	male	3	own	<NA>	<NA>	
8947								
## 897	896	28	female	3	rent	little	little	
2606								
## 898	897	35	female	2	own	rich	<NA>	
1592								
## 899	898	33	female	1	rent	<NA>	<NA>	
2186								
## 900	899	42	male	2	own	little	little	
4153								
## 901	900	43	male	2	rent	little	little	
2625								
## 902	901	44	male	2	own	<NA>	<NA>	
3485								
## 903	902	42	male	2	free	<NA>	<NA>	
10477								
## 904	903	40	male	2	rent	<NA>	<NA>	
1386								
## 905	904	36	male	3	own	little	<NA>	
1278								
## 906	905	20	male	3	rent	little	little	
1107								
## 907	906	24	male	1	own	<NA>	little	
3763								
## 908	907	27	male	2	own	<NA>	moderate	
3711								
## 909	908	46	female	1	own	little	<NA>	
3594								
## 910	909	33	female	1	own	<NA>	moderate	
3195								
## 911	910	34	female	2	own	little	<NA>	

4454								
## 912	911	25	female	1	own	little	moderate	
4736								
## 913	912	25	female	2	own	<NA>	moderate	
2991								
## 914	913	28	male	2	own	rich	<NA>	
2142								
## 915	914	31	male	2	rent	little	little	
3161								
## 916	915	32	female	3	own	little	moderate	
18424								
## 917	916	32	male	2	own	moderate	<NA>	
2848								
## 918	917	68	male	3	own	little	little	
14896								
## 919	918	33	male	2	own	moderate	little	
2359								
## 920	919	39	male	3	rent	little	little	
3345								
## 921	920	28	female	2	own	little	<NA>	
1817								
## 922	921	37	male	3	own	quite rich	<NA>	
12749								
## 923	922	22	female	2	rent	little	little	
1366								
## 924	923	30	male	2	rent	little	moderate	
2002								
## 925	924	55	male	2	own	little	little	
6872								
## 926	925	46	male	2	own	little	little	
697								
## 927	926	21	female	2	rent	little	little	
1049								
## 928	927	39	male	2	free	little	little	
10297								
## 929	928	58	male	2	own	<NA>	<NA>	
1867								
## 930	929	43	male	1	own	little	little	
1344								
## 931	930	24	male	1	own	little	little	
1747								
## 932	931	22	female	2	own	little	moderate	
1670								
## 933	932	30	male	2	own	little	<NA>	
1224								
## 934	933	42	male	2	own	quite rich	<NA>	
522								
## 935	934	23	female	2	own	little	little	
1498								
## 936	935	30	male	3	own	moderate	moderate	

1919								
## 937	936	28	female	1	own	little	rich	
745								
## 938	937	30	male	3	rent	little	moderate	
2063								
## 939	938	42	male	2	free	little	moderate	
6288								
## 940	939	46	male	3	own	<NA>	<NA>	
6842								
## 941	940	45	male	3	own	<NA>	<NA>	
3527								
## 942	941	31	male	1	own	little	<NA>	
1546								
## 943	942	31	male	2	own	<NA>	<NA>	
929								
## 944	943	42	male	1	own	little	<NA>	
1455								
## 945	944	46	female	2	rent	little	little	
1845								
## 946	945	30	female	2	own	quite rich	moderate	
8358								
## 947	946	30	male	2	free	quite rich	little	
3349								
## 948	947	38	male	3	own	<NA>	<NA>	
2859								
## 949	948	43	male	1	own	little	<NA>	
1533								
## 950	949	31	male	2	own	moderate	<NA>	
3621								
## 951	950	40	male	0	own	little	moderate	
3590								
## 952	951	24	male	2	own	little	little	
2145								
## 953	952	28	female	2	rent	quite rich	moderate	
4113								
## 954	953	26	female	3	own	little	<NA>	
10974								
## 955	954	29	female	2	own	little	little	
1893								
## 956	955	57	female	3	rent	rich	little	
1231								
## 957	956	49	male	1	own	<NA>	rich	
3656								
## 958	957	37	male	1	own	little	moderate	
1154								
## 959	958	45	male	1	own	little	little	
4006								
## 960	959	30	male	2	free	moderate	moderate	
3069								
## 961	960	30	male	2	rent	little	<NA>	

1740								
## 962	961	47	male	2	own	little	moderate	
2353								
## 963	962	29	male	2	own	<NA>	<NA>	
3556								
## 964	963	35	male	2	own	quite rich	<NA>	
2397								
## 965	964	22	male	1	own	little	moderate	
454								
## 966	965	26	female	2	own	<NA>	moderate	
1715								
## 967	966	23	male	1	own	quite rich	moderate	
2520								
## 968	967	54	female	3	rent	little	<NA>	
3568								
## 969	968	29	male	2	rent	<NA>	<NA>	
7166								
## 970	969	40	male	1	own	little	little	
3939								
## 971	970	22	male	2	own	moderate	moderate	
1514								
## 972	971	43	male	1	own	little	<NA>	
7393								
## 973	972	29	female	0	rent	little	little	
1193								
## 974	973	36	male	2	rent	little	little	
7297								
## 975	974	33	female	2	own	little	<NA>	
2831								
## 976	975	57	female	1	own	quite rich	rich	
1258								
## 977	976	64	female	2	own	little	moderate	
753								
## 978	977	42	male	2	own	<NA>	moderate	
2427								
## 979	978	47	male	1	own	little	<NA>	
2538								
## 980	979	25	male	2	rent	moderate	moderate	
1264								
## 981	980	49	male	2	own	little	moderate	
8386								
## 982	981	33	male	3	rent	little	<NA>	
4844								
## 983	982	28	female	3	own	moderate	rich	
2923								
## 984	983	26	male	2	own	little	little	
8229								
## 985	984	30	male	1	own	little	<NA>	
2028								
## 986	985	25	female	2	rent	little	little	

1433								
## 987	986	33	male	2	own	little	rich	
6289								
## 988	987	64	female	2	own	moderate	<NA>	
1409								
## 989	988	29	male	3	free	little	little	
6579								
## 990	989	48	male	1	own	little	moderate	
1743								
## 991	990	37	male	1	own	<NA>	<NA>	
3565								
## 992	991	34	male	1	own	moderate	<NA>	
1569								
## 993	992	23	male	1	rent	<NA>	little	
1936								
## 994	993	30	male	3	own	little	little	
3959								
## 995	994	50	male	2	own	<NA>	<NA>	
2390								
## 996	995	31	female	1	own	little	<NA>	
1736								
## 997	996	40	male	3	own	little	little	
3857								
## 998	997	38	male	2	own	little	<NA>	
804								
## 999	998	23	male	2	free	little	little	
1845								
## 1000	999	27	male	2	own	moderate	moderate	
4576								
##	Duration				Purpose			
## 1		6			radio/TV			
## 2		48			radio/TV			
## 3		12			education			
## 4		42			furniture/equipment			
## 5		24			car			
## 6		36			education			
## 7		24			furniture/equipment			
## 8		36			car			
## 9		12			radio/TV			
## 10		30			car			
## 11		12			car			
## 12		48			business			
## 13		12			radio/TV			
## 14		24			car			
## 15		15			car			
## 16		24			radio/TV			
## 17		24			radio/TV			
## 18		30			business			
## 19		24			car			
## 20		24			radio/TV			

## 21	9	car
## 22	6	radio/TV
## 23	10	car
## 24	12	car
## 25	10	furniture/equipment
## 26	6	furniture/equipment
## 27	6	radio/TV
## 28	12	radio/TV
## 29	7	radio/TV
## 30	60	business
## 31	18	business
## 32	24	furniture/equipment
## 33	18	car
## 34	12	business
## 35	12	furniture/equipment
## 36	45	radio/TV
## 37	48	education
## 38	18	radio/TV
## 39	10	domestic appliances
## 40	9	radio/TV
## 41	30	radio/TV
## 42	12	radio/TV
## 43	18	repairs
## 44	30	car
## 45	48	car
## 46	11	car
## 47	36	radio/TV
## 48	6	car
## 49	11	car
## 50	12	radio/TV
## 51	24	furniture/equipment
## 52	27	car
## 53	12	radio/TV
## 54	18	car
## 55	36	car
## 56	6	car
## 57	12	radio/TV
## 58	36	radio/TV
## 59	18	car
## 60	36	furniture/equipment
## 61	9	business
## 62	15	radio/TV
## 63	36	business
## 64	48	business
## 65	24	radio/TV
## 66	27	repairs
## 67	12	radio/TV
## 68	12	car
## 69	36	education
## 70	36	radio/TV

## 71	36	car
## 72	7	radio/TV
## 73	8	vacation/others
## 74	42	business
## 75	36	education
## 76	12	car
## 77	42	radio/TV
## 78	11	radio/TV
## 79	54	car
## 80	30	furniture/equipment
## 81	24	radio/TV
## 82	15	radio/TV
## 83	18	business
## 84	24	vacation/others
## 85	10	radio/TV
## 86	12	business
## 87	18	furniture/equipment
## 88	36	education
## 89	18	car
## 90	12	repairs
## 91	12	radio/TV
## 92	12	car
## 93	12	radio/TV
## 94	24	furniture/equipment
## 95	12	car
## 96	54	business
## 97	12	education
## 98	18	business
## 99	36	radio/TV
## 100	20	car
## 101	24	car
## 102	36	radio/TV
## 103	6	radio/TV
## 104	9	furniture/equipment
## 105	12	car
## 106	24	vacation/others
## 107	18	car
## 108	12	car
## 109	24	furniture/equipment
## 110	14	business
## 111	6	business
## 112	15	education
## 113	18	car
## 114	36	car
## 115	12	radio/TV
## 116	48	radio/TV
## 117	42	radio/TV
## 118	10	furniture/equipment
## 119	33	furniture/equipment
## 120	12	car

## 121	21	radio/TV
## 122	24	car
## 123	12	furniture/equipment
## 124	10	car
## 125	18	furniture/equipment
## 126	12	car
## 127	12	radio/TV
## 128	12	repairs
## 129	12	car
## 130	12	car
## 131	48	car
## 132	36	education
## 133	15	furniture/equipment
## 134	18	furniture/equipment
## 135	60	radio/TV
## 136	12	radio/TV
## 137	27	car
## 138	12	radio/TV
## 139	15	radio/TV
## 140	12	radio/TV
## 141	6	car
## 142	36	radio/TV
## 143	27	radio/TV
## 144	18	furniture/equipment
## 145	21	furniture/equipment
## 146	48	business
## 147	6	car
## 148	12	car
## 149	36	furniture/equipment
## 150	18	radio/TV
## 151	6	radio/TV
## 152	10	radio/TV
## 153	36	radio/TV
## 154	24	car
## 155	24	business
## 156	12	furniture/equipment
## 157	9	repairs
## 158	12	education
## 159	24	car
## 160	6	radio/TV
## 161	24	radio/TV
## 162	18	car
## 163	15	domestic appliances
## 164	10	car
## 165	36	car
## 166	6	furniture/equipment
## 167	18	furniture/equipment
## 168	11	furniture/equipment
## 169	24	furniture/equipment
## 170	24	business

```
## 171      15          car
## 172      12 furniture/equipment
## 173      24 furniture/equipment
## 174       8          radio/TV
## 175      21          education
## 176      30          car
## 177      12 furniture/equipment
## 178       6          radio/TV
## 179      12          radio/TV
## 180      21          car
## 181      36          business
## 182      36          business
## 183      21          car
## 184      24 furniture/equipment
## 185      18          car
## 186      15          radio/TV
## 187       9          car
## 188      16          car
## 189      12          radio/TV
## 190      18 furniture/equipment
## 191      24          business
## 192      48          business
## 193      27          business
## 194       6          radio/TV
## 195      45          radio/TV
## 196       9          education
## 197       6          radio/TV
## 198      12 furniture/equipment
## 199      24          car
## 200      18 furniture/equipment
## 201       9          education
## 202      12          car
## 203      27          business
## 204      12          education
## 205      12          car
## 206      30          car
## 207      12 furniture/equipment
## 208      12 domestic appliances
## 209      24          business
## 210      12          car
## 211       9          radio/TV
## 212      36          radio/TV
## 213      27          business
## 214      30          business
## 215      36          radio/TV
## 216       6          education
## 217      18          business
## 218      36          radio/TV
## 219      24 furniture/equipment
## 220      10          car
```

## 221	12	radio/TV
## 222	12	education
## 223	12	radio/TV
## 224	24	business
## 225	15	car
## 226	36	repairs
## 227	48	radio/TV
## 228	12	furniture/equipment
## 229	9	radio/TV
## 230	24	furniture/equipment
## 231	36	radio/TV
## 232	9	car
## 233	12	radio/TV
## 234	18	radio/TV
## 235	4	radio/TV
## 236	24	radio/TV
## 237	6	car
## 238	21	business
## 239	12	radio/TV
## 240	30	radio/TV
## 241	24	car
## 242	6	radio/TV
## 243	48	car
## 244	12	business
## 245	12	education
## 246	24	business
## 247	12	radio/TV
## 248	6	car
## 249	24	furniture/equipment
## 250	18	radio/TV
## 251	6	car
## 252	12	furniture/equipment
## 253	30	car
## 254	24	furniture/equipment
## 255	9	furniture/equipment
## 256	60	radio/TV
## 257	24	radio/TV
## 258	12	radio/TV
## 259	15	car
## 260	11	radio/TV
## 261	12	furniture/equipment
## 262	24	radio/TV
## 263	18	car
## 264	12	education
## 265	10	car
## 266	15	radio/TV
## 267	36	business
## 268	24	radio/TV
## 269	14	car
## 270	24	radio/TV

```
## 271      18          car
## 272      12 furniture/equipment
## 273      48          car
## 274      48          radio/TV
## 275      30          repairs
## 276      9           radio/TV
## 277      18          radio/TV
## 278      12 furniture/equipment
## 279      6  furniture/equipment
## 280      24          radio/TV
## 281      15          car
## 282      12 furniture/equipment
## 283      18          radio/TV
## 284      15 furniture/equipment
## 285      24          car
## 286      47          car
## 287      48          car
## 288      48    vacation/others
## 289      12          radio/TV
## 290      24          radio/TV
## 291      12          business
## 292      36          car
## 293      24          car
## 294      42          car
## 295      48          business
## 296      48 furniture/equipment
## 297      12          car
## 298      10          car
## 299      18 furniture/equipment
## 300      21 furniture/equipment
## 301      6           car
## 302      36          radio/TV
## 303      24          car
## 304      10          car
## 305      48          car
## 306      6  furniture/equipment
## 307      30          car
## 308      12          radio/TV
## 309      8  furniture/equipment
## 310      9           car
## 311      48    vacation/others
## 312      24 furniture/equipment
## 313      24 furniture/equipment
## 314      12          car
## 315      4           car
## 316      36 furniture/equipment
## 317      12 furniture/equipment
## 318      24 furniture/equipment
## 319      12          education
## 320      15 furniture/equipment
```

## 321	30	car
## 322	24	radio/TV
## 323	24	car
## 324	18	furniture/equipment
## 325	18	car
## 326	8	car
## 327	12	furniture/equipment
## 328	24	car
## 329	36	radio/TV
## 330	6	radio/TV
## 331	24	car
## 332	18	education
## 333	60	car
## 334	48	car
## 335	24	furniture/equipment
## 336	6	furniture/equipment
## 337	13	radio/TV
## 338	15	domestic appliances
## 339	24	furniture/equipment
## 340	10	furniture/equipment
## 341	24	education
## 342	21	furniture/equipment
## 343	18	radio/TV
## 344	18	business
## 345	10	car
## 346	15	radio/TV
## 347	13	radio/TV
## 348	24	radio/TV
## 349	6	business
## 350	9	education
## 351	9	domestic appliances
## 352	9	furniture/equipment
## 353	18	car
## 354	12	radio/TV
## 355	10	education
## 356	24	car
## 357	12	radio/TV
## 358	36	radio/TV
## 359	12	radio/TV
## 360	30	furniture/equipment
## 361	18	education
## 362	12	radio/TV
## 363	12	car
## 364	6	furniture/equipment
## 365	18	furniture/equipment
## 366	12	business
## 367	18	car
## 368	18	furniture/equipment
## 369	36	furniture/equipment
## 370	18	furniture/equipment

## 371	36	car
## 372	18	radio/TV
## 373	10	furniture/equipment
## 374	60	car
## 375	60	vacation/others
## 376	48	business
## 377	18	radio/TV
## 378	7	radio/TV
## 379	36	car
## 380	6	car
## 381	20	furniture/equipment
## 382	18	car
## 383	22	car
## 384	12	car
## 385	30	business
## 386	18	radio/TV
## 387	18	radio/TV
## 388	18	furniture/equipment
## 389	15	business
## 390	9	business
## 391	18	car
## 392	12	furniture/equipment
## 393	36	car
## 394	6	radio/TV
## 395	9	furniture/equipment
## 396	39	education
## 397	12	furniture/equipment
## 398	36	furniture/equipment
## 399	12	car
## 400	24	radio/TV
## 401	18	radio/TV
## 402	18	business
## 403	24	business
## 404	14	car
## 405	18	car
## 406	24	radio/TV
## 407	24	car
## 408	15	radio/TV
## 409	24	radio/TV
## 410	12	car
## 411	24	radio/TV
## 412	33	car
## 413	12	business
## 414	10	car
## 415	24	car
## 416	36	car
## 417	12	car
## 418	18	education
## 419	21	car
## 420	18	car

## 421	15	car
## 422	12	car
## 423	12	car
## 424	21	furniture/equipment
## 425	12	furniture/equipment
## 426	18	car
## 427	28	radio/TV
## 428	18	radio/TV
## 429	9	furniture/equipment
## 430	18	repairs
## 431	5	business
## 432	24	vacation/others
## 433	6	furniture/equipment
## 434	24	repairs
## 435	9	furniture/equipment
## 436	12	radio/TV
## 437	6	repairs
## 438	24	car
## 439	42	repairs
## 440	12	business
## 441	12	car
## 442	12	furniture/equipment
## 443	20	vacation/others
## 444	12	education
## 445	48	furniture/equipment
## 446	9	education
## 447	36	car
## 448	7	radio/TV
## 449	12	furniture/equipment
## 450	15	repairs
## 451	36	car
## 452	6	radio/TV
## 453	12	furniture/equipment
## 454	24	car
## 455	24	car
## 456	24	car
## 457	11	car
## 458	12	car
## 459	6	domestic appliances
## 460	18	radio/TV
## 461	36	furniture/equipment
## 462	15	car
## 463	12	furniture/equipment
## 464	12	education
## 465	18	business
## 466	24	car
## 467	24	radio/TV
## 468	48	radio/TV
## 469	33	business
## 470	24	car

## 471	24	radio/TV
## 472	6	education
## 473	9	car
## 474	6	education
## 475	18	radio/TV
## 476	18	furniture/equipment
## 477	39	car
## 478	24	radio/TV
## 479	12	business
## 480	15	furniture/equipment
## 481	12	radio/TV
## 482	24	car
## 483	30	furniture/equipment
## 484	15	furniture/equipment
## 485	12	car
## 486	6	car
## 487	12	radio/TV
## 488	24	car
## 489	10	car
## 490	6	car
## 491	12	radio/TV
## 492	27	business
## 493	6	radio/TV
## 494	6	radio/TV
## 495	12	car
## 496	24	furniture/equipment
## 497	36	furniture/equipment
## 498	24	furniture/equipment
## 499	18	radio/TV
## 500	6	car
## 501	24	car
## 502	36	car
## 503	9	radio/TV
## 504	24	radio/TV
## 505	24	car
## 506	10	car
## 507	15	car
## 508	15	car
## 509	24	radio/TV
## 510	39	car
## 511	12	car
## 512	36	car
## 513	15	business
## 514	12	radio/TV
## 515	24	car
## 516	6	car
## 517	6	car
## 518	36	furniture/equipment
## 519	6	car
## 520	6	radio/TV

## 521	24	repairs
## 522	18	radio/TV
## 523	48	furniture/equipment
## 524	24	car
## 525	18	radio/TV
## 526	26	car
## 527	15	education
## 528	4	radio/TV
## 529	36	radio/TV
## 530	6	car
## 531	36	education
## 532	15	car
## 533	12	car
## 534	24	radio/TV
## 535	24	radio/TV
## 536	21	education
## 537	6	car
## 538	18	furniture/equipment
## 539	48	car
## 540	18	furniture/equipment
## 541	12	radio/TV
## 542	24	car
## 543	30	furniture/equipment
## 544	18	furniture/equipment
## 545	12	car
## 546	24	car
## 547	24	car
## 548	24	radio/TV
## 549	12	radio/TV
## 550	48	car
## 551	12	repairs
## 552	6	radio/TV
## 553	48	radio/TV
## 554	12	car
## 555	9	education
## 556	12	radio/TV
## 557	18	car
## 558	21	car
## 559	24	furniture/equipment
## 560	18	furniture/equipment
## 561	24	car
## 562	24	radio/TV
## 563	6	radio/TV
## 564	36	car
## 565	24	business
## 566	24	radio/TV
## 567	12	car
## 568	24	radio/TV
## 569	48	radio/TV
## 570	48	radio/TV

```
## 571      24 furniture/equipment
## 572      30      radio/TV
## 573      24      car
## 574      15      business
## 575      9       radio/TV
## 576      15 furniture/equipment
## 577      12      radio/TV
## 578      24      education
## 579      36      car
## 580      24      education
## 581      18      car
## 582      12      car
## 583      9       furniture/equipment
## 584      36      repairs
## 585      12      car
## 586      18 furniture/equipment
## 587      9       car
## 588      12 furniture/equipment
## 589      18 domestic appliances
## 590      12 furniture/equipment
## 591      12      radio/TV
## 592      24      car
## 593      21      business
## 594      24      car
## 595      24      vacation/others
## 596      6       car
## 597      24      car
## 598      24      business
## 599      18      car
## 600      24      business
## 601      7       radio/TV
## 602      9       furniture/equipment
## 603      24      education
## 604      36 furniture/equipment
## 605      10 furniture/equipment
## 606      24 furniture/equipment
## 607      24      business
## 608      36      radio/TV
## 609      18      radio/TV
## 610      15      car
## 611      12 domestic appliances
## 612      10      car
## 613      21      radio/TV
## 614      24      car
## 615      18 furniture/equipment
## 616      48      business
## 617      60      radio/TV
## 618      6       car
## 619      30 furniture/equipment
## 620      12      car
```

## 621	21	business
## 622	18	car
## 623	48	business
## 624	12	furniture/equipment
## 625	18	radio/TV
## 626	15	radio/TV
## 627	6	furniture/equipment
## 628	9	car
## 629	42	furniture/equipment
## 630	9	education
## 631	24	radio/TV
## 632	18	furniture/equipment
## 633	15	radio/TV
## 634	9	furniture/equipment
## 635	24	car
## 636	12	education
## 637	24	radio/TV
## 638	60	radio/TV
## 639	12	radio/TV
## 640	42	radio/TV
## 641	18	education
## 642	15	repairs
## 643	15	education
## 644	24	radio/TV
## 645	18	radio/TV
## 646	36	business
## 647	30	furniture/equipment
## 648	12	car
## 649	24	car
## 650	12	education
## 651	48	education
## 652	12	furniture/equipment
## 653	24	car
## 654	36	car
## 655	24	car
## 656	14	car
## 657	12	car
## 658	48	radio/TV
## 659	30	business
## 660	18	furniture/equipment
## 661	12	radio/TV
## 662	12	car
## 663	21	furniture/equipment
## 664	6	furniture/equipment
## 665	6	education
## 666	24	vacation/others
## 667	30	furniture/equipment
## 668	48	business
## 669	12	car
## 670	30	radio/TV

## 671	24	business
## 672	36	business
## 673	60	car
## 674	6	car
## 675	21	business
## 676	30	radio/TV
## 677	24	furniture/equipment
## 678	72	radio/TV
## 679	24	radio/TV
## 680	18	radio/TV
## 681	6	education
## 682	12	radio/TV
## 683	15	radio/TV
## 684	24	radio/TV
## 685	36	business
## 686	60	car
## 687	10	radio/TV
## 688	36	car
## 689	9	radio/TV
## 690	12	car
## 691	15	furniture/equipment
## 692	15	repairs
## 693	24	radio/TV
## 694	6	car
## 695	24	radio/TV
## 696	6	car
## 697	12	radio/TV
## 698	12	car
## 699	18	radio/TV
## 700	15	education
## 701	12	furniture/equipment
## 702	48	car
## 703	24	radio/TV
## 704	30	business
## 705	27	business
## 706	15	car
## 707	48	car
## 708	12	furniture/equipment
## 709	9	radio/TV
## 710	9	radio/TV
## 711	18	radio/TV
## 712	6	education
## 713	21	car
## 714	9	radio/TV
## 715	60	car
## 716	30	car
## 717	30	radio/TV
## 718	18	radio/TV
## 719	24	radio/TV
## 720	20	car

## 721	9	radio/TV
## 722	6	education
## 723	12	car
## 724	9	radio/TV
## 725	27	car
## 726	6	car
## 727	15	radio/TV
## 728	18	radio/TV
## 729	48	business
## 730	24	business
## 731	24	radio/TV
## 732	24	radio/TV
## 733	8	radio/TV
## 734	24	car
## 735	4	car
## 736	36	domestic appliances
## 737	24	car
## 738	18	car
## 739	6	car
## 740	30	business
## 741	24	car
## 742	10	radio/TV
## 743	21	radio/TV
## 744	24	furniture/equipment
## 745	39	furniture/equipment
## 746	13	business
## 747	15	car
## 748	12	car
## 749	21	car
## 750	15	car
## 751	6	furniture/equipment
## 752	18	car
## 753	12	business
## 754	30	radio/TV
## 755	12	repairs
## 756	24	car
## 757	6	car
## 758	15	radio/TV
## 759	24	car
## 760	12	car
## 761	15	car
## 762	18	furniture/equipment
## 763	12	radio/TV
## 764	21	car
## 765	24	car
## 766	12	radio/TV
## 767	30	furniture/equipment
## 768	10	car
## 769	12	furniture/equipment
## 770	12	radio/TV

## 771	24	car
## 772	36	education
## 773	21	car
## 774	24	radio/TV
## 775	12	car
## 776	24	car
## 777	36	car
## 778	18	radio/TV
## 779	36	car
## 780	18	repairs
## 781	39	radio/TV
## 782	24	car
## 783	12	education
## 784	12	car
## 785	20	car
## 786	18	business
## 787	22	radio/TV
## 788	48	car
## 789	48	education
## 790	40	education
## 791	21	business
## 792	24	car
## 793	6	furniture/equipment
## 794	24	furniture/equipment
## 795	24	furniture/equipment
## 796	9	furniture/equipment
## 797	18	car
## 798	12	furniture/equipment
## 799	24	car
## 800	9	car
## 801	24	education
## 802	18	radio/TV
## 803	20	furniture/equipment
## 804	12	radio/TV
## 805	12	car
## 806	36	car
## 807	6	radio/TV
## 808	12	radio/TV
## 809	42	car
## 810	15	car
## 811	8	business
## 812	6	radio/TV
## 813	36	car
## 814	48	domestic appliances
## 815	48	car
## 816	36	car
## 817	6	domestic appliances
## 818	6	radio/TV
## 819	36	vacation/others
## 820	18	radio/TV

## 821	12	car
## 822	12	radio/TV
## 823	36	furniture/equipment
## 824	8	car
## 825	18	furniture/equipment
## 826	21	car
## 827	18	car
## 828	18	business
## 829	36	car
## 830	48	business
## 831	24	business
## 832	18	car
## 833	45	business
## 834	24	radio/TV
## 835	15	radio/TV
## 836	12	car
## 837	12	radio/TV
## 838	4	furniture/equipment
## 839	24	car
## 840	24	radio/TV
## 841	36	furniture/equipment
## 842	21	car
## 843	18	repairs
## 844	24	business
## 845	18	furniture/equipment
## 846	21	furniture/equipment
## 847	18	car
## 848	24	car
## 849	9	radio/TV
## 850	12	radio/TV
## 851	20	car
## 852	24	car
## 853	15	radio/TV
## 854	18	car
## 855	36	car
## 856	24	car
## 857	10	education
## 858	15	furniture/equipment
## 859	15	car
## 860	9	car
## 861	24	car
## 862	18	business
## 863	24	radio/TV
## 864	27	furniture/equipment
## 865	10	furniture/equipment
## 866	15	furniture/equipment
## 867	18	radio/TV
## 868	12	furniture/equipment
## 869	36	business
## 870	12	furniture/equipment

## 871	36	furniture/equipment
## 872	6	car
## 873	24	business
## 874	15	domestic appliances
## 875	12	furniture/equipment
## 876	11	car
## 877	18	radio/TV
## 878	36	radio/TV
## 879	9	car
## 880	30	radio/TV
## 881	24	car
## 882	24	car
## 883	30	car
## 884	18	radio/TV
## 885	24	furniture/equipment
## 886	12	education
## 887	24	business
## 888	48	business
## 889	36	car
## 890	28	car
## 891	27	business
## 892	15	radio/TV
## 893	12	car
## 894	36	car
## 895	18	radio/TV
## 896	36	car
## 897	21	radio/TV
## 898	12	furniture/equipment
## 899	15	furniture/equipment
## 900	18	furniture/equipment
## 901	16	car
## 902	20	car
## 903	36	car
## 904	15	radio/TV
## 905	24	radio/TV
## 906	12	radio/TV
## 907	21	car
## 908	36	education
## 909	15	car
## 910	9	car
## 911	36	radio/TV
## 912	24	furniture/equipment
## 913	30	radio/TV
## 914	11	business
## 915	24	business
## 916	48	vacation/others
## 917	10	car
## 918	6	car
## 919	24	furniture/equipment
## 920	24	furniture/equipment

## 921	18	furniture/equipment
## 922	48	radio/TV
## 923	9	radio/TV
## 924	12	car
## 925	24	furniture/equipment
## 926	12	car
## 927	18	furniture/equipment
## 928	48	car
## 929	30	radio/TV
## 930	12	car
## 931	24	furniture/equipment
## 932	9	radio/TV
## 933	9	car
## 934	12	radio/TV
## 935	12	radio/TV
## 936	30	radio/TV
## 937	9	radio/TV
## 938	6	radio/TV
## 939	60	education
## 940	24	car
## 941	12	car
## 942	10	car
## 943	24	furniture/equipment
## 944	4	car
## 945	15	furniture/equipment
## 946	48	car
## 947	24	furniture/equipment
## 948	12	car
## 949	18	furniture/equipment
## 950	24	radio/TV
## 951	18	business
## 952	36	business
## 953	24	car
## 954	36	furniture/equipment
## 955	12	car
## 956	24	radio/TV
## 957	30	radio/TV
## 958	9	radio/TV
## 959	28	car
## 960	24	furniture/equipment
## 961	6	radio/TV
## 962	21	car
## 963	15	car
## 964	24	radio/TV
## 965	6	repairs
## 966	30	radio/TV
## 967	27	radio/TV
## 968	15	radio/TV
## 969	42	radio/TV
## 970	11	car

```

## 971      15      repairs
## 972      24      car
## 973      24      car
## 974      60      business
## 975      30      radio/TV
## 976      24      radio/TV
## 977      6      radio/TV
## 978      18      business
## 979      24      car
## 980      15      car
## 981      30  furniture/equipment
## 982      48      business
## 983      21      car
## 984      36      car
## 985      24  furniture/equipment
## 986      15  furniture/equipment
## 987      42      business
## 988      13      radio/TV
## 989      24      car
## 990      24      radio/TV
## 991      12      education
## 992      15      radio/TV
## 993      18      radio/TV
## 994      36  furniture/equipment
## 995      12      car
## 996      12  furniture/equipment
## 997      30      car
## 998      12      radio/TV
## 999      45      radio/TV
## 1000     45      car

```

DATA PREPROCESSING

#check for missing values

```

colSums(is.na(german_data))

##          X          Age          Sex          Job
##          0          0          0          0
## Housing  Saving.accounts Checking.account Credit.amount
##          0          183          394          0
## Duration        Purpose
##          0          0

```

#impute missing values

```

num_vars <- sapply(german_data, is.numeric)
german_data[num_vars] <- lapply(german_data[num_vars], function(x) {
  if(any(is.na(x))) {
    x[is.na(x)] <- median(x, na.rm = TRUE)
  }
})

```

```

    return(x)
})

# categorical variables with mode
cat_vars <- sapply(german_data, is.character)
german_data[cat_vars] <- lapply(german_data[cat_vars], function(x) {
  if(any(is.na(x))) {
    x[is.na(x)] <- names(sort(table(x), decreasing = TRUE))[1]
  }
  return(x)
})

#convert categorical values into factors

german_data$Sex <- as.factor(german_data$Sex)
german_data$Housing <- as.factor(german_data$Housing)
german_data$Saving.accounts <- as.factor(german_data$Saving.accounts)
german_data$Checking.account <- as.factor(german_data$Checking.account)
german_data$Purpose <- as.factor(german_data$Purpose)
german_data$Job <- as.factor(german_data$Job)

#split the data into training and testing

set.seed(123)
train_index <- createDataPartition(german_data$Credit.amount, p = 0.8, list =
FALSE)
train_data <- german_data[train_index, ]
test_data <- german_data[-train_index, ]

#normalize the nummerical values

preprocess_params <- preProcess(train_data[, sapply(train_data, is.numeric)],
method = c("center", "scale"))
train_data[, sapply(train_data, is.numeric)] <- predict(preprocess_params,
train_data[, sapply(train_data, is.numeric)])
test_data[, sapply(test_data, is.numeric)] <- predict(preprocess_params,
test_data[, sapply(test_data, is.numeric)])

```

DATA VISUALIZATION

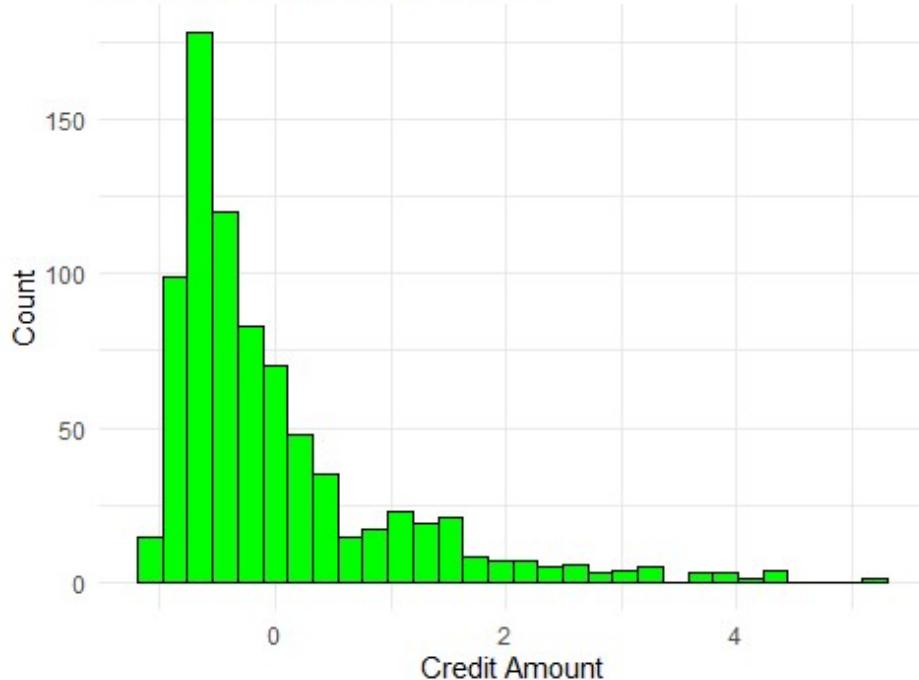
#Visualize Distribution of Credit Amount

```

ggplot(train_data, aes(x = Credit.amount)) +
  geom_histogram(bins = 30, fill = 'green', color = 'black') +
  theme_minimal() +
  labs(title = "Distribution of Credit Amount", x = "Credit Amount", y =
"Count")

```

Distribution of Credit Amount



#Visualize Correlation Between Numerical Features

```
install.packages("ggcorrplot", repos = "https://cran.us.r-project.org")
## Installing package into 'C:/Users/Raniya/AppData/Local/R/win-library/4.4'
## (as 'lib' is unspecified)

## Warning: unable to access index for repository https://cran.us.r-
## project.org/src/contrib:
##   cannot open URL 'https://cran.us.r-project.org/src/contrib/PACKAGES'

## Warning: package 'ggcorrplot' is not available for this version of R
##
## A version of this package for your version of R might be available
## elsewhere,
## see the ideas at
## https://cran.r-project.org/doc/manuals/r-patched/R-admin.html#Installing-
## packages

## Warning: unable to access index for repository https://cran.us.r-
## project.org/bin/windows/contrib/4.4:
##   cannot open URL 'https://cran.us.r-
## project.org/bin/windows/contrib/4.4/PACKAGES'

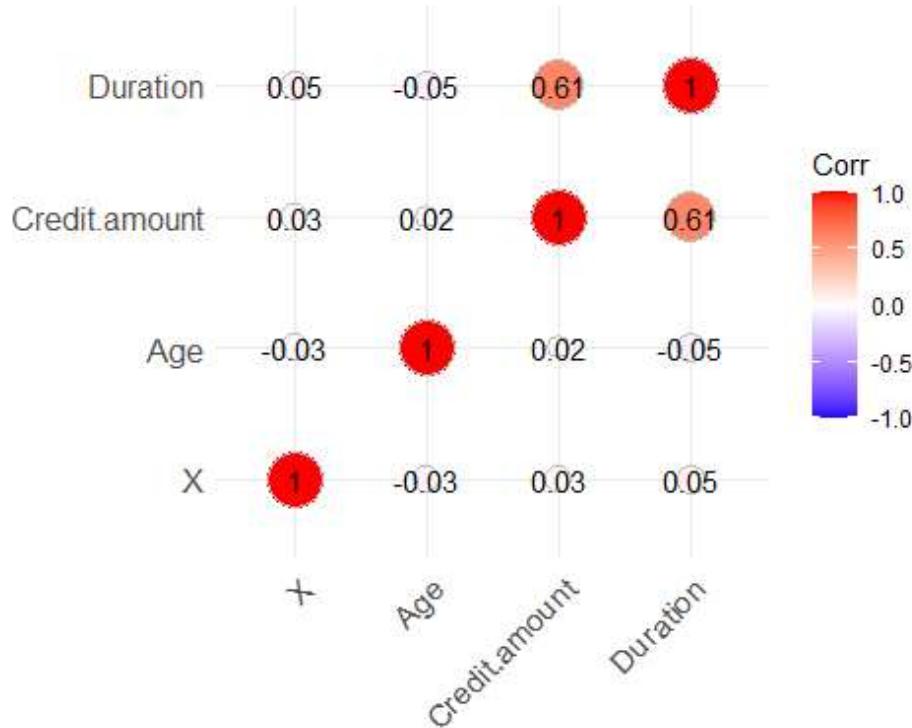
library(ggcorrplot)
library(ggplot2)
```

```

num_vars <- train_data[, sapply(train_data, is.numeric)]
cor_matrix <- cor(num_vars)

ggcorrplot::ggcorrplot(cor_matrix, method = "circle", lab = TRUE)

```



MODEL DEVELOPMENT

1. Linear Regression Model

```

lm_model <- lm(Credit.amount ~ ., data = train_data)

# Model summary
summary(lm_model)

##
## Call:
## lm(formula = Credit.amount ~ ., data = train_data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max 
## -2.0007 -0.4069 -0.1067  0.2707  4.4630 
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)    
## (Intercept) -0.040531  0.214789 -0.189  0.85037  
## X            0.007432  0.026386  0.282  0.77827  
## Age          0.007584  0.028714  0.264  0.79176  

```

```

## Sexmale          0.080055  0.060322  1.327  0.18485
## Job1            0.049152  0.183821  0.267  0.78924
## Job2            0.073069  0.177452  0.412  0.68062
## Job3            0.607402  0.186801  3.252  0.00120  **
## Housingown      -0.135469 0.089805 -1.508  0.13184
## Housingrent     -0.083602 0.111721 -0.748  0.45450
## Saving.accountsmoderate -0.169791 0.090397 -1.878  0.06072 .
## Saving.accountsquite rich -0.131399 0.105231 -1.249  0.21216
## Saving.accountsrich    -0.103602 0.120223 -0.862  0.38909
## Checking.accountmoderate 0.142743 0.061349  2.327  0.02023 *
## Checking.acountrich     -0.154093 0.111494 -1.382  0.16735
## Duration         0.550903  0.027916 19.735 < 2e-16 ***
## Purposecar        0.093023  0.099165  0.938  0.34851
## Purposedomestic appliances -0.374811 0.263489 -1.422  0.15528
## Purposeeducation   -0.236401 0.140482 -1.683  0.09282 .
## Purposefurniture/equipment -0.018524 0.109500 -0.169  0.86571
## Purposeradio/TV      -0.236013 0.100900 -2.339  0.01958 *
## Purposerepairs      -0.002207 0.196754 -0.011  0.99105
## Purposevacation/others 0.672397  0.252998  2.658  0.00803 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7366 on 778 degrees of freedom
## Multiple R-squared:  0.4717, Adjusted R-squared:  0.4574
## F-statistic: 33.08 on 21 and 778 DF,  p-value: < 2.2e-16

# Predict on test data
lm_predictions <- predict(lm_model, newdata = test_data)

```

2. Random Forest Model

```

rf_model <- randomForest(Credit.amount ~ ., data = train_data)

# Predict on test data
rf_predictions <- predict(rf_model, newdata = test_data)
rf_predictions

##           2          3          11         14          22
33  1.390324813 -0.392116058 -0.251164589 -0.056604331 -0.558042000 -
0.110518330
##           44          53          54          60          61
70  0.820931965 -0.548357103 -0.013074385  0.868481462 -0.270363232
0.821629914
##           72          74          79          87          88
90 -0.447418381  1.106872978  1.445156984 -0.141782460  0.504074894 -
0.386066351
##           99         104         105         111         113
114

```

```

##  0.362471458 -0.203960074 -0.233901646 -0.367183092 -0.284479653
0.875451522
##      121          123          128          131          136
142
## -0.139274232 -0.465228212 -0.331998515  1.160896468 -0.580244292
0.645325847
##      144          146          147          152          153
162
## -0.261664271  1.392790185 -0.397059230 -0.584291812  0.239971975 -
0.412833737
##      169          181          184          187          188
194
## -0.016605639  0.840613160 -0.216345338  0.987977036  0.307069775 -
0.422881871
##      203          207          215          223          229
238
##  0.638584286 -0.398373755  0.156109904 -0.556025169 -0.618016647 -
0.004012352
##      240          246          250          252          258
261
##  0.308882501  0.357471394 -0.381642396 -0.509418362 -0.361698337 -
0.462927202
##      271          276          284          296          299
305
## -0.201976829 -0.505402147 -0.327904873  0.896034727 -0.238542790
0.842877002
##      314          323          335          336          338
339
## -0.634738779  0.977058856 -0.021674883  0.181803908 -0.542469487
0.024816345
##      340          345          363          368          369
371
## -0.515850722 -0.547234026 -0.553160850 -0.325325044  0.047581739
0.626777638
##      375          378          385          387          390
394
##  2.214767596 -0.557304347  0.884299127 -0.326384230 -0.586823539 -
0.727696778
##      401          402          410          411          418
424
## -0.236416829 -0.154180903 -0.526830769 -0.213556414 -0.479977418 -
0.046336345
##      425          437          445          446          449
457
## -0.548780973 -0.510834995  1.690335962 -0.637180358 -0.204086884 -
0.193999427
##      471          479          482          487          493
495
## -0.253123193 -0.496250329 -0.088281852 -0.670135326 -0.725679500 -
0.375880497

```

##	496	504	505	508	510
512					
##	-0.006233733	-0.145124842	-0.328608379	0.054769452	1.583248641
1.575419943					
##	516	531	532	533	538
545					
##	-0.540010095	0.723081051	-0.330887386	-0.162733147	-0.274802440
0.603548566					
##	548	549	552	558	570
573					
##	-0.223789696	-0.521720759	-0.685905622	-0.398855559	1.161182293
0.352535277					
##	584	589	590	594	607
610					
##	1.248074165	-0.391089515	-0.412946854	-0.185133773	0.442320308
0.039715153					
##	612	613	615	616	624
629					
##	-0.468551455	-0.404047157	-0.371085841	1.655012549	-0.517690489
0.541701764					
##	631	632	643	644	651
654					
##	-0.435939277	-0.251575486	-0.274521601	-0.209162907	1.361679737
1.441523617					
##	656	657	660	662	665
666					
##	0.002486192	-0.452207419	-0.178533033	-0.503689048	-0.673051359
0.800119622					
##	668	670	676	679	687
688					
##	1.056419800	0.233595569	0.422020846	-0.367497916	-0.513382285
1.320068063					
##	695	697	700	701	702
704					
##	-0.316895770	-0.528414431	-0.229877522	-0.428232123	1.388821989
0.607762369					
##	705	711	723	726	729
730					
##	0.361553017	-0.276398567	-0.592604151	-0.606873330	1.708156461
0.112111999					
##	733	734	735	738	747
754					
##	-0.556253070	-0.158656459	-0.448947397	-0.248599256	-0.332016265
0.197990519					
##	786	791	800	805	815
816					
##	-0.207252908	-0.086687696	-0.010493154	0.020357230	1.586401692
1.098073903					
##	817	818	827	833	838
841					

```

## -0.635106591 -0.668702681 -0.418449196  1.339037917 -0.544863657
0.591110569
##          842          851          853          860          876
885
## -0.218848435 -0.131834503 -0.374735833 -0.370949971 -0.327258165
0.076482696
##          886          893          896          899          906
915
## -0.626783928 -0.397630228  1.540982226 -0.302444869  0.031528883 -
0.088260642
##          924          925          937          938          941
942
## -0.226639407 -0.218044725 -0.550140203 -0.059635624  0.503236422 -
0.434296944
##          945          952          983          988          990
991
## -0.289792192  1.533759234  0.336504082 -0.620713804 -0.148427487 -
0.562563639
##          993          997
## -0.454676140  0.965396114

```

MODEL EVALUATION

#Evaluation Metrics for Linear Regression

```

lm_mse <- mean((lm_predictions - test_data$Credit.amount)^2, na.rm = TRUE)
lm_rmse <- sqrt(lm_mse)
lm_mae <- mean(abs(lm_predictions - test_data$Credit.amount), na.rm = TRUE)
lm_r2 <- 1 - (sum((lm_predictions - test_data$Credit.amount)^2, na.rm = TRUE) /
/ sum((mean(test_data$Credit.amount) -
test_data$Credit.amount)^2, na.rm = TRUE))

cat("Linear Regression MSE:", lm_mse, "\n")
## Linear Regression MSE: 0.3758339

cat("Linear Regression RMSE:", lm_rmse, "\n")
## Linear Regression RMSE: 0.6130529

cat("Linear Regression MAE:", lm_mae, "\n")
## Linear Regression MAE: 0.4615791

cat("Linear Regression R-squared:", lm_r2, "\n")
## Linear Regression R-squared: 0.5204491

```

#Evaluation Metrics for Random Forest

```
rf_mse <- mean((rf_predictions - test_data$Credit.amount)^2, na.rm = TRUE)
rf_rmse <- sqrt(rf_mse)
rf_mae <- mean(abs(rf_predictions - test_data$Credit.amount), na.rm = TRUE)
rf_r2 <- 1 - (sum((rf_predictions - test_data$Credit.amount)^2, na.rm = TRUE) /
    sum((mean(test_data$Credit.amount) -
test_data$Credit.amount)^2, na.rm = TRUE))

cat("Random Forest MSE:", rf_mse, "\n")
## Random Forest MSE: 0.4123034

cat("Random Forest RMSE:", rf_rmse, "\n")
## Random Forest RMSE: 0.6421086

cat("Random Forest MAE:", rf_mae, "\n")
## Random Forest MAE: 0.4578682

cat("Random Forest R-squared:", rf_r2, "\n")
## Random Forest R-squared: 0.4739152
```

Mall_Customers

Vijayasri Vijith

2024-09-14

#LOADING NECESSERY DATASET

```
library(ggplot2)
library(dplyr)

##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##      filter, lag

## The following objects are masked from 'package:base':
##      intersect, setdiff, setequal, union

library(cluster)
library(factoextra)

## Welcome! Want to learn more? See two factoextra-related books at https:// goo.gl/ve3WBa
```

#DATA PREPROCESSING

#LOAD THE DATASET

```
data<-read.csv("C:\\\\Users\\\\HP\\\\Downloads\\\\ComponentII_Datasets\\\\ComponentII_D
atasets\\\\Mall_Customers.csv")

head(data)

##   CustomerID Gender Age Annual.Income..k.. Spending.Score..1.100.
## 1            1   Male  19             15              39
## 2            2   Male  21             15              81
## 3            3 Female  20             16               6
## 4            4 Female  23             16              77
## 5            5 Female  31             17              40
## 6            6 Female  22             17              76
```

CHECKING THE NULL VALUES

```
sum(is.na(data))

## [1] 0
```

```

#FEMALE=0, MALE=1

data$Gender <- ifelse(data$Gender == "Male", 1, 0)

#SCALING THE AGE, ANNUAL INCOME, SPENDING SCORE

data_scaled <- scale(data[, c("Age", "Annual.Income..k..", "Spending.Score..1
.100.")])

```

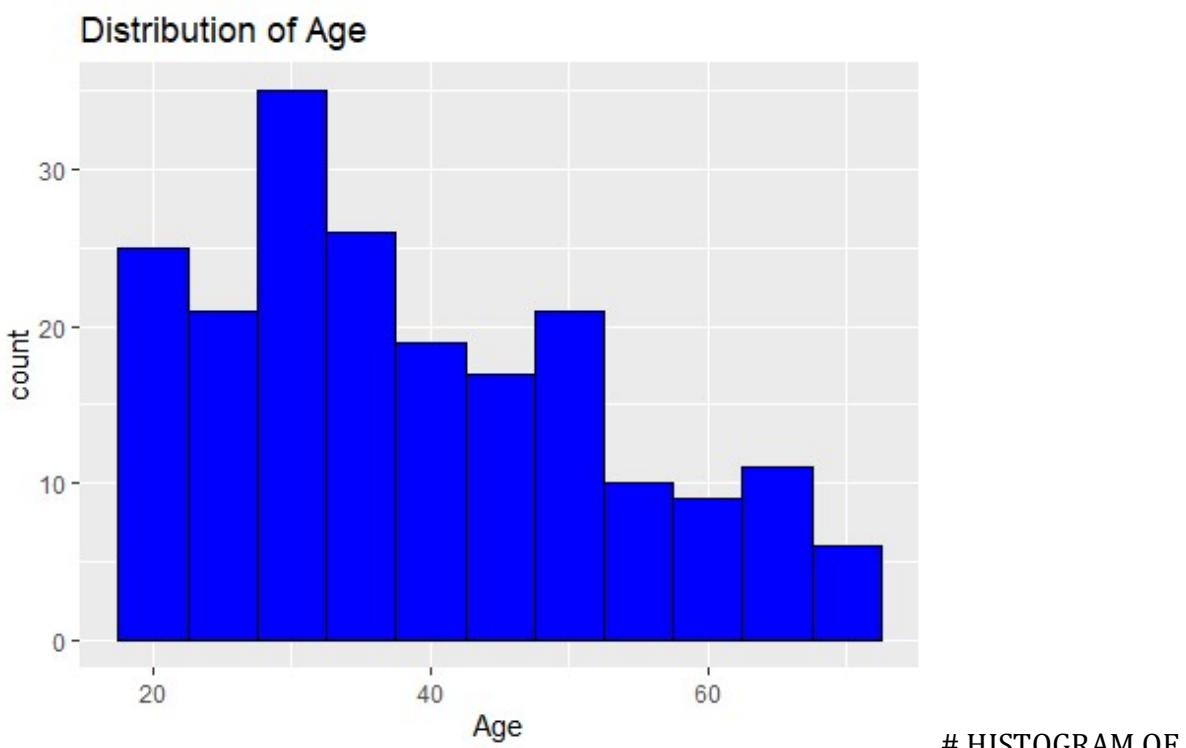
#VISUALIZATION

#HISTOGRAM OF AGE

```

ggplot(data, aes(x = Age)) +
  geom_histogram(binwidth = 5, fill = "blue", color = "black") +
  ggtitle("Distribution of Age")

```



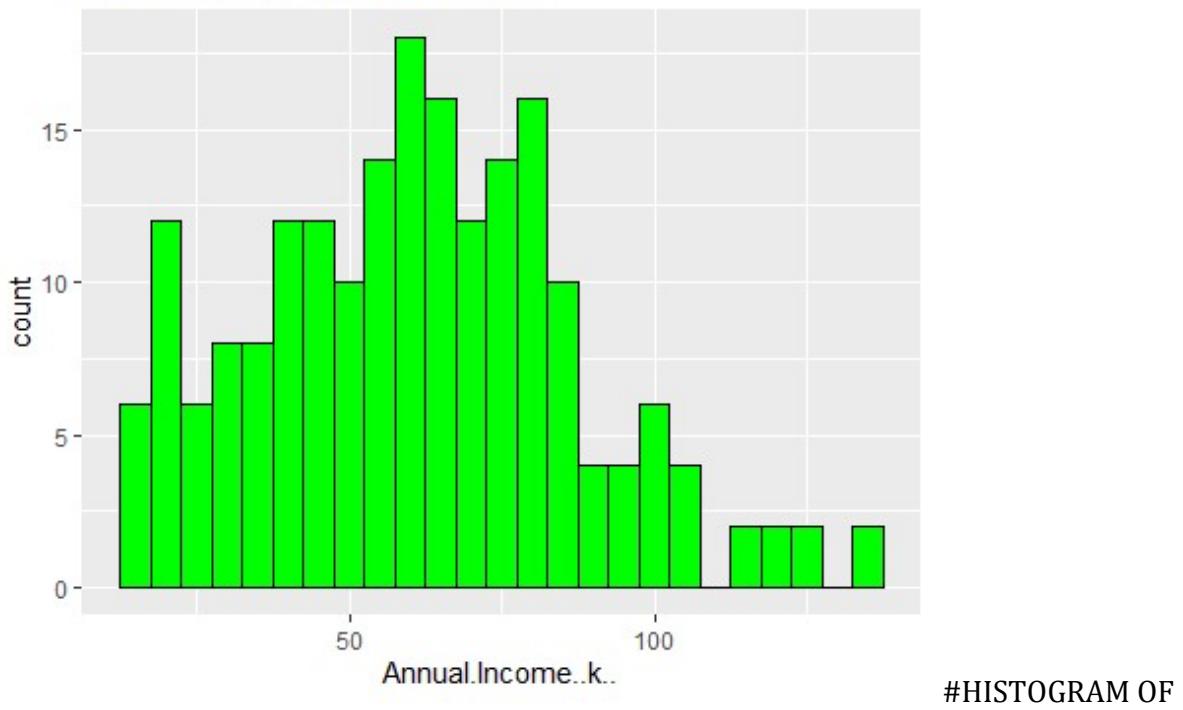
HISTOGRAM OF ANNUAL INCOME

```

ggplot(data, aes(x = Annual.Income..k..)) +
  geom_histogram(binwidth = 5, fill = "green", color = "black") +
  ggtitle("Distribution of Annual Income")

```

Distribution of Annual Income

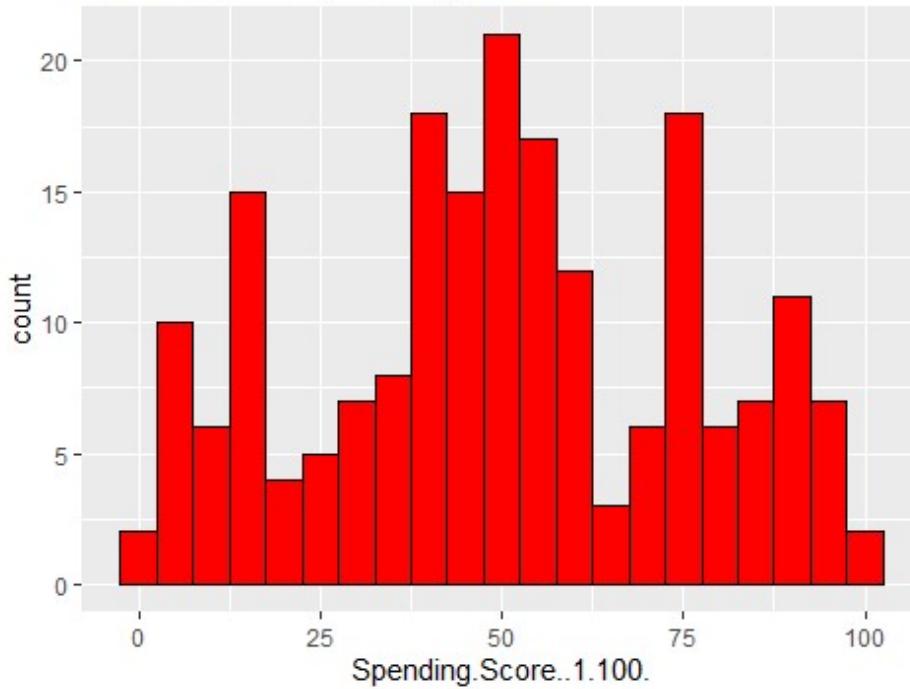


#HISTOGRAM OF

SPENDING SCORE

```
ggplot(data, aes(x = Spending.Score..1..100.)) +  
  geom_histogram(binwidth = 5, fill = "red", color = "black") +  
  ggttitle("Distribution of Spending Score")
```

Distribution of Spending Score



#COUNT OF

FEMALE AND MALE CUSTOMERS

```
ggplot(data, aes(x = Gender)) +  
  geom_bar(fill = c("lightblue", "pink")) +  
  scale_x_continuous(breaks = c(0, 1), labels = c("Female", "Male")) +  
  ggtitle("Count of Male and Female Customers") +  
  xlab("Gender") +  
  ylab("Count") +  
  theme_minimal()
```

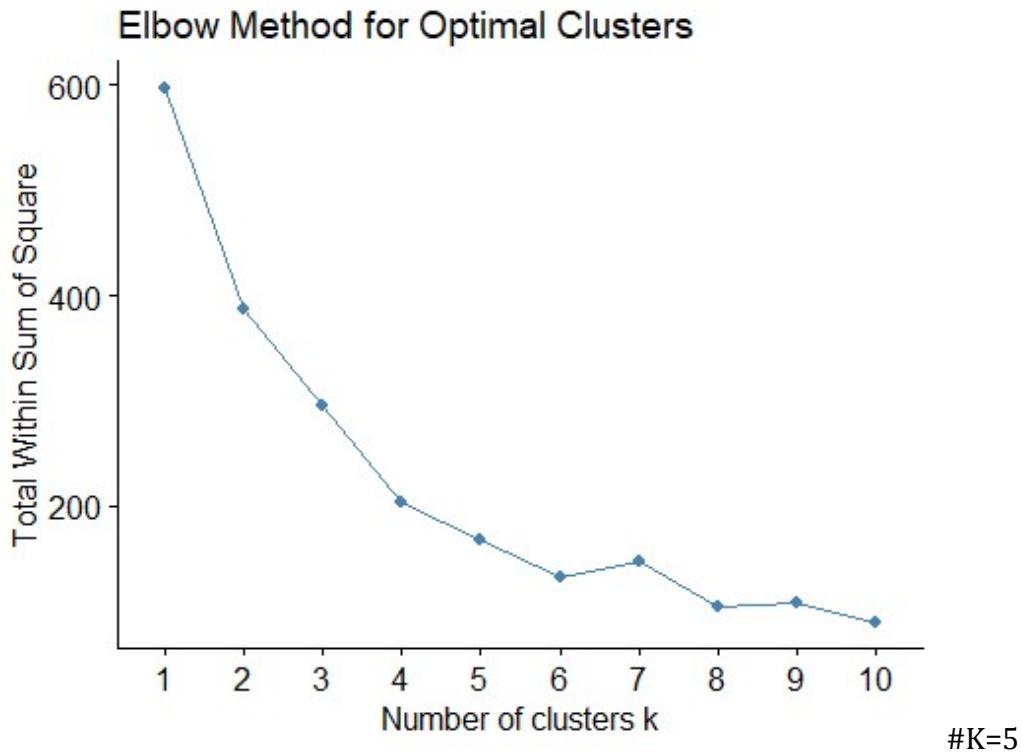
Count of Male and Female Customers



#K MEANS CLUSTERING

#ELBOW METHOD

```
set.seed(123)
fviz_nbclust(data_scaled, kmeans, method = "wss") +
  ggtitle("Elbow Method for Optimal Clusters")
```



```

set.seed(123)
kmeans_result <- kmeans(data_scaled, centers = 5, nstart = 25)

#ADD CLUSTERS
data$Cluster <- as.factor(kmeans_result$cluster)

#EVALUATION AND VISUALIZATION OF CLUSTERS

#VISUALIZE CLUSTERS OF AGE AND SPENDING SCORE

ggplot(data, aes(x = Age, y = Spending.Score..1.100., color = Cluster)) +
  geom_point(size = 3) +
  ggtitle("Clusters based on Age and Spending Score")
  
```

Clusters based on Age and Spending Score

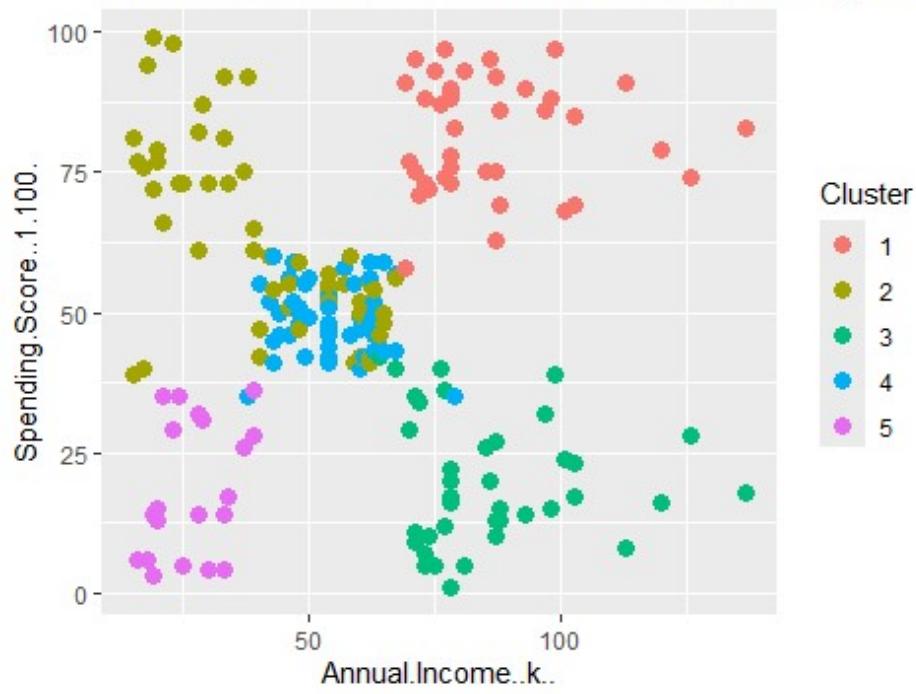


#VISUALIZE

CLUSTERS OF ANNUAL INCOME AND SPENDING SCORE

```
ggplot(data, aes(x = Annual.Income..k.., y = Spending.Score..1..100., color = Cluster)) + geom_point(size = 3) +
  ggtitle("Clusters based on Annual Income and Spending Score")
```

Clusters based on Annual Income and Spending Score



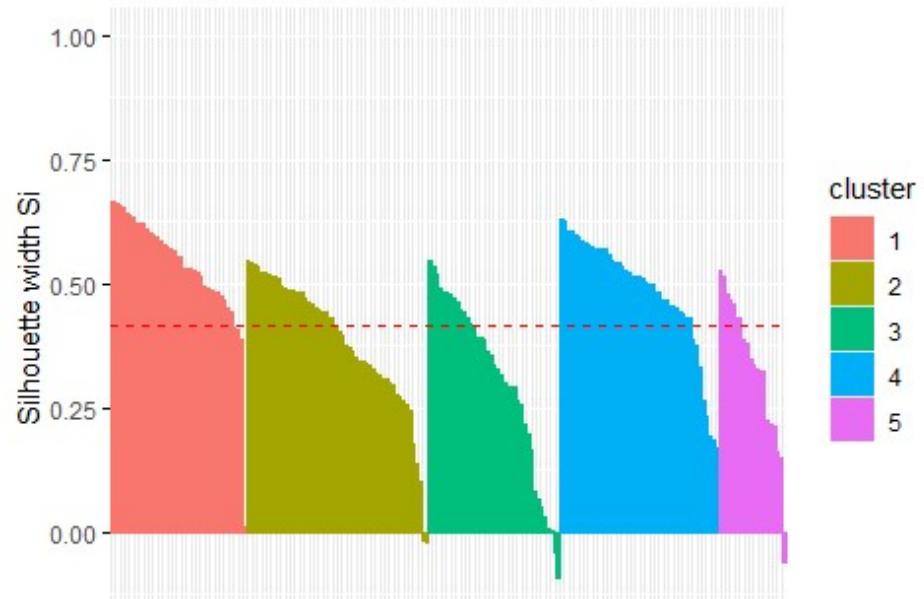
#SILHOUETTE

PLOT

```
s_plot <- silhouette(kmeans_result$cluster, dist(data_scaled))
fviz_silhouette(s_plot)

##   cluster size ave.sil.width
## 1       1   40      0.54
## 2       2   54      0.38
## 3       3   39      0.30
## 4       4   47      0.48
## 5       5   20      0.33
```

Clusters silhouette plot
Average silhouette width: 0.42



Stock_market_pred

Vijayasri Vijith

2024-09-14

SMARKET DATASET

#LOAD THE DATASET

```
data<-  
read.csv("C:\\\\Users\\\\HP\\\\Downloads\\\\ComponentII_Datasets\\\\ComponentII_Dataset  
s\\\\Smarket.csv")
```

#EXPLORE THE DATASET

```
str(data)  
  
## 'data.frame': 1250 obs. of 9 variables:  
## $ Year      : int  2001 2001 2001 2001 2001 2001 2001 2001 2001 2001 ...  
## $ Lag1       : num  0.381 0.959 1.032 -0.623 0.614 ...  
## $ Lag2       : num  -0.192 0.381 0.959 1.032 -0.623 ...  
## $ Lag3       : num  -2.624 -0.192 0.381 0.959 1.032 ...  
## $ Lag4       : num  -1.055 -2.624 -0.192 0.381 0.959 ...  
## $ Lag5       : num  5.01 -1.055 -2.624 -0.192 0.381 ...  
## $ Volume    : num  1.19 1.3 1.41 1.28 1.21 ...  
## $ Today     : num  0.959 1.032 -0.623 0.614 0.213 ...  
## $ Direction: chr  "Up" "Up" "Down" "Up" ...  
  
summary(data)  
  
##      Year           Lag1          Lag2          Lag3  
## Min. :2001   Min. :-4.922000   Min. :-4.922000   Min. :-4.922000  
## 1st Qu.:2002  1st Qu.:-0.639500  1st Qu.:-0.639500  1st Qu.:-0.640000  
## Median :2003  Median : 0.039000  Median : 0.039000  Median : 0.038500  
## Mean   :2003  Mean   : 0.003834  Mean   : 0.003919  Mean   : 0.001716  
## 3rd Qu.:2004  3rd Qu.: 0.596750  3rd Qu.: 0.596750  3rd Qu.: 0.596750  
## Max.  :2005   Max.  : 5.733000   Max.  : 5.733000   Max.  : 5.733000  
##      Lag4           Lag5          Volume         Today  
## Min. :-4.922000   Min. :-4.922000   Min. : 0.3561   Min. :-4.922000  
## 1st Qu.:-0.640000  1st Qu.:-0.640000  1st Qu.: 1.2574  1st Qu.:-0.639500  
## Median : 0.038500  Median : 0.038500  Median : 1.4229  Median : 0.038500  
## Mean   : 0.001636  Mean   : 0.00561   Mean   : 1.4783  Mean   : 0.003138  
## 3rd Qu.: 0.596750  3rd Qu.: 0.59700   3rd Qu.: 1.6417  3rd Qu.: 0.596750  
## Max.  : 5.733000   Max.  : 5.733000   Max.  : 3.1525  Max.  : 5.733000  
##      Direction  
## Length:1250  
## Class :character  
## Mode  :character
```

```

##  

##  

##  

head(data)

##   Year    Lag1    Lag2    Lag3    Lag4    Lag5 Volume Today Direction
## 1 2001  0.381 -0.192 -2.624 -1.055  5.010 1.1913  0.959      Up
## 2 2001  0.959  0.381 -0.192 -2.624 -1.055 1.2965  1.032      Up
## 3 2001  1.032  0.959  0.381 -0.192 -2.624 1.4112 -0.623     Down
## 4 2001 -0.623  1.032  0.959  0.381 -0.192 1.2760  0.614      Up
## 5 2001  0.614 -0.623  1.032  0.959  0.381 1.2057  0.213      Up
## 6 2001  0.213  0.614 -0.623  1.032  0.959 1.3491  1.392      Up

#PREPROCESS THE DATA

data$Direction<-as.factor(data$Direction)

#SPLIT THE DATA

set.seed(123)
train<-sample(1:nrow(data),0.7*nrow(data))
train_data<-data[train,]
test_data<-data[-train,]

#BUILD THE LOGISTIC REGRESSION

model<-glm(Direction ~ Lag1 + Lag2 + Lag3 + Lag4 + Lag5 + Volume,
           data=train_data,
           family = binomial)

#MAKE PREDICTIONS

pred<-predict(model,newdata = test_data,type="response")

#convert the probabilities to binary outcomes
predict_class<-ifelse(pred > 0.5, "Up", "Down")

#EVALUATE THE MODEL

conf_matrix<-table(Predicted=predict_class,Actual=test_data$Direction)

print(conf_matrix)

##          Actual
## Predicted  Down  Up
##       Down    40  38
##       Up     142 155

#Accuracy
accu<-sum(diag(conf_matrix))/sum(conf_matrix)

print(paste("Accuracy: ",round(accu*100,2),"%"))

```

```

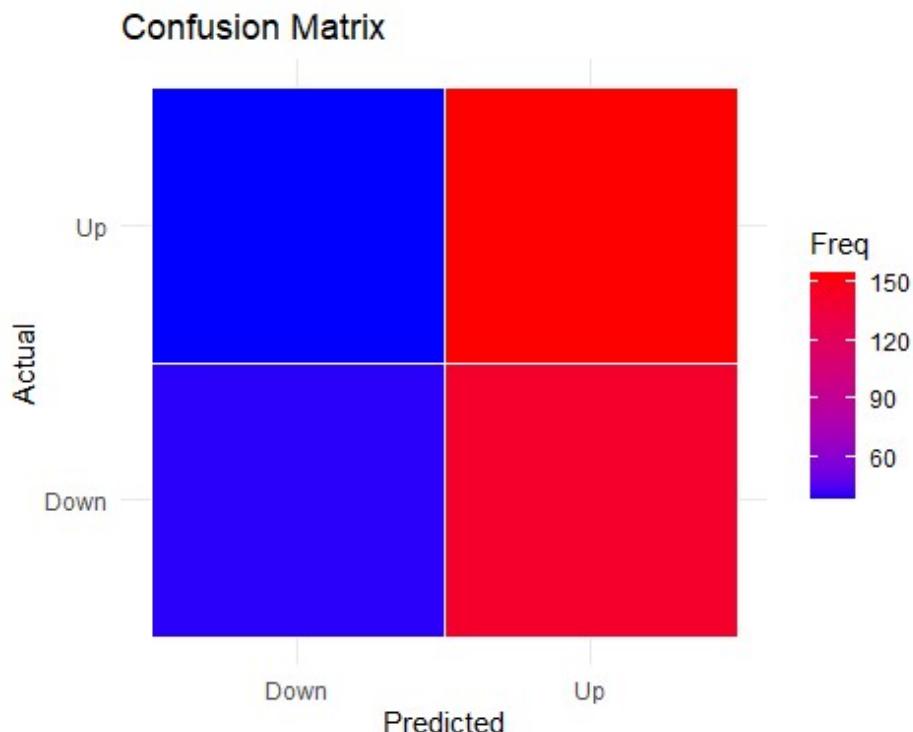
## [1] "Accuracy: 52 %"

#VISUALIZE THE RESULT

library(ggplot2)

ggplot(as.data.frame(conf_matrix), aes(x = Predicted, y = Actual)) +
  geom_tile(aes(fill = Freq), color = "white") +
  scale_fill_gradient(low = "blue", high = "red") +
  theme_minimal() +
  labs(title = "Confusion Matrix", x = "Predicted", y = "Actual")

```



-----TSLA DATASET-----

```

#LOAD THE LIBRARIES

options(repos = "https://cran.us.r-project.org")

install.packages("forecast")

## Installing package into 'C:/Users/Raniya/AppData/Local/R/win-library/4.4'
## (as 'lib' is unspecified)

## Warning: unable to access index for repository https://cran.us.r-
## project.org/src/contrib:
##   cannot open URL 'https://cran.us.r-project.org/src/contrib/PACKAGES'

## Warning: package 'forecast' is not available for this version of R
##

```

```

## A version of this package for your version of R might be available
elsewhere,
## see the ideas at
## https://cran.r-project.org/doc/manuals/r-patched/R-admin.html#Installing-
packages

## Warning: unable to access index for repository https://cran.us.r-
project.org/bin/windows/contrib/4.4:
##   cannot open URL 'https://cran.us.r-
project.org/bin/windows/contrib/4.4/PACKAGES'

library(tidyverse)

## — Attaching core tidyverse packages ——————— tidyverse
2.0.0 —
## ✓ dplyr      1.1.4    ✓ readr      2.1.5
## ✓forcats     1.0.0    ✓ stringr    1.5.1
## ✓ lubridate   1.9.3    ✓ tibble     3.2.1
## ✓ purrr      1.0.2    ✓ tidyverse   1.3.1
## — Conflicts ———————
tidyverse_conflicts() —
## ✗ dplyr::filter() masks stats::filter()
## ✗ dplyr::lag()   masks stats::lag()
## [i] Use the conflicted package (<http://conflicted.r-lib.org/>) to force
all conflicts to become errors

library(forecast)

## Registered S3 method overwritten by 'quantmod':
##   method           from
##   as.zoo.data.frame zoo

```

#LOAD THE DATASET

```

tdata<-
read.csv("C:\\\\Users\\\\Raniya\\\\Downloads\\\\ComponentII_Datasets\\\\ComponentII_Dat
ases\\\\TSLA.csv")

```

#DATA PREPROCESSING

```

library(dplyr)
tdata$date <- as.Date(tdata$date, format="%d-%m-%Y")
tdata <- tdata %>% select(Date, Close)

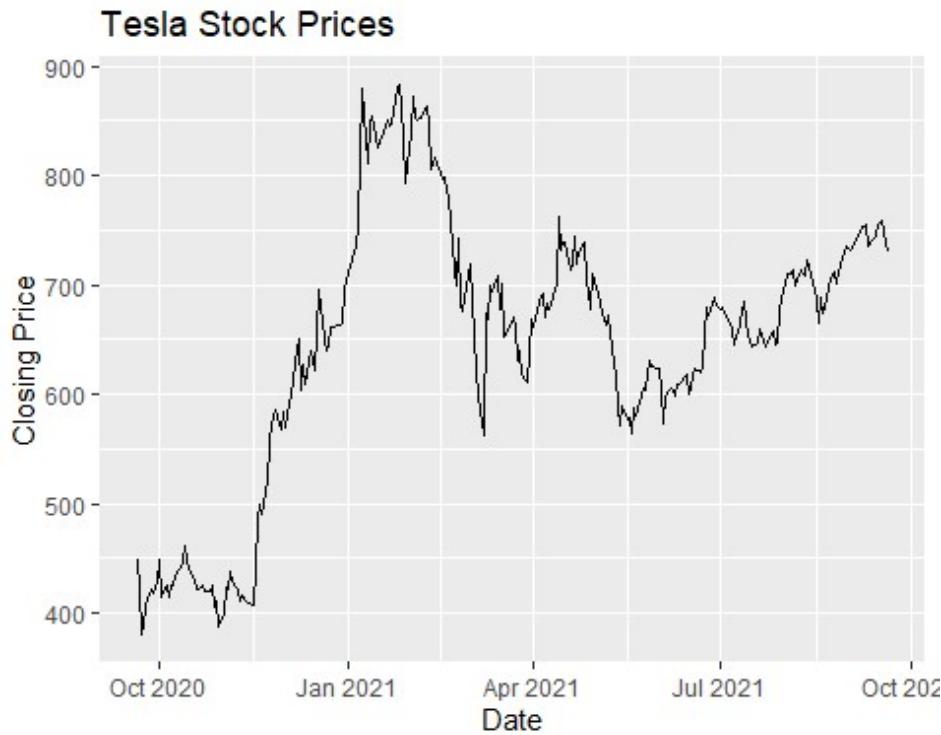
```

#VISUALIZE THE DATA

```

ggplot(tdata, aes(x = Date, y = Close)) +
  geom_line() +
  labs(title = "Tesla Stock Prices", x = "Date", y = "Closing Price")

```



#CREATE A TIME

SERIES OBJECT

```
ts_data <- ts(tdata$Close, frequency = 365, start = c(2020, 1))
```

#SPLIT THE DATA

```
train_size <- round(length(ts_data) * 0.8)
train_set <- ts_data[1:train_size]
test_set <- ts_data[(train_size + 1):length(ts_data)]
```

#FIT A MODEL

#Arima model is used

```
fit <- auto.arima(train_set)
summary(fit)

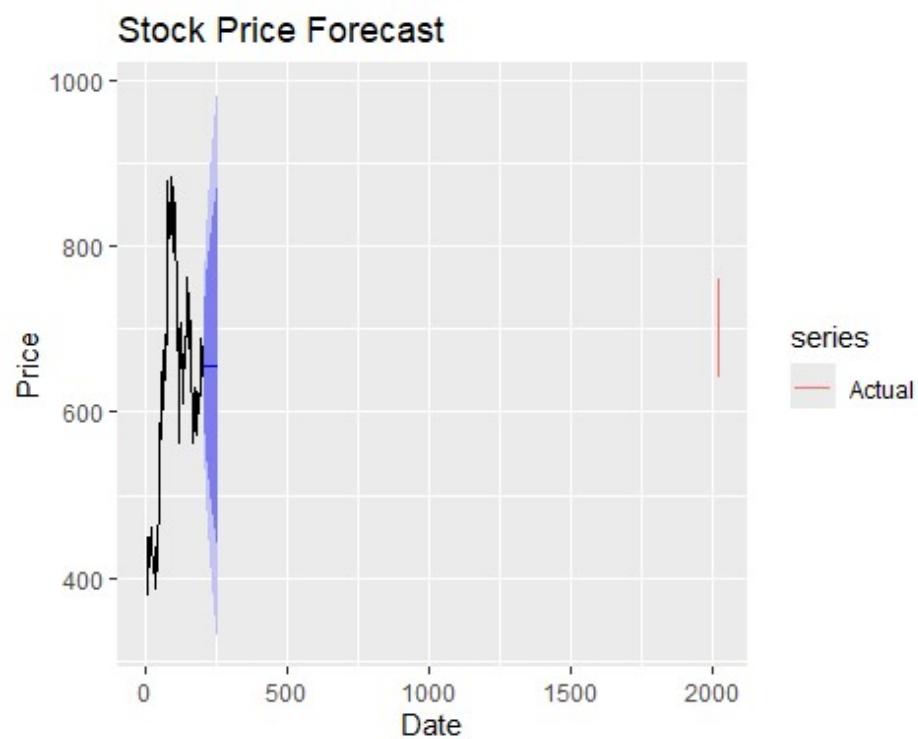
## Series: train_set
## ARIMA(0,1,0)
##
## sigma^2 = 573.3: log likelihood = -923.52
## AIC=1849.04   AICc=1849.06   BIC=1852.34
##
## Training set error measures:
##               ME      RMSE      MAE      MPE      MAPE      MASE
## Training set 1.029749 23.88408 17.75173 0.1182915 2.833432 0.9951742
##               ACF1
## Training set -0.08090906
```

```
#MAKE PREDICTIONS  
test_set_ts <- ts(test_set, frequency = 365, start = c(2020, 1))  
forecastvalue <- forecast(fit, h = length(test_set))
```

#VISUALIZE THE PREDICTION

```
autoplot(forecastvalue) +  
  autolayer(test_set_ts, series = "Actual", PI = FALSE) +  
  labs(title = "Stock Price Forecast", x = "Date", y = "Price")
```

```
## Warning in ggplot2::geom_line(ggplot2::aes(x = .data[["timeVal"]], y =  
## .data[["seriesVal"]]), : Ignoring unknown parameters: `PI`
```



#EVALUATE THE MODEL

```
mae <- mean(abs(forecastvalue$mean - test_set))  
print(paste("Mean Absolute Error:", mae))  
## [1] "Mean Absolute Error: 47.66118908"
```