ModelosDeRegresionLineal

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```
library(haven)
library(rpart)
library(stats)
library(caret)
```

```
## Loading required package: ggplot2
```

```
## Loading required package: lattice
```

```
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(rpart.plot)
library(fpc)
library(ggplot2)
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.2
## --
```

```
## v tibble  3.1.8     v purrr   1.0.1
## v tidyr   1.3.0     v stringr 1.5.0
## v readr   2.1.3     v forcats 1.0.0
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## x purrr::lift()   masks caret::lift()
```

```
library(e1071)
library(corrplot)
```

```
## corrplot 0.92 loaded
```

```
library(dummy)
```

```
## dummy 0.1.3
## dummyNews()
```

```
#train <- read.csv("train.csv")
#test <- read.csv("test.csv")
```

1. Descargue los conjuntos de datos de la plataforma kaggle.

librerías

```
datos = read.csv("./train.csv")
test<- read.csv("./test.csv", stringsAsFactors = FALSE)

#Columnas
house <-select(datos, LotFrontage, LotArea, YearBuilt, YearRemodAdd, MasVnrArea, BsmtFinSF1,BsmtFinSF2,

#Data
house <- na.omit(house)

# Resumen
summary(house)
```

```
##   LotFrontage        LotArea         YearBuilt     YearRemodAdd
##  Min.   : 21.00   Min.   :  1300   Min.   :1880   Min.   :1950
##  1st Qu.: 60.00   1st Qu.:  7590   1st Qu.:1953   1st Qu.:1966
##  Median : 70.00   Median :  9416   Median :1974   Median :1995
##  Mean   : 70.67   Mean   : 10123   Mean   :1972   Mean   :1986
##  3rd Qu.: 80.00   3rd Qu.: 11361   3rd Qu.:2003   3rd Qu.:2005
##  Max.   :313.00   Max.   :215245   Max.   :2010   Max.   :2010
##    MasVnrArea       BsmtFinSF1       BsmtFinSF2        BsmtUnfSF
##  Min.   :   0.0   Min.   :   0.0   Min.   :   0.00   Min.   :   0.0
##  1st Qu.:   0.0   1st Qu.:   0.0   1st Qu.:   0.00   1st Qu.: 250.0
##  Median :   0.0   Median : 374.0   Median :   0.00   Median : 506.0
##  Mean   : 108.5   Mean   : 438.4   Mean   :  44.59   Mean   : 594.1
##  3rd Qu.: 170.0   3rd Qu.: 702.0   3rd Qu.:   0.00   3rd Qu.: 840.0
##  Max.   :1600.0   Max.   :5644.0   Max.   :1474.00   Max.   :2336.0
##   TotalBsmtSF     X1stFlrSF      X2ndFlrSF       LowQualFinSF
##  Min.   :   0   Min.   : 438   Min.   :   0.0   Min.   :  0.000
##  1st Qu.: 803   1st Qu.: 894   1st Qu.:   0.0   1st Qu.:  0.000
##  Median :1008   Median :1097   Median :   0.0   Median :  0.000
##  Mean   :1077   Mean   :1174   Mean   : 353.3   Mean   :  4.568
##  3rd Qu.:1324   3rd Qu.:1411   3rd Qu.: 728.0   3rd Qu.:  0.000
##  Max.   :6110   Max.   :4692   Max.   :2065.0   Max.   :572.000
```

```
##    GrLivArea     TotRmsAbvGrd      Fireplaces      GarageYrBlt
##  Min.   : 438   Min.   : 3.000   Min.   :0.0000   Min.   :1900
##  1st Qu.:1155   1st Qu.: 5.000   1st Qu.:0.0000   1st Qu.:1959
##  Median :1479   Median : 6.000   Median :1.0000   Median :1981
##  Mean   :1531   Mean   : 6.576   Mean   :0.6039   Mean   :1978
##  3rd Qu.:1776   3rd Qu.: 7.000   3rd Qu.:1.0000   3rd Qu.:2003
##  Max.   :5642   Max.   :12.000   Max.   :3.0000   Max.   :2010
##    GarageCars      GarageArea     WoodDeckSF      OpenPorchSF
##  Min.   :1.000   Min.   : 160   Min.   :  0.00   Min.   :  0.00
##  1st Qu.:1.000   1st Qu.: 360   1st Qu.:  0.00   1st Qu.:  0.00
##  Median :2.000   Median : 484   Median :  0.00   Median : 27.00
##  Mean   :1.879   Mean   : 503   Mean   : 92.61   Mean   : 46.13
##  3rd Qu.:2.000   3rd Qu.: 600   3rd Qu.:168.00   3rd Qu.: 68.00
##  Max.   :4.000   Max.   :1418   Max.   :857.00   Max.   :547.00
##  EnclosedPorch     ScreenPorch       PoolArea           MoSold
##  Min.   :  0.00   Min.   :  0.0   Min.   :  0.000   Min.   : 1.00
##  1st Qu.:  0.00   1st Qu.:  0.0   1st Qu.:  0.000   1st Qu.: 5.00
##  Median :  0.00   Median :  0.0   Median :  0.000   Median : 6.00
##  Mean   : 21.84   Mean   : 16.1   Mean   :  2.935   Mean   : 6.34
##  3rd Qu.:  0.00   3rd Qu.:  0.0   3rd Qu.:  0.000   3rd Qu.: 8.00
##  Max.   :552.00   Max.   :480.0   Max.   :648.000   Max.   :12.00
##      YrSold       SalePrice
##  Min.   :2006   Min.   : 35311
##  1st Qu.:2007   1st Qu.:131000
##  Median :2008   Median :164900
##  Mean   :2008   Mean   :185506
##  3rd Qu.:2009   3rd Qu.:219500
##  Max.   :2010   Max.   :755000
```

2. Haga un análisis exploratorio extenso de los datos. Explique bien todos los hallazgos. No ponga solo gráficas y código. Debe llegar a conclusiones interesantes para poder predecir. Explique el preprocesamiento que necesitó hacer.

Analisis exploratorio

—Exploración rápida de datos— train

```
summary(datos)
```

```
##        Id           MSSubClass      MSZoning          LotFrontage
##  Min.   :   1.0   Min.   : 20.0   Length:1460        Min.   : 21.00
##  1st Qu.: 365.8   1st Qu.: 20.0   Class :character   1st Qu.: 59.00
##  Median : 730.5   Median : 50.0   Mode  :character   Median : 69.00
##  Mean   : 730.5   Mean   : 56.9                      Mean   : 70.05
##  3rd Qu.:1095.2   3rd Qu.: 70.0                      3rd Qu.: 80.00
##  Max.   :1460.0   Max.   :190.0                      Max.   :313.00
##                                                      NA's   :259
##     LotArea          Street             Alley             LotShape
##  Min.   :  1300   Length:1460        Length:1460        Length:1460
##  1st Qu.:  7554   Class :character   Class :character   Class :character
##  Median :  9478   Mode  :character   Mode  :character   Mode  :character
##  Mean   : 10517
##  3rd Qu.: 11602
```

```
##  Max.   :215245
##
##  LandContour         Utilities          LotConfig          LandSlope
##  Length:1460        Length:1460        Length:1460        Length:1460
##  Class :character   Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character
##
##
##
##
##  Neighborhood        Condition1         Condition2          BldgType
##  Length:1460        Length:1460        Length:1460        Length:1460
##  Class :character   Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character
##
##
##
##
##   HouseStyle         OverallQual      OverallCond      YearBuilt
##  Length:1460        Min.   : 1.000   Min.   :1.000   Min.   :1872
##  Class :character   1st Qu.: 5.000   1st Qu.:5.000   1st Qu.:1954
##  Mode  :character   Median : 6.000   Median :5.000   Median :1973
##                     Mean   : 6.099   Mean   :5.575   Mean   :1971
##                     3rd Qu.: 7.000   3rd Qu.:6.000   3rd Qu.:2000
##                     Max.   :10.000   Max.   :9.000   Max.   :2010
##
##   YearRemodAdd   RoofStyle           RoofMatl         Exterior1st
##  Min.   :1950   Length:1460        Length:1460        Length:1460
##  1st Qu.:1967   Class :character   Class :character   Class :character
##  Median :1994   Mode  :character   Mode  :character   Mode  :character
##  Mean   :1985
##  3rd Qu.:2004
##  Max.   :2010
##
##  Exterior2nd         MasVnrType          MasVnrArea      ExterQual
##  Length:1460        Length:1460        Min.   :   0.0   Length:1460
##  Class :character   Class :character   1st Qu.:   0.0   Class :character
##  Mode  :character   Mode  :character   Median :   0.0   Mode  :character
##                                        Mean   : 103.7
##                                        3rd Qu.: 166.0
##                                        Max.   :1600.0
##                                        NA's   :8
##   ExterCond          Foundation          BsmtQual           BsmtCond
##  Length:1460        Length:1460        Length:1460        Length:1460
##  Class :character   Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character
##
##
##
##
##  BsmtExposure       BsmtFinType1         BsmtFinSF1     BsmtFinType2
##  Length:1460        Length:1460        Min.   :   0.0   Length:1460
##  Class :character   Class :character   1st Qu.:   0.0   Class :character
##  Mode  :character   Mode  :character   Median : 383.5   Mode  :character
```

```
##                                     Mean   : 443.6
##                                     3rd Qu.: 712.2
##                                     Max.   :5644.0
##
##    BsmtFinSF2        BsmtUnfSF       TotalBsmtSF       Heating
##  Min.   :   0.00   Min.   :   0.0   Min.   :   0.0   Length:1460
##  1st Qu.:   0.00   1st Qu.: 223.0   1st Qu.: 795.8   Class :character
##  Median :   0.00   Median : 477.5   Median : 991.5   Mode  :character
##  Mean   :  46.55   Mean   : 567.2   Mean   :1057.4
##  3rd Qu.:   0.00   3rd Qu.: 808.0   3rd Qu.:1298.2
##  Max.   :1474.00   Max.   :2336.0   Max.   :6110.0
##
##   HeatingQC          CentralAir         Electrical          X1stFlrSF
##  Length:1460        Length:1460        Length:1460        Min.   : 334
##  Class :character   Class :character   Class :character   1st Qu.: 882
##  Mode  :character   Mode  :character   Mode  :character   Median :1087
##                                                           Mean   :1163
##                                                           3rd Qu.:1391
##                                                           Max.   :4692
##
##    X2ndFlrSF     LowQualFinSF       GrLivArea     BsmtFullBath
##  Min.   :   0   Min.   :  0.000   Min.   : 334   Min.   :0.0000
##  1st Qu.:   0   1st Qu.:  0.000   1st Qu.:1130   1st Qu.:0.0000
##  Median :   0   Median :  0.000   Median :1464   Median :0.0000
##  Mean   : 347   Mean   :  5.845   Mean   :1515   Mean   :0.4253
##  3rd Qu.: 728   3rd Qu.:  0.000   3rd Qu.:1777   3rd Qu.:1.0000
##  Max.   :2065   Max.   :572.000   Max.   :5642   Max.   :3.0000
##
##   BsmtHalfBath        FullBath        HalfBath       BedroomAbvGr
##  Min.   :0.00000   Min.   :0.000   Min.   :0.0000   Min.   :0.000
##  1st Qu.:0.00000   1st Qu.:1.000   1st Qu.:0.0000   1st Qu.:2.000
##  Median :0.00000   Median :2.000   Median :0.0000   Median :3.000
##  Mean   :0.05753   Mean   :1.565   Mean   :0.3829   Mean   :2.866
##  3rd Qu.:0.00000   3rd Qu.:2.000   3rd Qu.:1.0000   3rd Qu.:3.000
##  Max.   :2.00000   Max.   :3.000   Max.   :2.0000   Max.   :8.000
##
##   KitchenAbvGr   KitchenQual         TotRmsAbvGrd     Functional
##  Min.   :0.000   Length:1460        Min.   : 2.000   Length:1460
##  1st Qu.:1.000   Class :character   1st Qu.: 5.000   Class :character
##  Median :1.000   Mode  :character   Median : 6.000   Mode  :character
##  Mean   :1.047                      Mean   : 6.518
##  3rd Qu.:1.000                      3rd Qu.: 7.000
##  Max.   :3.000                      Max.   :14.000
##
##    Fireplaces    FireplaceQu         GarageType          GarageYrBlt
##  Min.   :0.000   Length:1460        Length:1460        Min.   :1900
##  1st Qu.:0.000   Class :character   Class :character   1st Qu.:1961
##  Median :1.000   Mode  :character   Mode  :character   Median :1980
##  Mean   :0.613                                         Mean   :1979
##  3rd Qu.:1.000                                         3rd Qu.:2002
##  Max.   :3.000                                         Max.   :2010
##                                                        NA's   :81
##  GarageFinish         GarageCars      GarageArea      GarageQual
##  Length:1460        Min.   :0.000   Min.   :   0.0   Length:1460
```

```
##  Class :character   1st Qu.:1.000   1st Qu.: 334.5   Class :character
##  Mode  :character   Median :2.000   Median : 480.0   Mode  :character
##                     Mean   :1.767   Mean   : 473.0
##                     3rd Qu.:2.000   3rd Qu.: 576.0
##                     Max.   :4.000   Max.   :1418.0
##
##   GarageCond         PavedDrive          WoodDeckSF      OpenPorchSF
##  Length:1460        Length:1460        Min.   :  0.00   Min.   :  0.00
##  Class :character   Class :character   1st Qu.:  0.00   1st Qu.:  0.00
##  Mode  :character   Mode  :character   Median :  0.00   Median : 25.00
##                                        Mean   : 94.24   Mean   : 46.66
##                                        3rd Qu.:168.00   3rd Qu.: 68.00
##                                        Max.   :857.00   Max.   :547.00
##
##  EnclosedPorch      X3SsnPorch      ScreenPorch        PoolArea
##  Min.   :  0.00   Min.   :  0.00   Min.   :  0.00   Min.   :  0.000
##  1st Qu.:  0.00   1st Qu.:  0.00   1st Qu.:  0.00   1st Qu.:  0.000
##  Median :  0.00   Median :  0.00   Median :  0.00   Median :  0.000
##  Mean   : 21.95   Mean   :  3.41   Mean   : 15.06   Mean   :  2.759
##  3rd Qu.:  0.00   3rd Qu.:  0.00   3rd Qu.:  0.00   3rd Qu.:  0.000
##  Max.   :552.00   Max.   :508.00   Max.   :480.00   Max.   :738.000
##
##     PoolQC             Fence           MiscFeature           MiscVal
##  Length:1460        Length:1460        Length:1460        Min.   :    0.00
##  Class :character   Class :character   Class :character   1st Qu.:    0.00
##  Mode  :character   Mode  :character   Mode  :character   Median :    0.00
##                                                           Mean   :   43.49
##                                                           3rd Qu.:    0.00
##                                                           Max.   :15500.00
##
##      MoSold           YrSold       SaleType         SaleCondition
##  Min.   : 1.000   Min.   :2006   Length:1460        Length:1460
##  1st Qu.: 5.000   1st Qu.:2007   Class :character   Class :character
##  Median : 6.000   Median :2008   Mode  :character   Mode  :character
##  Mean   : 6.322   Mean   :2008
##  3rd Qu.: 8.000   3rd Qu.:2009
##  Max.   :12.000   Max.   :2010
##
##    SalePrice
##  Min.   : 34900
##  1st Qu.:129975
##  Median :163000
##  Mean   :180921
##  3rd Qu.:214000
##  Max.   :755000
##
```

test

```
summary(test)
```

```
##        Id          MSSubClass       MSZoning          LotFrontage
##  Min.   :1461   Min.   : 20.00   Length:1459        Min.   : 21.00
```

```
##  1st Qu.:1826   1st Qu.: 20.00   Class :character   1st Qu.: 58.00
##  Median :2190   Median : 50.00   Mode  :character   Median : 67.00
##  Mean   :2190   Mean   : 57.38                      Mean   : 68.58
##  3rd Qu.:2554   3rd Qu.: 70.00                      3rd Qu.: 80.00
##  Max.   :2919   Max.   :190.00                      Max.   :200.00
##                                                     NA's   :227
##     LotArea         Street             Alley             LotShape
##  Min.   : 1470   Length:1459        Length:1459        Length:1459
##  1st Qu.: 7391   Class :character   Class :character   Class :character
##  Median : 9399   Mode  :character   Mode  :character   Mode  :character
##  Mean   : 9819
##  3rd Qu.:11518
##  Max.   :56600
##
##  LandContour         Utilities          LotConfig          LandSlope
##  Length:1459        Length:1459        Length:1459        Length:1459
##  Class :character   Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character
##
##
##
##
##  Neighborhood        Condition1         Condition2          BldgType
##  Length:1459        Length:1459        Length:1459        Length:1459
##  Class :character   Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character
##
##
##
##
##   HouseStyle         OverallQual      OverallCond      YearBuilt
##  Length:1459        Min.   : 1.000   Min.   :1.000   Min.   :1879
##  Class :character   1st Qu.: 5.000   1st Qu.:5.000   1st Qu.:1953
##  Mode  :character   Median : 6.000   Median :5.000   Median :1973
##                     Mean   : 6.079   Mean   :5.554   Mean   :1971
##                     3rd Qu.: 7.000   3rd Qu.:6.000   3rd Qu.:2001
##                     Max.   :10.000   Max.   :9.000   Max.   :2010
##
##   YearRemodAdd   RoofStyle           RoofMatl         Exterior1st
##  Min.   :1950   Length:1459        Length:1459        Length:1459
##  1st Qu.:1963   Class :character   Class :character   Class :character
##  Median :1992   Mode  :character   Mode  :character   Mode  :character
##  Mean   :1984
##  3rd Qu.:2004
##  Max.   :2010
##
##  Exterior2nd         MasVnrType          MasVnrArea      ExterQual
##  Length:1459        Length:1459        Min.   :   0.0   Length:1459
##  Class :character   Class :character   1st Qu.:   0.0   Class :character
##  Mode  :character   Mode  :character   Median :   0.0   Mode  :character
##                                        Mean   : 100.7
##                                        3rd Qu.: 164.0
##                                        Max.   :1290.0
##                                        NA's   :15
```

```
##   ExterCond          Foundation          BsmtQual          BsmtCond
##  Length:1459        Length:1459        Length:1459        Length:1459
##  Class :character   Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character
##
##
##
##
##  BsmtExposure       BsmtFinType1         BsmtFinSF1     BsmtFinType2
##  Length:1459        Length:1459        Min.   :   0.0   Length:1459
##  Class :character   Class :character   1st Qu.:   0.0   Class :character
##  Mode  :character   Mode  :character   Median : 350.5   Mode  :character
##                                        Mean   : 439.2
##                                        3rd Qu.: 753.5
##                                        Max.   :4010.0
##                                        NA's   :1
##    BsmtFinSF2        BsmtUnfSF       TotalBsmtSF     Heating
##  Min.   :   0.00   Min.   :   0.0   Min.   :   0   Length:1459
##  1st Qu.:   0.00   1st Qu.: 219.2   1st Qu.: 784   Class :character
##  Median :   0.00   Median : 460.0   Median : 988   Mode  :character
##  Mean   :  52.62   Mean   : 554.3   Mean   :1046
##  3rd Qu.:   0.00   3rd Qu.: 797.8   3rd Qu.:1305
##  Max.   :1526.00   Max.   :2140.0   Max.   :5095
##  NA's   :1         NA's   :1        NA's   :1
##   HeatingQC          CentralAir         Electrical          X1stFlrSF
##  Length:1459        Length:1459        Length:1459        Min.   : 407.0
##  Class :character   Class :character   Class :character   1st Qu.: 873.5
##  Mode  :character   Mode  :character   Mode  :character   Median :1079.0
##                                                           Mean   :1156.5
##                                                           3rd Qu.:1382.5
##                                                           Max.   :5095.0
##
##    X2ndFlrSF     LowQualFinSF        GrLivArea     BsmtFullBath
##  Min.   :   0   Min.   :   0.000   Min.   : 407   Min.   :0.0000
##  1st Qu.:   0   1st Qu.:   0.000   1st Qu.:1118   1st Qu.:0.0000
##  Median :   0   Median :   0.000   Median :1432   Median :0.0000
##  Mean   : 326   Mean   :   3.543   Mean   :1486   Mean   :0.4345
##  3rd Qu.: 676   3rd Qu.:   0.000   3rd Qu.:1721   3rd Qu.:1.0000
##  Max.   :1862   Max.   :1064.000   Max.   :5095   Max.   :3.0000
##                                                   NA's   :2
##   BsmtHalfBath       FullBath        HalfBath       BedroomAbvGr
##  Min.   :0.0000   Min.   :0.000   Min.   :0.0000   Min.   :0.000
##  1st Qu.:0.0000   1st Qu.:1.000   1st Qu.:0.0000   1st Qu.:2.000
##  Median :0.0000   Median :2.000   Median :0.0000   Median :3.000
##  Mean   :0.0652   Mean   :1.571   Mean   :0.3777   Mean   :2.854
##  3rd Qu.:0.0000   3rd Qu.:2.000   3rd Qu.:1.0000   3rd Qu.:3.000
##  Max.   :2.0000   Max.   :4.000   Max.   :2.0000   Max.   :6.000
##  NA's   :2
##   KitchenAbvGr   KitchenQual         TotRmsAbvGrd     Functional
##  Min.   :0.000   Length:1459        Min.   : 3.000   Length:1459
##  1st Qu.:1.000   Class :character   1st Qu.: 5.000   Class :character
##  Median :1.000   Mode  :character   Median : 6.000   Mode  :character
##  Mean   :1.042                      Mean   : 6.385
##  3rd Qu.:1.000                      3rd Qu.: 7.000
```

```
##  Max.   :2.000                      Max.   :15.000
##
##    Fireplaces     FireplaceQu         GarageType         GarageYrBlt
##  Min.   :0.0000   Length:1459        Length:1459        Min.   :1895
##  1st Qu.:0.0000   Class :character   Class :character   1st Qu.:1959
##  Median :0.0000   Mode  :character   Mode  :character   Median :1979
##  Mean   :0.5812                                        Mean   :1978
##  3rd Qu.:1.0000                                        3rd Qu.:2002
##  Max.   :4.0000                                        Max.   :2207
##                                                        NA's   :78
##  GarageFinish         GarageCars      GarageArea      GarageQual
##  Length:1459        Min.   :0.000   Min.   :   0.0   Length:1459
##  Class :character   1st Qu.:1.000   1st Qu.: 318.0   Class :character
##  Mode  :character   Median :2.000   Median : 480.0   Mode  :character
##                     Mean   :1.766   Mean   : 472.8
##                     3rd Qu.:2.000   3rd Qu.: 576.0
##                     Max.   :5.000   Max.   :1488.0
##                     NA's   :1       NA's   :1
##   GarageCond         PavedDrive          WoodDeckSF       OpenPorchSF
##  Length:1459        Length:1459        Min.   :   0.00   Min.   :  0.00
##  Class :character   Class :character   1st Qu.:   0.00   1st Qu.:  0.00
##  Mode  :character   Mode  :character   Median :   0.00   Median : 28.00
##                                        Mean   :  93.17   Mean   : 48.31
##                                        3rd Qu.: 168.00   3rd Qu.: 72.00
##                                        Max.   :1424.00   Max.   :742.00
##
##  EnclosedPorch       X3SsnPorch       ScreenPorch        PoolArea
##  Min.   :   0.00   Min.   :  0.000   Min.   :  0.00   Min.   :  0.000
##  1st Qu.:   0.00   1st Qu.:  0.000   1st Qu.:  0.00   1st Qu.:  0.000
##  Median :   0.00   Median :  0.000   Median :  0.00   Median :  0.000
##  Mean   :  24.24   Mean   :  1.794   Mean   : 17.06   Mean   :  1.744
##  3rd Qu.:   0.00   3rd Qu.:  0.000   3rd Qu.:  0.00   3rd Qu.:  0.000
##  Max.   :1012.00   Max.   :360.000   Max.   :576.00   Max.   :800.000
##
##     PoolQC             Fence           MiscFeature          MiscVal
##  Length:1459        Length:1459        Length:1459        Min.   :    0.00
##  Class :character   Class :character   Class :character   1st Qu.:    0.00
##  Mode  :character   Mode  :character   Mode  :character   Median :    0.00
##                                                           Mean   :   58.17
##                                                           3rd Qu.:    0.00
##                                                           Max.   :17000.00
##
##      MoSold           YrSold       SaleType         SaleCondition
##  Min.   : 1.000   Min.   :2006   Length:1459        Length:1459
##  1st Qu.: 4.000   1st Qu.:2007   Class :character   Class :character
##  Median : 6.000   Median :2008   Mode  :character   Mode  :character
##  Mean   : 6.104   Mean   :2008
##  3rd Qu.: 8.000   3rd Qu.:2009
##  Max.   :12.000   Max.   :2010
##
```

```
NombreDeLaVariables <- c("SalePrice", "MSSubClass", "MSZoning", "LotFrontage", "LotArea", "Street", "Al

Cualitativa <- c("", "", "x", "", "", "x", "x", "x", "x", "x", "x", "x", "x", "x", "x", "x", "x", "", "
```

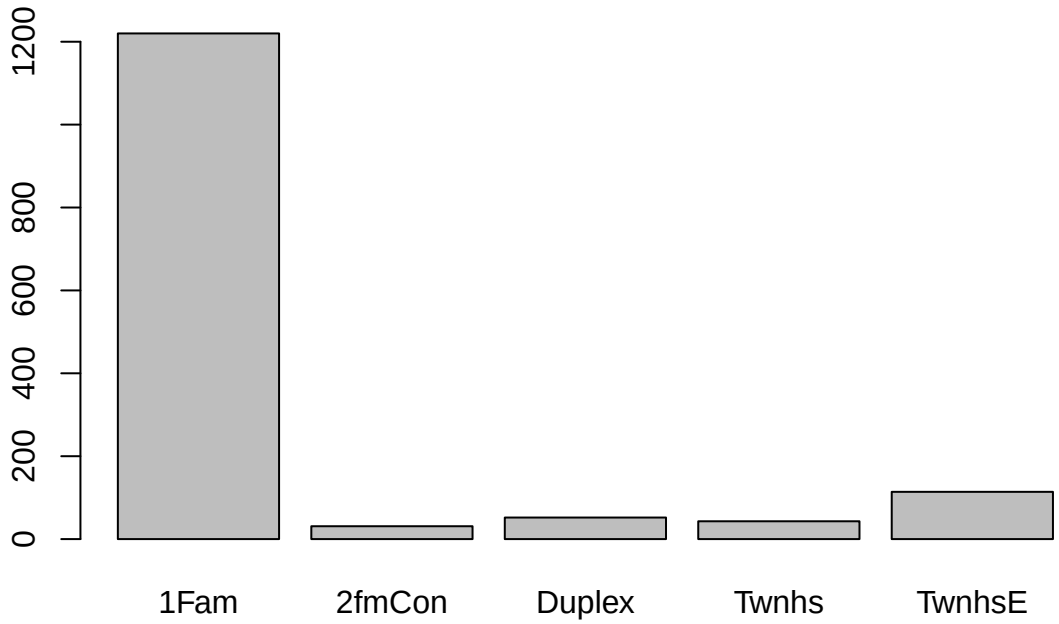
```r
Cuantitativa <- c("x", "x", "", "x", "x", "", "", "", "", "", "", "", "", "", "", "", "", "x", "x", "x"

Discreta <- c("", "", "", "", "", "", "", "", "", "", "", "", "", "", "", "", "", "", "", "", "", "", "
Continua <- c("x", "x", "", "x", "x", "", "", "", "", "", "", "", "", "", "", "", "", "x", "x", "x", "x



DataFrame.NombreDeLaVariables <- data.frame(NombreDeLaVariables, Cualitativa,Cuantitativa,Discreta,Cont

print(DataFrame.NombreDeLaVariables)
```

```
##    NombreDeLaVariables Cualitativa Cuantitativa Discreta Continua
## 1            SalePrice                        x                 x
## 2           MSSubClass                        x                 x
## 3             MSZoning           x
## 4          LotFrontage                        x                 x
## 5              LotArea                        x                 x
## 6               Street           x
## 7                Alley           x
## 8             LotShape           x
## 9          LandContour           x
## 10           Utilities           x
## 11           LotConfig           x
## 12           LandSlope           x
## 13        Neighborhood           x
## 14          Condition1           x
## 15          Condition2           x
## 16            BldgType           x
## 17          HouseStyle           x
## 18         OverallQual                        x                 x
## 19         OverallCond                        x                 x
## 20           YearBuilt                        x                 x
## 21           YearBuilt                        x                 x
## 22           RoofStyle           x
## 23            RoofMatl           x
## 24         Exterior1st           x
## 25         Exterior2nd           x
## 26          MasVnrType           x
## 27          MasVnrArea                        x                 x
## 28           ExterQual           x
## 29           ExterCond           x
## 30          Foundation           x
## 31            BsmtQual           x
## 32            BsmtCond           x
## 33        BsmtExposure           x
## 34        BsmtFinType1           x
## 35          BsmtFinSF1                        x                 x
## 36        BsmtFinType2           x
## 37          BsmtFinSF2                        x                 x
## 38           BsmtUnfSF                        x                 x
## 39         TotalBsmtSF                        x                 x
## 40             Heating           x
## 41           HeatingQC           x
```

```
## 42          CentralAir           x
## 43          Electrical           x
## 44            1stFlrSF                      x                x
## 45            2ndFlrSF                      x                x
## 46        LowQualFinSF                      x                x
## 47           GrLivArea                      x                x
## 48        BsmtFullBath                      x        x
## 49        BsmtHalfBath                      x        x
## 50            FullBath           f          xf       xf       f
## 51            HalfBath                      x        x
## 52             Bedroom                      x        x
## 53             Kitchen                      x        x
## 54         KitchenQual           x
## 55        TotRmsAbvGrd                      x        x
## 56          Functional           x
## 57          Fireplaces                      x        x
## 58         FireplaceQu           x
## 59          GarageType           x
## 60         GarageYrBlt                      x                x
## 61        GarageFinish           x
## 62          GarageCars                      x        x
## 63          GarageArea                      x                x
## 64          GarageQual           x
## 65          GarageCond           x
## 66          PavedDrive           x
## 67          WoodDeckSF                      x                x
## 68         OpenPorchSF                      x                x
## 69       EnclosedPorch                      x                x
## 70           3SsnPorch                      x                x
## 71         ScreenPorch                      x                x
## 72            PoolArea                      x                x
## 73              PoolQC           x
## 74               Fence           x
## 75         MiscFeature           x
## 76             MiscVal                      x                x
## 77              MoSold                      x                x
## 78              YrSold                      x                x
## 79            SaleType           x
## 80       SaleCondition           x
```

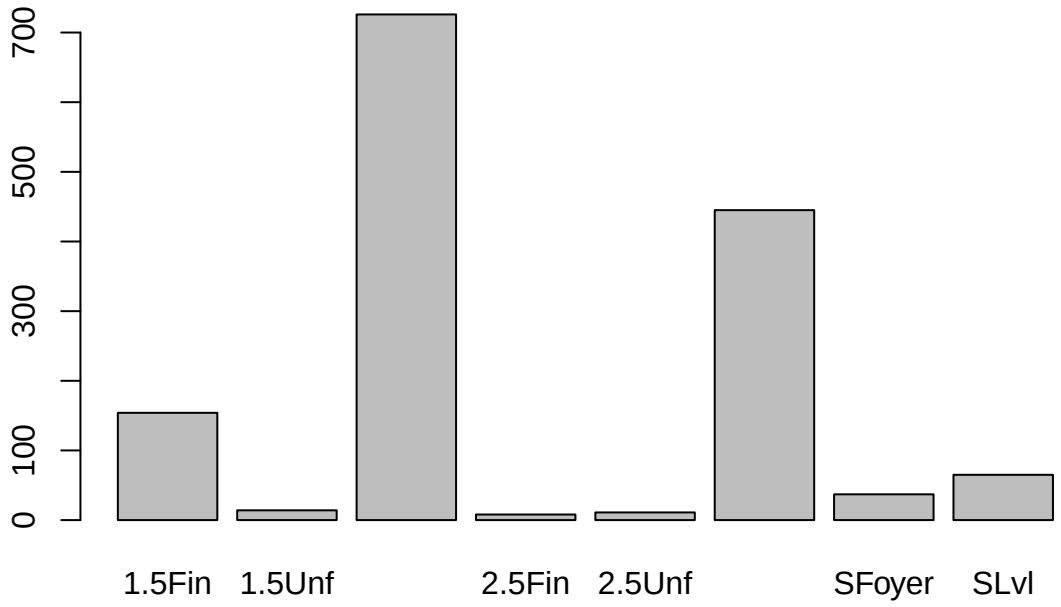
Estilo de vivienda

```
totalGenres <- unlist(strsplit(as.character(datos$BldgType), "\\|"))
barplot(table(totalGenres))
```



La mayorías de las casas son para una familia

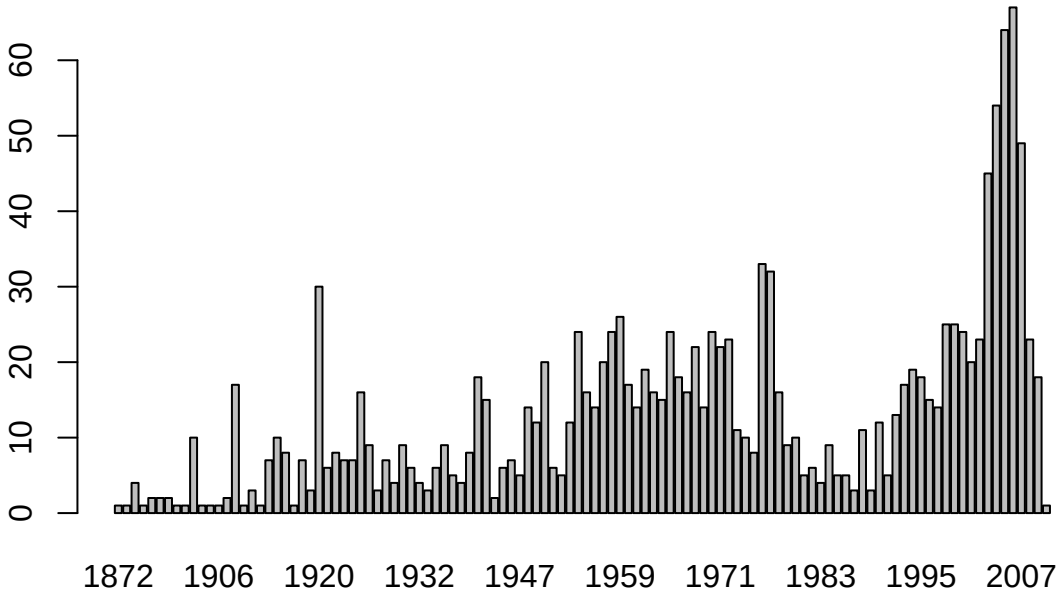
```
totalGenres <- unlist(strsplit(as.character(datos$HouseStyle), "\\|"))
barplot(table(totalGenres))
```



El estilo más común de casa es de 1 solo nivel, por lo que podemos deducir que las casas de 2 niveles son más cotizadas

Año de construcción

```
totalGenres <- unlist(strsplit(as.character(datos$YearBuilt), "\\|"))
barplot(table(totalGenres))
```



La mayoría de las casas fueron construidas en los años 2000

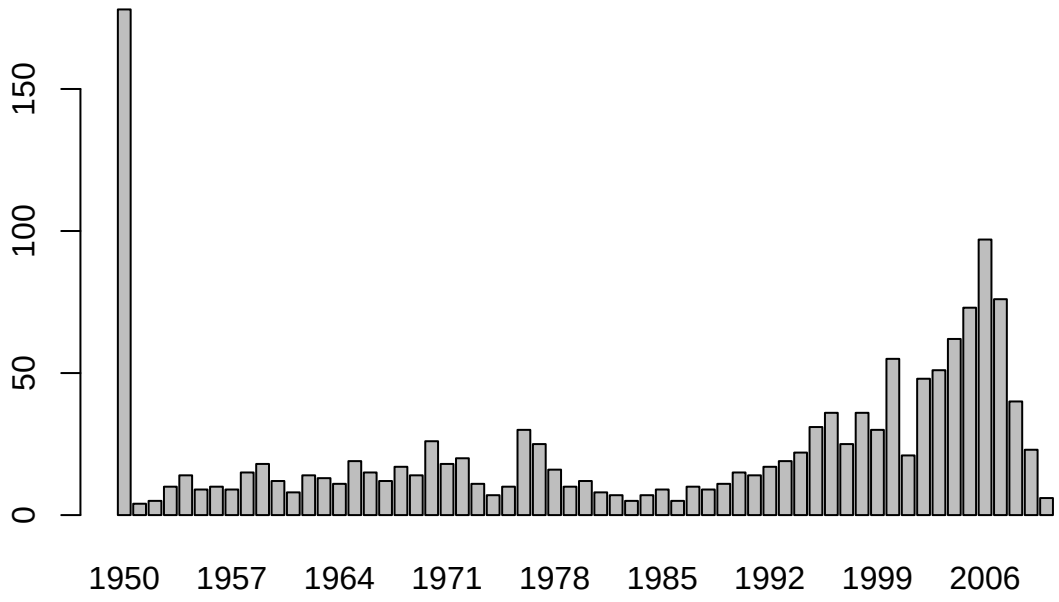
Casas mas nuevas:

```
newhouses <- head(order(datos$YearBuilt, decreasing = T), n=10)
datos[newhouses,c("Id","YearBuilt","SalePrice")]
```

```
##      Id YearBuilt SalePrice
## 379 379      2010    394432
## 88   88      2009    164500
## 104 104      2009    198900
## 158 158      2009    269500
## 212 212      2009    186000
## 213 213      2009    252678
## 413 413      2009    222000
## 461 461      2009    263435
## 508 508      2009    208300
## 516 516      2009    402861
```

Año de remodelación

```
totalGenres <- unlist(strsplit(as.character(datos$YearRemodAdd), "\\|"))
barplot(table(totalGenres))
```



La mayoría de las casas no han sido remodeladas desde la decada de los 50s

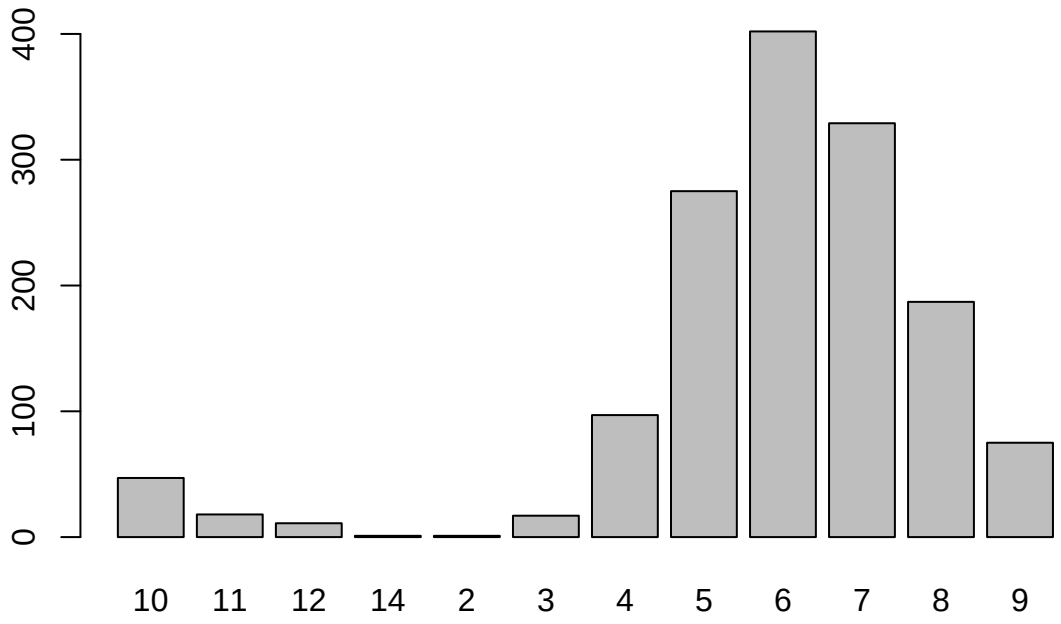
Casas recientementes remodeladas:

```
newhouses <- head(order(datos$YearRemodAdd, decreasing = T), n=10)
datos[newhouses,c("Id","YearRemodAdd", "SalePrice")]
```

```
##      Id YearRemodAdd SalePrice
## 158 158         2010    269500
## 379 379         2010    394432
## 820 820         2010    224000
## 856 856         2010    127000
## 899 899         2010    611657
## 988 988         2010    395192
## 88   88         2009    164500
## 104 104         2009    198900
## 179 179         2009    501837
## 212 212         2009    186000
```

Cantidad de habitaciones

```
totalGenres <- unlist(strsplit(as.character(datos$TotRmsAbvGrd), "\\|"))
barplot(table(totalGenres))
```



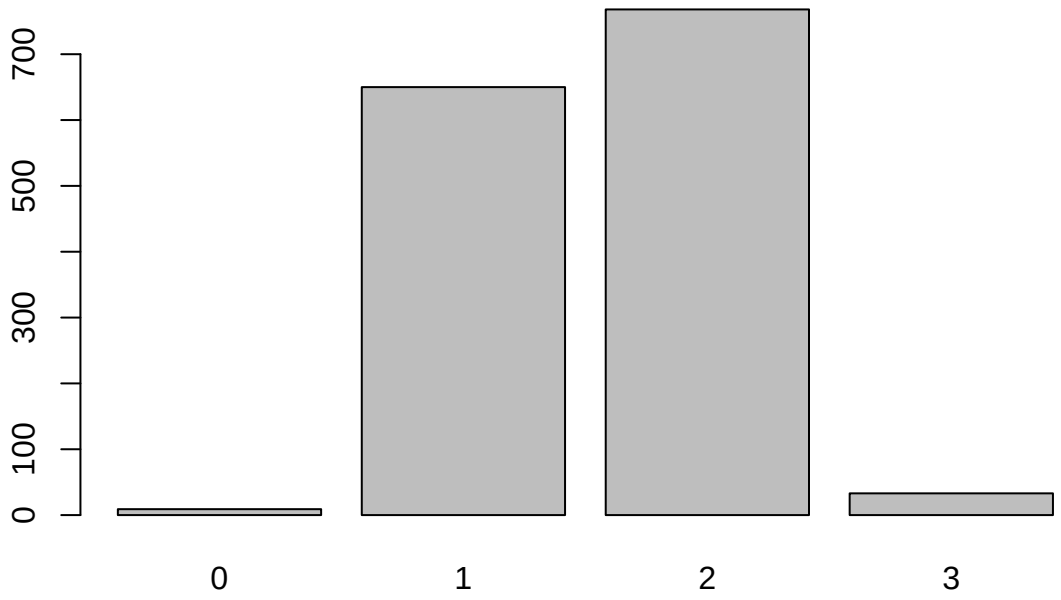
La mayoría de las casast tienen solo 6 habitaciones

```
newhouses <- head(order(datos$TotRmsAbvGrd, decreasing = T), n=10)
datos[newhouses,c("Id","TotRmsAbvGrd","SalePrice")]
```

```
##        Id TotRmsAbvGrd SalePrice
## 636   636           14    200000
## 186   186           12    475000
## 770   770           12    538000
## 804   804           12    582933
## 898   898           12    142953
## 911   911           12    154300
## 1032 1032           12    197000
## 1174 1174           12    200500
## 1231 1231           12    190000
## 1299 1299           12    160000
```

cantidad de baños

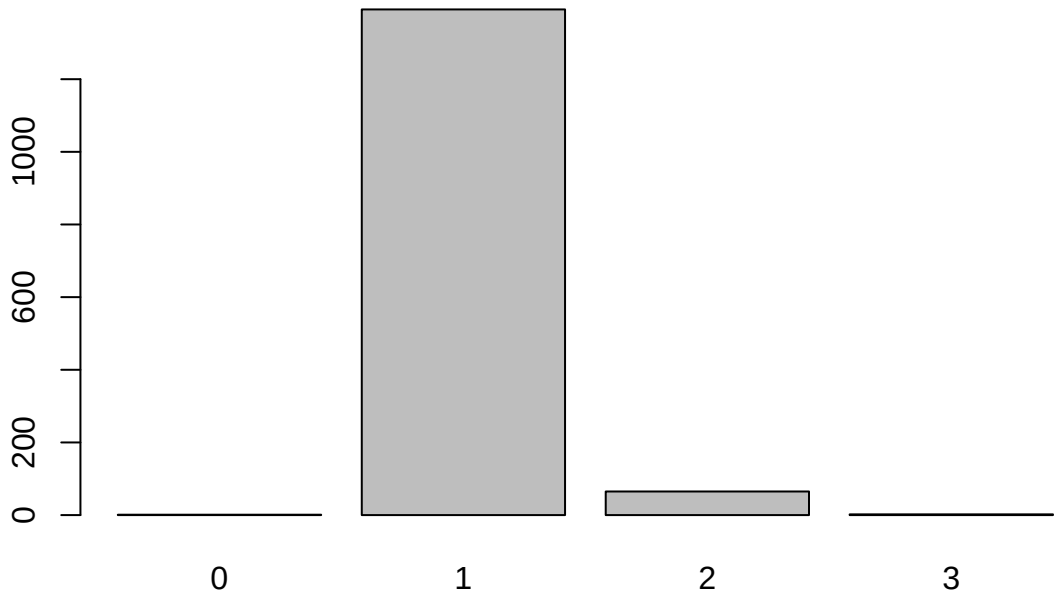
```
totalGenres <- unlist(strsplit(as.character(datos$FullBath), "\\|"))
barplot(table(totalGenres))
```



Las casas familiares tienen entre 1 y 2 baños

cantidad de cocinas

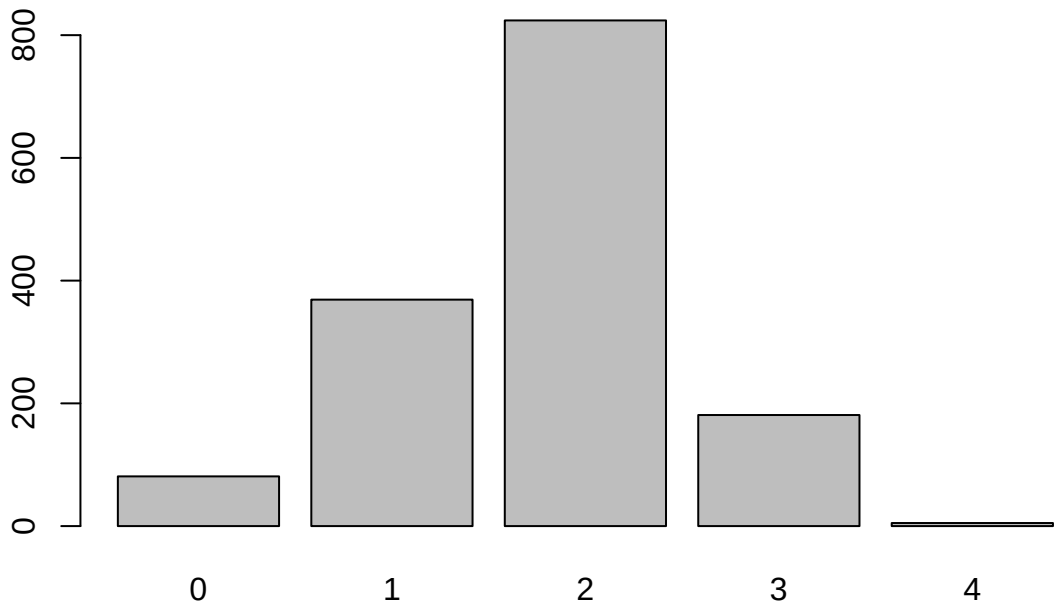
```
totalGenres <- unlist(strsplit(as.character(datos$KitchenAbvGr), "\\|"))
barplot(table(totalGenres))
```



LAs casas por lo general tienen solo una cocina

capacidad de garages

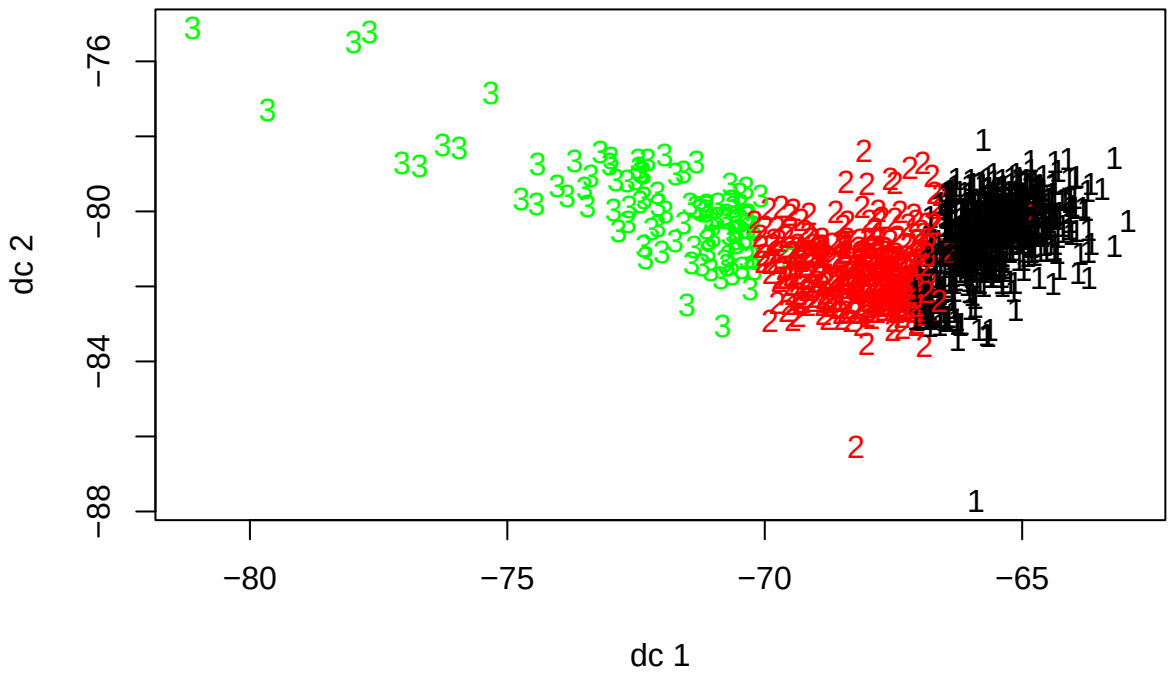
```
totalGenres <- unlist(strsplit(as.character(datos$GarageCars), "\\|"))
barplot(table(totalGenres))
```



La mayoría de las casas estan adecuadas para estacionar 2 autos

3. Incluya un análisis de grupos en el análisis exploratorio. Explique las características de los grupos.

```
# con k-medias
cluster <- house
km<-kmeans(house,3)
house$grupo<-km$cluster
plotcluster(cluster,km$cluster) # los cluster
```




```
#método de la silueta
silkm<-silhouette(km$cluster,dist(house))
mean(silkm[,3]) #Silueta
```

```
## [1] 0.561677
```

```
g1<- house[house$grupo==1,]
prop.table(table(g1$Species))*100
```

```
## numeric(0)
```

```
g2<- house[house$grupo==2,]
prop.table(table(g2$Species))*100
```

```
## numeric(0)
```

```
g3<- house[house$grupo==3,]
prop.table(table(g3$Species))*100
```

```
## numeric(0)
```

```
summary(g1)
```

```
##   LotFrontage        LotArea        YearBuilt     YearRemodAdd
##  Min.   : 21.00   Min.   : 1300   Min.   :1880   Min.   :1950
##  1st Qu.: 55.00   1st Qu.: 7000   1st Qu.:1940   1st Qu.:1956
##  Median : 64.00   Median : 8593   Median :1959   Median :1972
##  Mean   : 65.45   Mean   : 8680   Mean   :1957   Mean   :1976
##  3rd Qu.: 75.00   3rd Qu.:10172   3rd Qu.:1973   3rd Qu.:1998
##  Max.   :313.00   Max.   :63887   Max.   :2009   Max.   :2009
##    MasVnrArea        BsmtFinSF1       BsmtFinSF2        BsmtUnfSF
##  Min.   :   0.00   Min.   :   0.0   Min.   :   0.00   Min.   :   0.0
##  1st Qu.:   0.00   1st Qu.:   0.0   1st Qu.:   0.00   1st Qu.: 192.0
##  Median :   0.00   Median : 319.0   Median :   0.00   Median : 450.0
##  Mean   :  60.21   Mean   : 351.2   Mean   :  51.82   Mean   : 491.1
##  3rd Qu.:  66.50   3rd Qu.: 600.0   3rd Qu.:   0.00   3rd Qu.: 719.0
##  Max.   :1129.00   Max.   :5644.0   Max.   :1085.00   Max.   :1907.0
##   TotalBsmtSF       X1stFlrSF      X2ndFlrSF       LowQualFinSF
##  Min.   :   0.0   Min.   : 438   Min.   :   0.0   Min.   :  0.000
##  1st Qu.: 728.0   1st Qu.: 834   1st Qu.:   0.0   1st Qu.:  0.000
##  Median : 894.0   Median : 981   Median :   0.0   Median :  0.000
##  Mean   : 894.1   Mean   :1020   Mean   : 256.5   Mean   :  4.513
##  3rd Qu.:1060.5   3rd Qu.:1150   3rd Qu.: 588.0   3rd Qu.:  0.000
##  Max.   :6110.0   Max.   :4692   Max.   :1230.0   Max.   :481.000
##    GrLivArea     TotRmsAbvGrd   Fireplaces      GarageYrBlt     GarageCars
##  Min.   : 438   Min.   : 3    Min.   :0.0000   Min.   :1900   Min.   :1.000
##  1st Qu.:1032   1st Qu.: 5    1st Qu.:0.0000   1st Qu.:1953   1st Qu.:1.000
##  Median :1224   Median : 6    Median :0.0000   Median :1966   Median :2.000
##  Mean   :1281   Mean   : 6    Mean   :0.4137   Mean   :1967   Mean   :1.568
##  3rd Qu.:1484   3rd Qu.: 7    3rd Qu.:1.0000   3rd Qu.:1983   3rd Qu.:2.000
##  Max.   :5642   Max.   :12    Max.   :3.0000   Max.   :2009   Max.   :4.000
##    GarageArea       WoodDeckSF      OpenPorchSF     EnclosedPorch
##  Min.   : 160.0   Min.   :  0.00   Min.   :  0.00   Min.   :  0.00
##  1st Qu.: 288.0   1st Qu.:  0.00   1st Qu.:  0.00   1st Qu.:  0.00
##  Median : 416.0   Median :  0.00   Median :  0.00   Median :  0.00
##  Mean   : 417.4   Mean   : 63.95   Mean   : 26.44   Mean   : 30.07
##  3rd Qu.: 506.0   3rd Qu.:106.00   3rd Qu.: 35.00   3rd Qu.:  0.00
##  Max.   :1418.0   Max.   :736.00   Max.   :418.00   Max.   :330.00
##   ScreenPorch        PoolArea           MoSold           YrSold
##  Min.   :  0.00   Min.   :  0.000   Min.   : 1.000   Min.   :2006
##  1st Qu.:  0.00   1st Qu.:  0.000   1st Qu.: 4.000   1st Qu.:2007
##  Median :  0.00   Median :  0.000   Median : 6.000   Median :2008
##  Mean   : 13.26   Mean   :  1.612   Mean   : 6.157   Mean   :2008
##  3rd Qu.:  0.00   3rd Qu.:  0.000   3rd Qu.: 7.000   3rd Qu.:2009
##  Max.   :385.00   Max.   :576.000   Max.   :12.000   Max.   :2010
##    SalePrice          grupo
##  Min.   : 35311   Min.   :1
##  1st Qu.:118450   1st Qu.:1
##  Median :135000   Median :1
##  Mean   :134136   Mean   :1
##  3rd Qu.:154400   3rd Qu.:1
##  Max.   :178000   Max.   :1
```

```
summary(g2)
```

```
##   LotFrontage        LotArea        YearBuilt     YearRemodAdd
##  Min.   : 24.00   Min.   : 2280   Min.   :1880   Min.   :1950
##  1st Qu.: 63.00   1st Qu.: 8737   1st Qu.:1990   1st Qu.:1996
##  Median : 74.00   Median :10206   Median :2002   Median :2003
##  Mean   : 75.13   Mean   :11018   Mean   :1991   Mean   :1998
##  3rd Qu.: 85.00   3rd Qu.:12011   3rd Qu.:2005   3rd Qu.:2006
##  Max.   :313.00   Max.   :70761   Max.   :2009   Max.   :2010
##    MasVnrArea       BsmtFinSF1     BsmtFinSF2       BsmtUnfSF
##  Min.   :   0.0   Min.   :   0   Min.   :   0.0   Min.   :   0.0
##  1st Qu.:   0.0   1st Qu.:   0   1st Qu.:   0.0   1st Qu.: 314.0
##  Median :  40.0   Median : 410   Median :   0.0   Median : 725.0
##  Mean   : 127.1   Mean   : 451   Mean   :  36.1   Mean   : 748.5
##  3rd Qu.: 210.0   3rd Qu.: 767   3rd Qu.:   0.0   3rd Qu.:1141.0
##  Max.   :1600.0   Max.   :2260   Max.   :1127.0   Max.   :2042.0
##   TotalBsmtSF     X1stFlrSF      X2ndFlrSF       LowQualFinSF
##  Min.   :   0   Min.   : 495   Min.   :   0.0   Min.   :  0.000
##  1st Qu.: 915   1st Qu.:1020   1st Qu.:   0.0   1st Qu.:  0.000
##  Median :1240   Median :1307   Median :   0.0   Median :  0.000
##  Mean   :1236   Mean   :1299   Mean   : 458.9   Mean   :  4.413
##  3rd Qu.:1496   3rd Qu.:1552   3rd Qu.: 872.0   3rd Qu.:  0.000
##  Max.   :3206   Max.   :3138   Max.   :1818.0   Max.   :420.000
##    GrLivArea     TotRmsAbvGrd      Fireplaces      GarageYrBlt     GarageCars
##  Min.   :1146   Min.   : 4.000   Min.   :0.0000   Min.   :1908   Min.   :1.00
##  1st Qu.:1502   1st Qu.: 6.000   1st Qu.:0.0000   1st Qu.:1991   1st Qu.:2.00
##  Median :1684   Median : 7.000   Median :1.0000   Median :2002   Median :2.00
##  Mean   :1763   Mean   : 7.075   Mean   :0.7756   Mean   :1993   Mean   :2.18
##  3rd Qu.:1947   3rd Qu.: 8.000   3rd Qu.:1.0000   3rd Qu.:2005   3rd Qu.:2.00
##  Max.   :4676   Max.   :12.000   Max.   :3.0000   Max.   :2010   Max.   :4.00
##    GarageArea       WoodDeckSF     OpenPorchSF     EnclosedPorch
##  Min.   : 180.0   Min.   :  0.0   Min.   :  0.00   Min.   :  0.00
##  1st Qu.: 484.0   1st Qu.:  0.0   1st Qu.: 30.00   1st Qu.:  0.00
##  Median : 552.0   Median :120.0   Median : 54.00   Median :  0.00
##  Mean   : 582.9   Mean   :115.7   Mean   : 69.62   Mean   : 11.56
##  3rd Qu.: 662.0   3rd Qu.:192.0   3rd Qu.: 96.00   3rd Qu.:  0.00
##  Max.   :1390.0   Max.   :635.0   Max.   :547.00   Max.   :552.00
##   ScreenPorch        PoolArea           MoSold           YrSold
##  Min.   :  0.00   Min.   :  0.000   Min.   : 1.000   Min.   :2006
##  1st Qu.:  0.00   1st Qu.:  0.000   1st Qu.: 5.000   1st Qu.:2007
##  Median :  0.00   Median :  0.000   Median : 6.000   Median :2008
##  Mean   : 19.45   Mean   :  4.651   Mean   : 6.554   Mean   :2008
##  3rd Qu.:  0.00   3rd Qu.:  0.000   3rd Qu.: 8.000   3rd Qu.:2009
##  Max.   :480.00   Max.   :648.000   Max.   :12.000   Max.   :2010
##    SalePrice          grupo
##  Min.   :178900   Min.   :2
##  1st Qu.:193000   1st Qu.:2
##  Median :216837   Median :2
##  Mean   :222938   Mean   :2
##  3rd Qu.:248900   3rd Qu.:2
##  Max.   :297000   Max.   :2
```

```
summary(g3)
```

```
##   LotFrontage        LotArea          YearBuilt     YearRemodAdd
##  Min.   : 32.00   Min.   :  5119   Min.   :1892   Min.   :1965
##  1st Qu.: 76.00   1st Qu.: 11003   1st Qu.:1998   1st Qu.:2000
##  Median : 86.00   Median : 12444   Median :2005   Median :2006
##  Mean   : 87.82   Mean   : 16048   Mean   :1999   Mean   :2003
##  3rd Qu.: 99.00   3rd Qu.: 14601   3rd Qu.:2007   3rd Qu.:2007
##  Max.   :174.00   Max.   :215245   Max.   :2010   Max.   :2010
##    MasVnrArea       BsmtFinSF1       BsmtFinSF2       BsmtUnfSF
##  Min.   :   0.0   Min.   :   0.0   Min.   :   0.0   Min.   :   0.0
##  1st Qu.: 160.0   1st Qu.: 240.0   1st Qu.:   0.0   1st Qu.: 294.0
##  Median : 302.0   Median :1163.0   Median :   0.0   Median : 528.0
##  Mean   : 345.6   Mean   : 939.3   Mean   :  28.7   Mean   : 705.9
##  3rd Qu.: 466.0   3rd Qu.:1406.0   3rd Qu.:   0.0   3rd Qu.:1117.0
##  Max.   :1378.0   Max.   :2188.0   Max.   :1474.0   Max.   :2336.0
##   TotalBsmtSF     X1stFlrSF      X2ndFlrSF       LowQualFinSF
##  Min.   : 853   Min.   :1026   Min.   :   0.0   Min.   :  0.000
##  1st Qu.:1410   1st Qu.:1470   1st Qu.:   0.0   1st Qu.:  0.000
##  Median :1702   Median :1718   Median : 568.0   Median :  0.000
##  Mean   :1674   Mean   :1699   Mean   : 593.6   Mean   :  5.448
##  3rd Qu.:1926   3rd Qu.:1940   3rd Qu.:1177.0   3rd Qu.:  0.000
##  Max.   :3094   Max.   :2444   Max.   :2065.0   Max.   :572.000
##    GrLivArea     TotRmsAbvGrd      Fireplaces   GarageYrBlt     GarageCars
##  Min.   :1419   Min.   : 5.000   Min.   :0.0   Min.   :1932   Min.   :2.000
##  1st Qu.:1869   1st Qu.: 7.000   1st Qu.:1.0   1st Qu.:1998   1st Qu.:3.000
##  Median :2224   Median : 8.000   Median :1.0   Median :2005   Median :3.000
##  Mean   :2298   Mean   : 8.457   Mean   :1.2   Mean   :2001   Mean   :2.781
##  3rd Qu.:2610   3rd Qu.:10.000   3rd Qu.:1.0   3rd Qu.:2007   3rd Qu.:3.000
##  Max.   :4476   Max.   :12.000   Max.   :3.0   Max.   :2010   Max.   :3.000
##    GarageArea       WoodDeckSF   OpenPorchSF     EnclosedPorch
##  Min.   : 380.0   Min.   :  0   Min.   :  0.00   Min.   :  0.000
##  1st Qu.: 672.0   1st Qu.:113   1st Qu.: 45.00   1st Qu.:  0.000
##  Median : 774.0   Median :186   Median : 72.00   Median :  0.000
##  Mean   : 762.2   Mean   :192   Mean   : 88.22   Mean   :  5.876
##  3rd Qu.: 842.0   3rd Qu.:250   3rd Qu.:111.00   3rd Qu.:  0.000
##  Max.   :1220.0   Max.   :857   Max.   :502.00   Max.   :216.000
##   ScreenPorch       PoolArea           MoSold           YrSold
##  Min.   :  0.0   Min.   :  0.000   Min.   : 1.000   Min.   :2006
##  1st Qu.:  0.0   1st Qu.:  0.000   1st Qu.: 5.000   1st Qu.:2007
##  Median :  0.0   Median :  0.000   Median : 7.000   Median :2008
##  Mean   : 22.3   Mean   :  5.286   Mean   : 6.743   Mean   :2008
##  3rd Qu.:  0.0   3rd Qu.:  0.000   3rd Qu.: 9.000   3rd Qu.:2009
##  Max.   :410.0   Max.   :555.000   Max.   :12.000   Max.   :2010
##    SalePrice          grupo
##  Min.   :301000   Min.   :3
##  1st Qu.:320000   1st Qu.:3
##  Median :348000   Median :3
##  Mean   :377265   Mean   :3
##  3rd Qu.:395000   3rd Qu.:3
##  Max.   :755000   Max.   :3
```

— prueba 1 —

```r
##Similitud en las variables independientes y los precios de venta:
cor(house$YearBuilt, house$SalePrice, method = c("pearson", "kendall", "spearman"))
```

```
## [1] 0.5253936
```

```r
cor(house$YearRemodAdd, house$SalePrice, method = c("pearson", "kendall", "spearman"))
```

```
## [1] 0.5212533
```

```r
cor(house$TotalBsmtSF, house$SalePrice, method = c("pearson", "kendall", "spearman"))
```

```
## [1] 0.6156122
```

```r
cor(house$X1stFlrSF, house$SalePrice, method = c("pearson", "kendall", "spearman"))
```

```
## [1] 0.6079691
```

```r
cor(house$GrLivArea, house$SalePrice, method = c("pearson", "kendall", "spearman"))
```

```
## [1] 0.7051536
```

```r
cor(house$TotRmsAbvGrd, house$SalePrice, method = c("pearson", "kendall", "spearman"))
```

```
## [1] 0.5470674
```

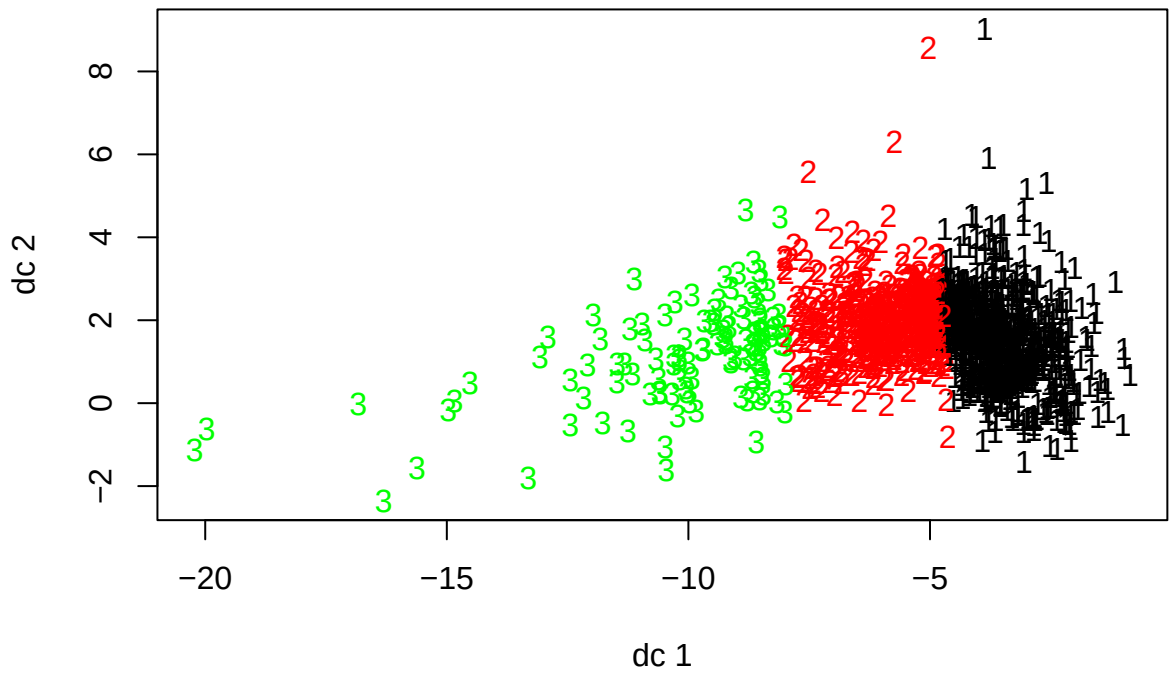
```r
cor(house$GarageCars, house$SalePrice, method = c("pearson", "kendall", "spearman"))
```

```
## [1] 0.6470336
```

```r
cor(house$GarageArea, house$SalePrice, method = c("pearson", "kendall", "spearman"))
```

```
## [1] 0.6193296
```

```r
#Columnas
house <-select(datos,TotalBsmtSF,X1stFlrSF,GrLivArea,GarageCars,GarageArea,SalePrice)

#limpiamos
house <- na.omit(house)

#k-medias
cluster <- house
km<-kmeans(house,3)
house$grupo<-km$cluster
plotcluster(cluster,km$cluster) #graficamos ubicacion de cluster
```




```
#Silueta
silkm<-silhouette(km$cluster,dist(house))
mean(silkm[,3])
```

```
## [1] 0.5612983
```

— prueba 2 —

```
cor(house$TotalBsmtSF, house$SalePrice, method = c("pearson", "kendall", "spearman"))
```

```
## [1] 0.6135806
```

```
cor(house$X1stFlrSF, house$SalePrice, method = c("pearson", "kendall", "spearman"))
```

```
## [1] 0.6058522
```

```
cor(house$GrLivArea, house$SalePrice, method = c("pearson", "kendall", "spearman"))
```

```
## [1] 0.7086245
```

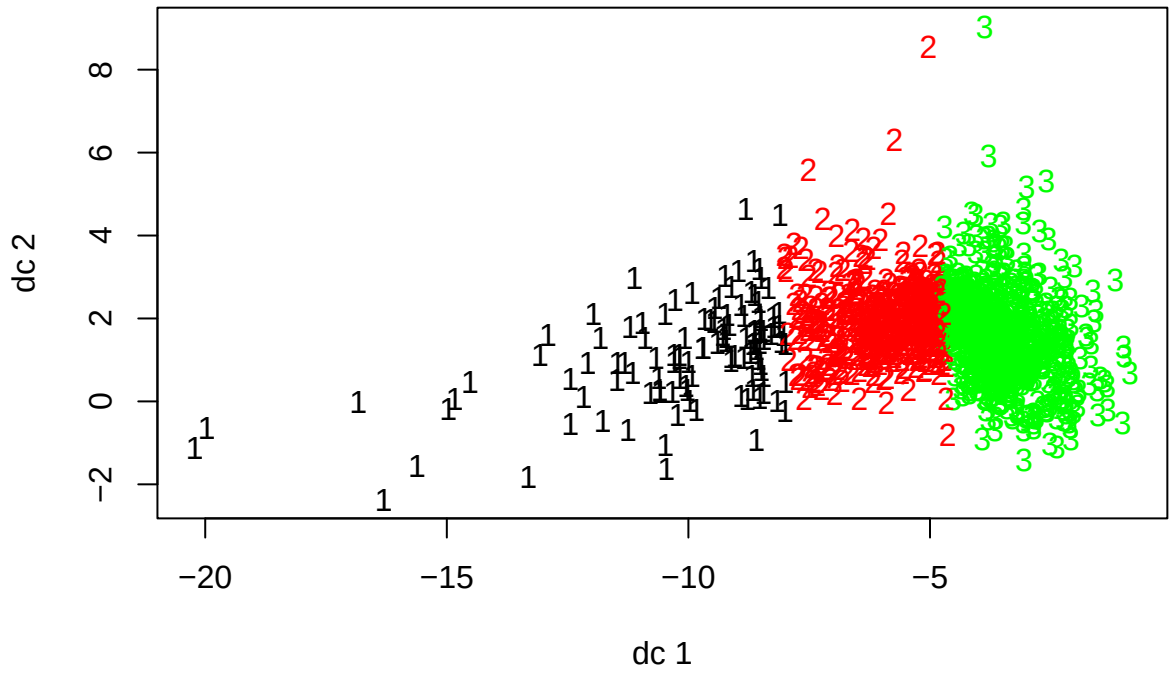
```
cor(house$GarageCars, house$SalePrice, method = c("pearson", "kendall", "spearman"))
```

```
## [1] 0.6404092
```

```r
cor(house$GarageArea, house$SalePrice, method = c("pearson", "kendall", "spearman"))
```

```
## [1] 0.6234314
```

```r
#Columnas
house <-select(datos,TotalBsmtSF,X1stFlrSF,GrLivArea,GarageCars,GarageArea,SalePrice)

#limpiamos
house <- na.omit(house)

#k-medias
cluster <- house
km<-kmeans(house,3)
house$grupo<-km$cluster
plotcluster(cluster,km$cluster) #Graficamos clusters
```




```r
#silueta
silkm<-silhouette(km$cluster,dist(house))
mean(silkm[,3])
```

```
## [1] 0.5612983
```

4. Divida el set de datos preprocesados en dos conjuntos: Entrenamiento y prueba. Describa el criterio que usó para crear los conjuntos: número de filas de cada uno, estratificado o no, balanceado o no, etc. Si le proveen un conjunto de datos de prueba y tiene suficientes datos, tómelo como de validación, pero haga sus propios conjuntos de prueba.

Division de sets: porcentajes de 70% entrenamiento 30% de prueba

```
set_entrenamiento <- sample_frac(datos, .7)
set_prueba <-setdiff(datos, set_entrenamiento)


drop <- c("LotFrontage", "Alley", "MasVnrType", "MasVnrArea", "BsmtQual", "BsmtCond", "BsmtExposure", "
set_entrenamiento <- set_entrenamiento[, !(names(set_entrenamiento) %in% drop)]
set_prueba <- set_prueba[, !(names(set_prueba) %in% drop)]
```

5. Haga ingeniería de características, ¿qué variables cree que puedan ser mejores predictores para el precio de las casas? Explique en que basó la selección o no de las variables.

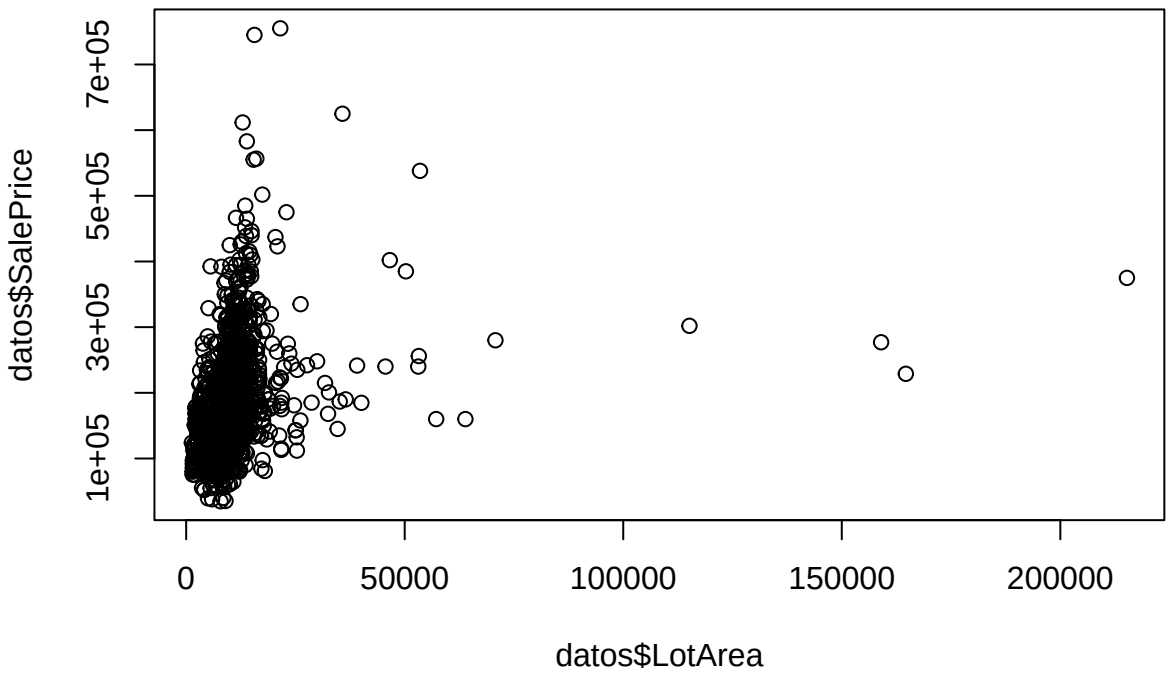
LotArea: Tamaño del terreno de la casa Neighborhood: Vecindario donde esta ubicada la casa BldgType: Tipo/estilo de casa OverallQual: Material de la casa FullBath: Cantidad de baños TotRmsAbvGrd: Cantidad de habitaciones Fireplaces: Si tiene chimenea GarageCars: tamaño del parqueo en capacidad de autos

Nos basamos en las caracterísicas mas distintivas de las casas, y las que considera el mercado actual para darle valor a un inmueble La ubicación y tamaño de la casa son una de las más importantes, así como la cantidad de habitacions y parqueos que tiene. Loas materiales de construcción nos permite deducir cuanto dinero se invirtó durante su construcción y el hecho de tener chimenea hace que aumenta el valor de un inmueble considerablemente

6. Todos los resultados deben ser reproducible por lo que debe fijar que los conjuntos de entrenamiento y prueba sean los mismos siempre que se ejecute el código.

7. Seleccione una de las variables y haga un modelo univariado de regresión lineal para predecir el precio de las casas. Analice el modelo

```
plot(datos$LotArea,datos$SalePrice)
```



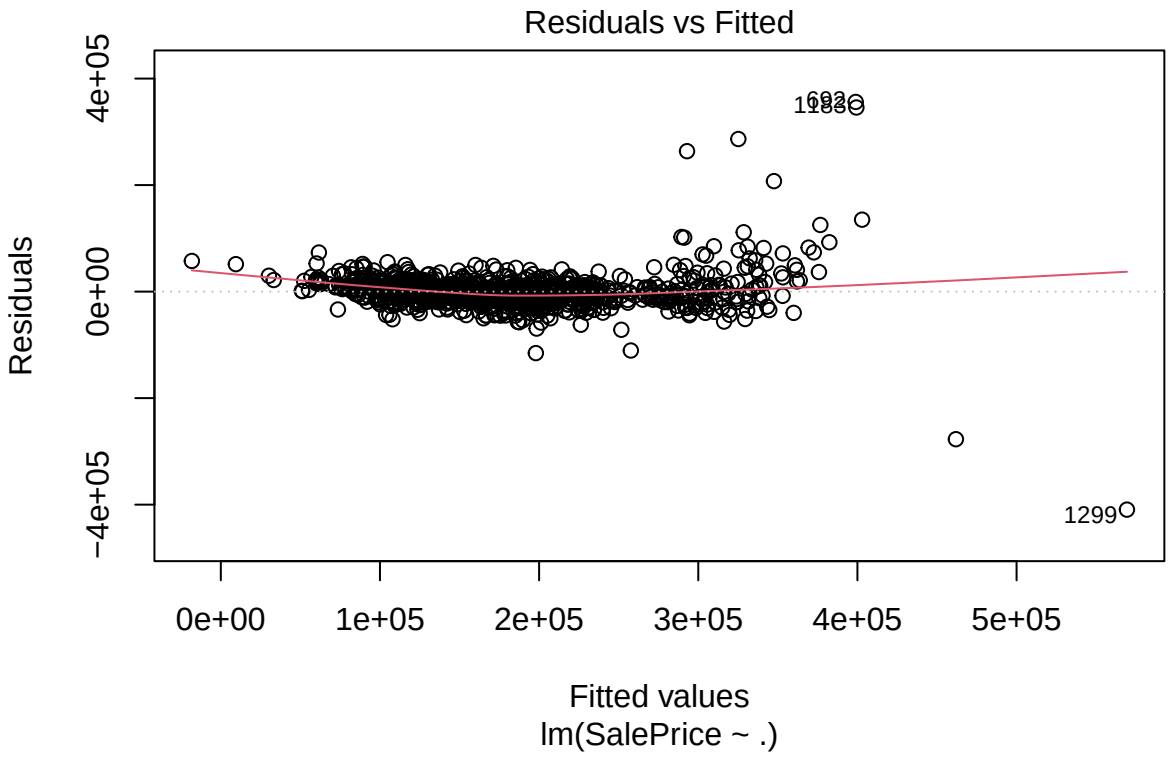
8. Haga un modelo de regresión lineal con todas las variables numéricas para predecir el precio de las casas. Analice el modelo (resumen, residuos, resultados de la predicción). Muestre el modelo gráficamente.

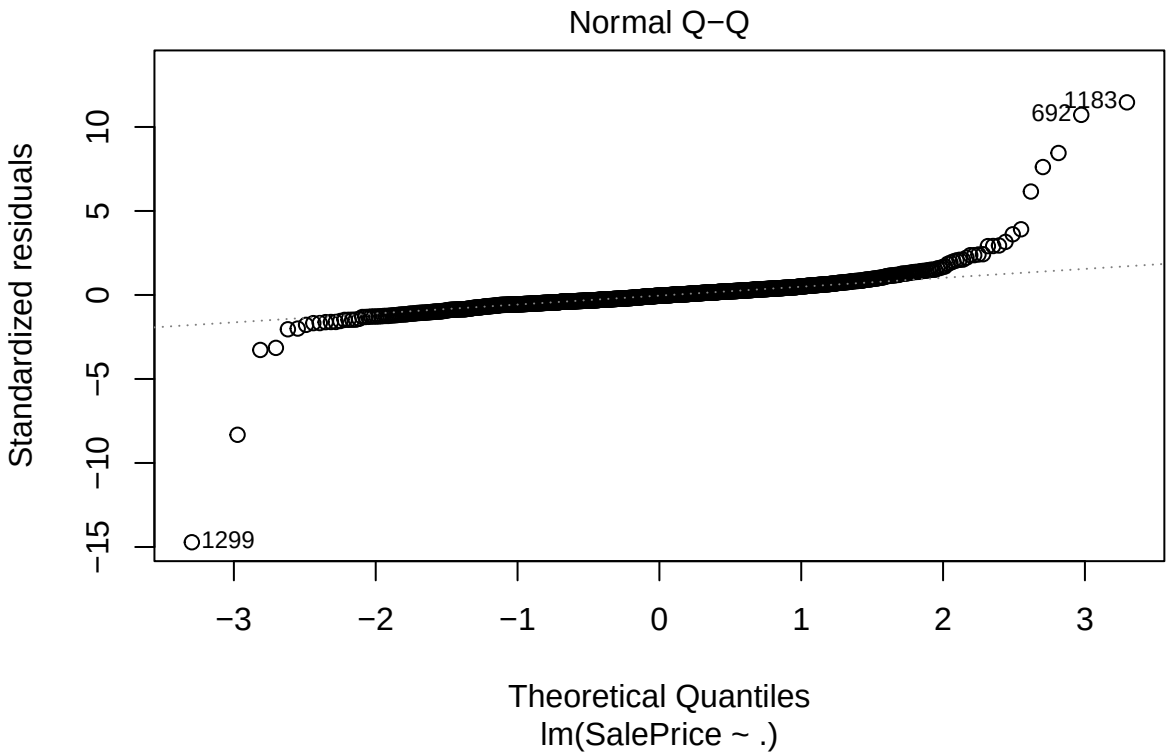
```
porciento <- 70/100
datos$clasificacion <- ifelse(datos$SalePrice <= 251000, "Economicas", ifelse(datos$SalePrice <= 538000

datos$y <- as.numeric(factor(datos$clasificacion))
datosCC <- datos[,c(2,4,18,19,20,21,27,35,37,38,39,44,45,46,47,48,49,50,51,52,53,55,57,60,62,63,67,68,6
datosCC <- datosCC[,colSums(is.na(datosCC))==0]
set.seed(123)
trainRowsNumber<-sample(nrow(datosCC),porciento*nrow(datosCC))
train<-datosCC[trainRowsNumber,]
test<-datosCC[-trainRowsNumber,]

fitLM<-lm(SalePrice~., data = train)
summary(fitLM)
```

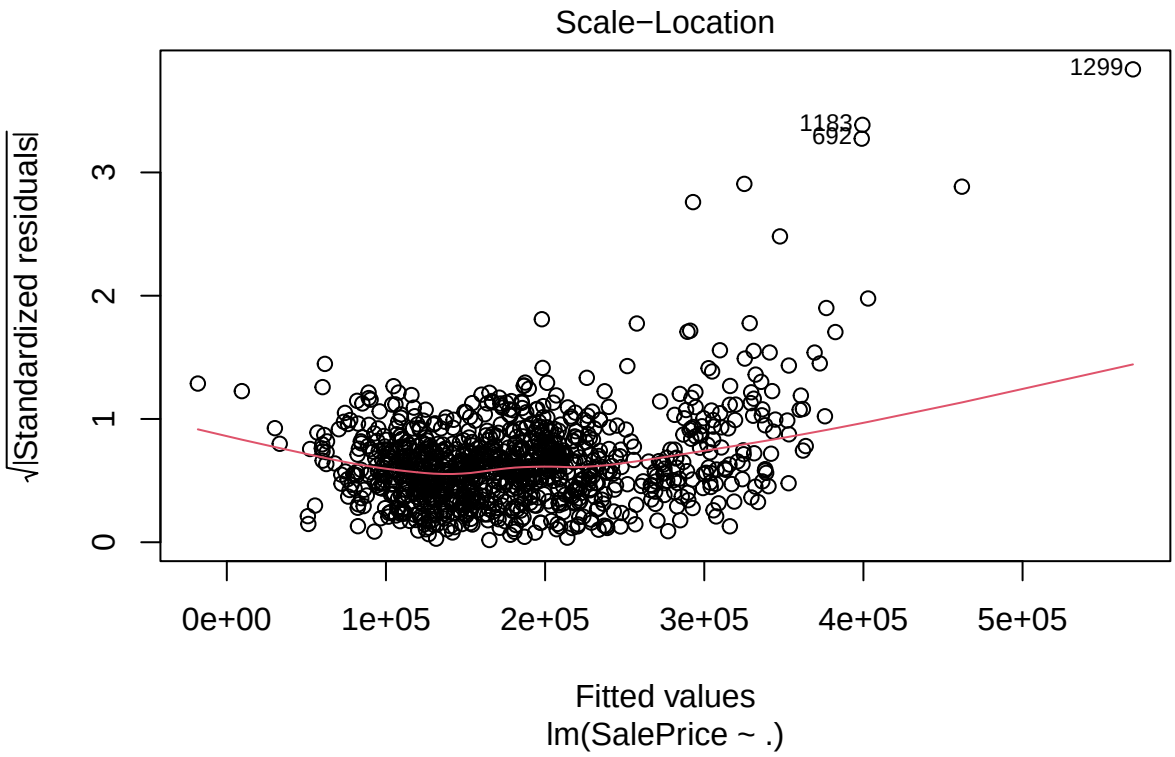
```
##
## Call:
## lm(formula = SalePrice ~ ., data = train)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
```

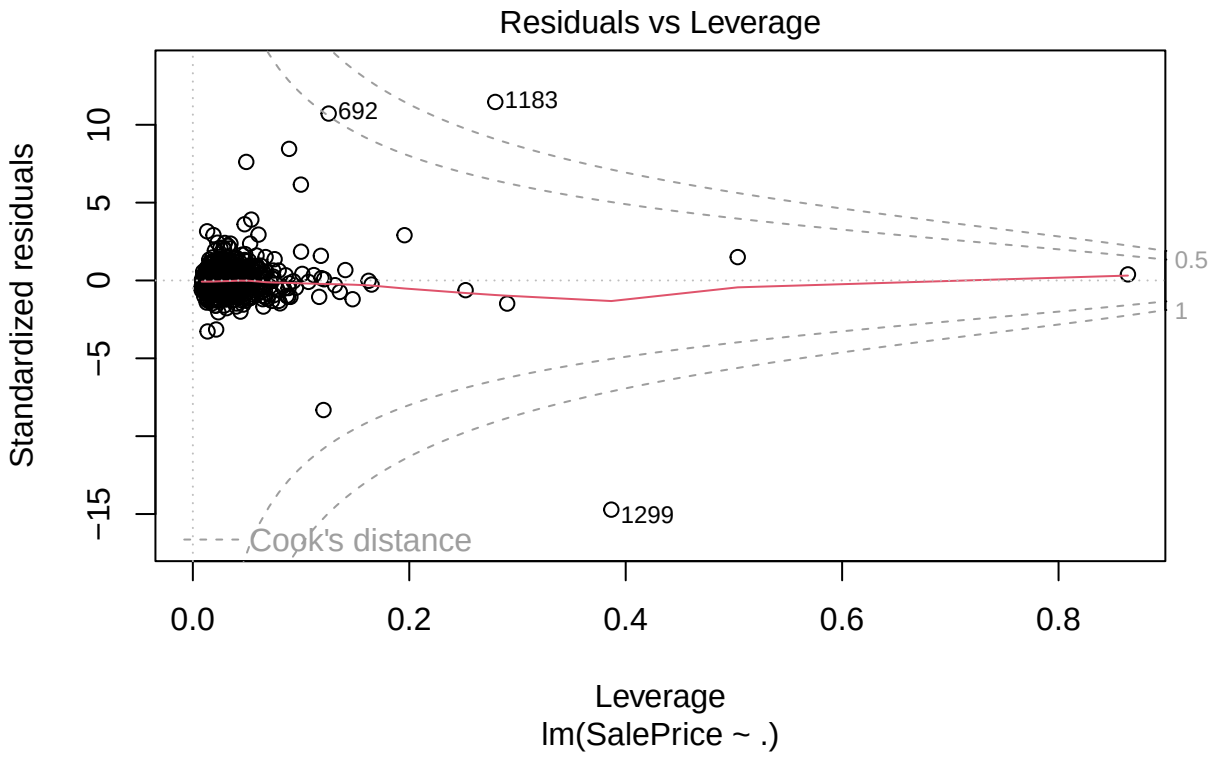
```
## -409357  -13924   -1521   11097  356054
##
## Coefficients: (2 not defined because of singularities)
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -4.064e+05  1.717e+06  -0.237 0.812984
## MSSubClass    -1.520e+02  3.248e+01  -4.680 3.26e-06 ***
## OverallQual    1.523e+04  1.494e+03  10.196  < 2e-16 ***
## OverallCond    4.302e+03  1.271e+03   3.386 0.000737 ***
## YearBuilt      3.472e+02  7.624e+01   4.553 5.94e-06 ***
## YearRemodAdd   1.128e+02  8.110e+01   1.391 0.164565
## BsmtFinSF1     1.868e+01  5.805e+00   3.218 0.001331 **
## BsmtFinSF2     8.863e+00  8.865e+00   1.000 0.317656
## BsmtUnfSF      7.719e+00  5.330e+00   1.448 0.147847
## TotalBsmtSF           NA         NA      NA       NA
## X1stFlrSF      4.513e+01  7.292e+00   6.188 8.89e-10 ***
## X2ndFlrSF      4.172e+01  6.006e+00   6.946 6.81e-12 ***
## LowQualFinSF   3.158e+01  2.310e+01   1.368 0.171753
## GrLivArea             NA         NA      NA       NA
## BsmtFullBath   6.811e+03  3.198e+03   2.130 0.033430 *
## BsmtHalfBath   9.361e+03  5.365e+03   1.745 0.081329 .
## FullBath       5.713e+03  3.515e+03   1.625 0.104417
## HalfBath      -1.497e+02  3.257e+03  -0.046 0.963340
## BedroomAbvGr  -9.937e+03  2.087e+03  -4.762 2.20e-06 ***
## KitchenAbvGr  -1.536e+04  6.372e+03  -2.410 0.016134 *
## TotRmsAbvGrd   5.698e+03  1.528e+03   3.730 0.000203 ***
## Fireplaces     4.313e+03  2.144e+03   2.012 0.044530 *
## GarageCars     1.217e+04  3.478e+03   3.498 0.000490 ***
## GarageArea    -1.132e+01  1.166e+01  -0.971 0.331910
## WoodDeckSF     2.184e+01  9.935e+00   2.198 0.028178 *
## OpenPorchSF   -2.412e+01  1.853e+01  -1.302 0.193369
## EnclosedPorch  1.174e+01  2.133e+01   0.550 0.582223
## X3SsnPorch     3.492e+01  3.496e+01   0.999 0.318074
## ScreenPorch    4.727e+01  2.126e+01   2.224 0.026395 *
## PoolArea      -6.411e-01  3.308e+01  -0.019 0.984540
## MiscVal        2.427e-02  2.144e+00   0.011 0.990970
## MoSold        -2.243e+02  4.264e+02  -0.526 0.599008
## YrSold        -3.044e+02  8.539e+02  -0.356 0.721578
## y              3.591e+04  3.874e+03   9.270  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 35520 on 989 degrees of freedom
## Multiple R-squared:  0.8068, Adjusted R-squared:  0.8007
## F-statistic: 133.2 on 31 and 989 DF,  p-value: < 2.2e-16
```

```
plot(fitLM)
```


Residuals vs Fitted
Residuals
4e+05
0e+00
−4e+05
1299
0e+00
1e+05
2e+05
3e+05
4e+05
5e+05
Fitted values
lm(SalePrice ~ .)

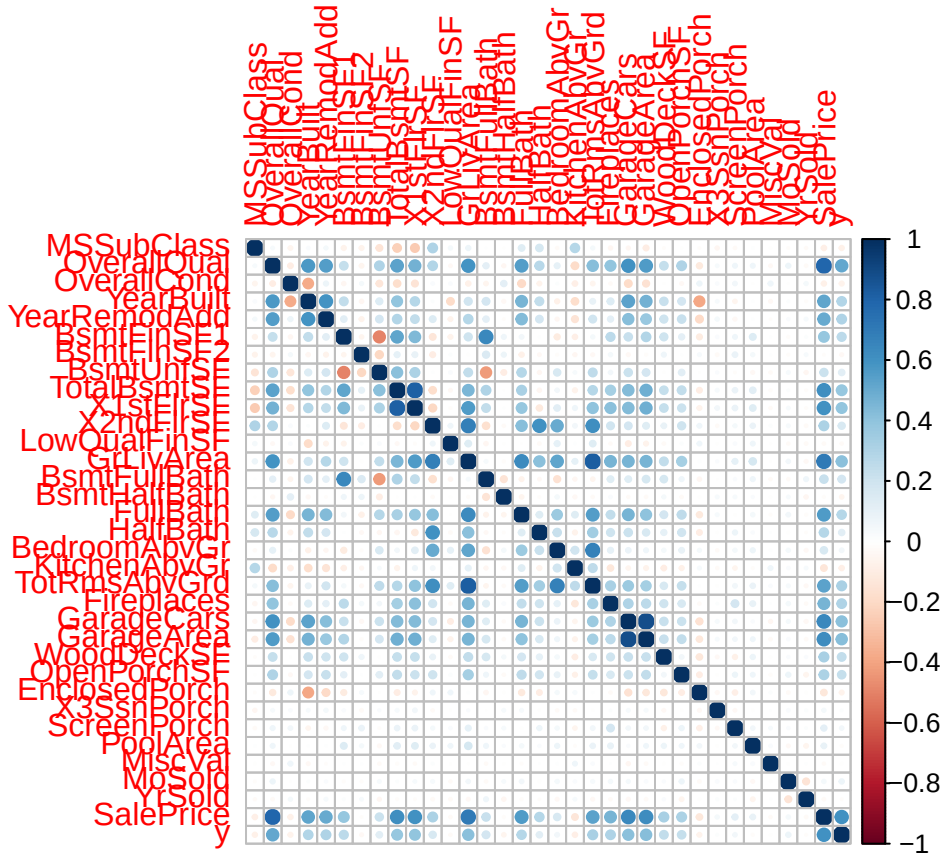

Normal Q−Q
Standardized residuals
10
5
0
−5
−10
−15
1183
692
1299
−3
−2
−1
0
1
2
3
Theoretical Quantiles
lm(SalePrice ~ .)


Scale−Location
1299
1183
692
√|Standardized residuals|
0
1
2
3
0e+00
1e+05
2e+05
3e+05
4e+05
5e+05
Fitted values
lm(SalePrice ~ .)



9. Analice el modelo. Determine si hay multicolinealidad entre las variables, y cuáles son las que aportan al modelo, por su valor de significación. Haga un análisis de correlación de las características del modelo y especifique si el modelo se adapta bien a los datos. Explique si hay sobreajuste (overfitting) o no. En caso de existir sobreajuste, haga otro modelo que lo corrija.

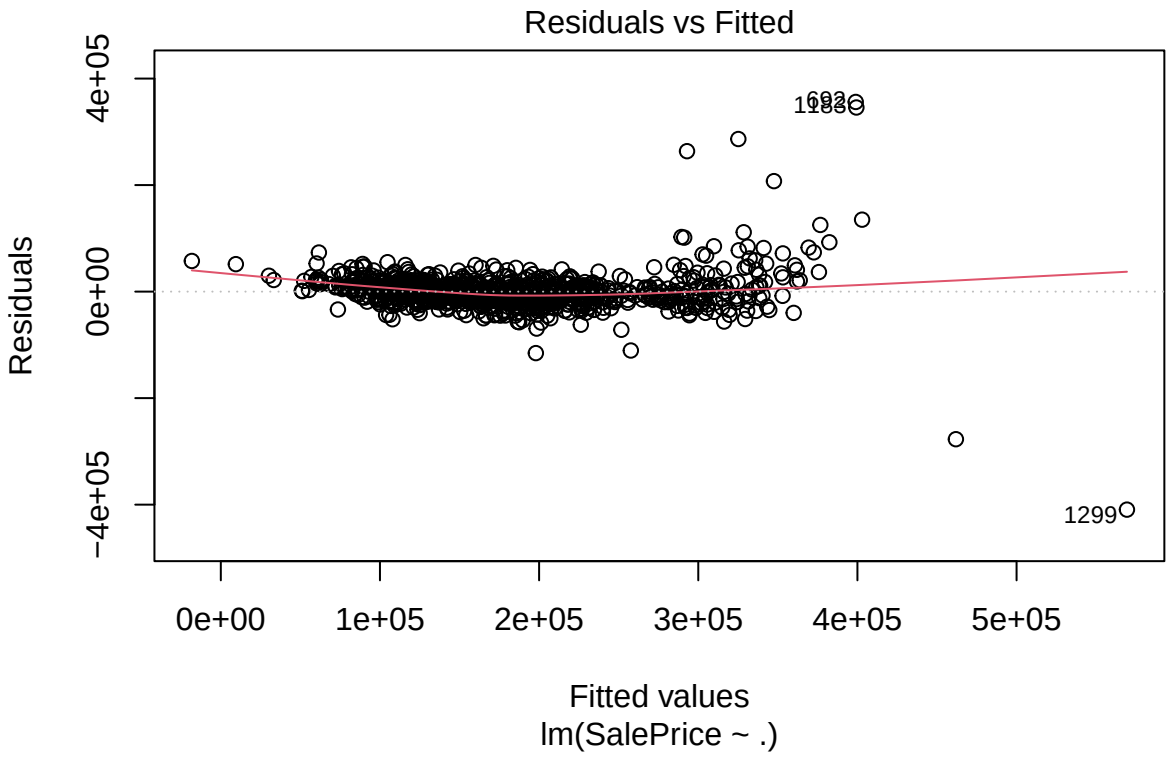
```
corrplot(cor(datosCC), method = "circle")
```

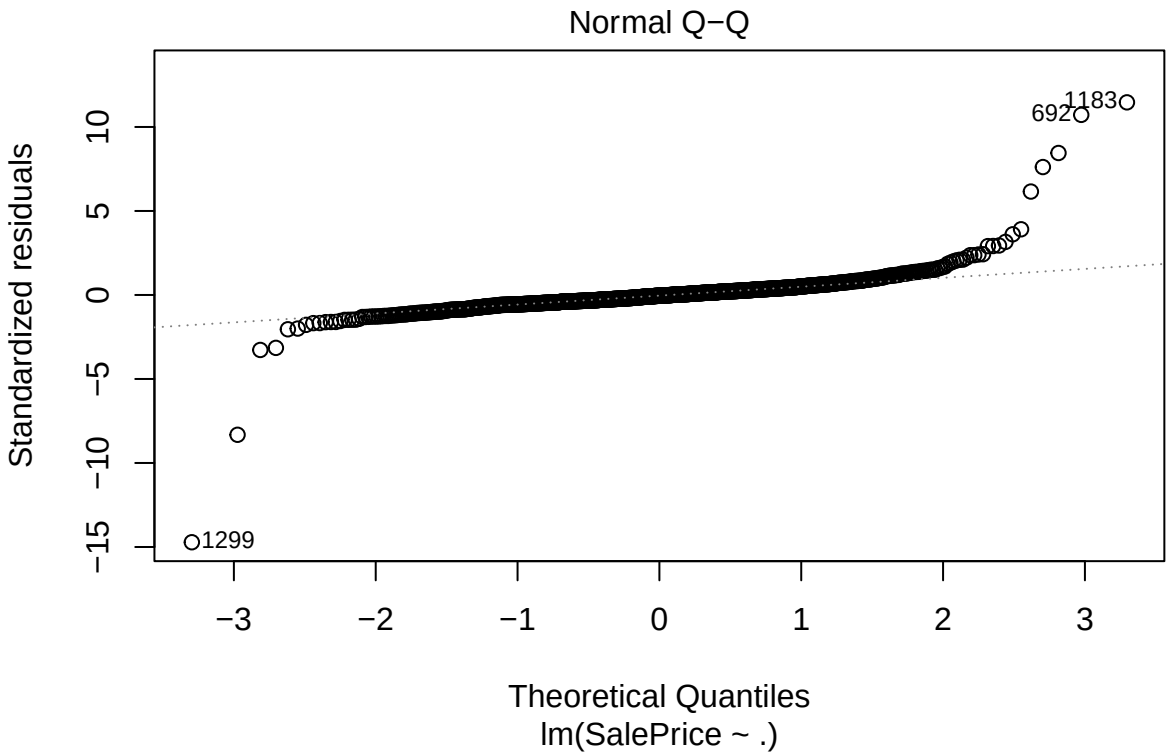


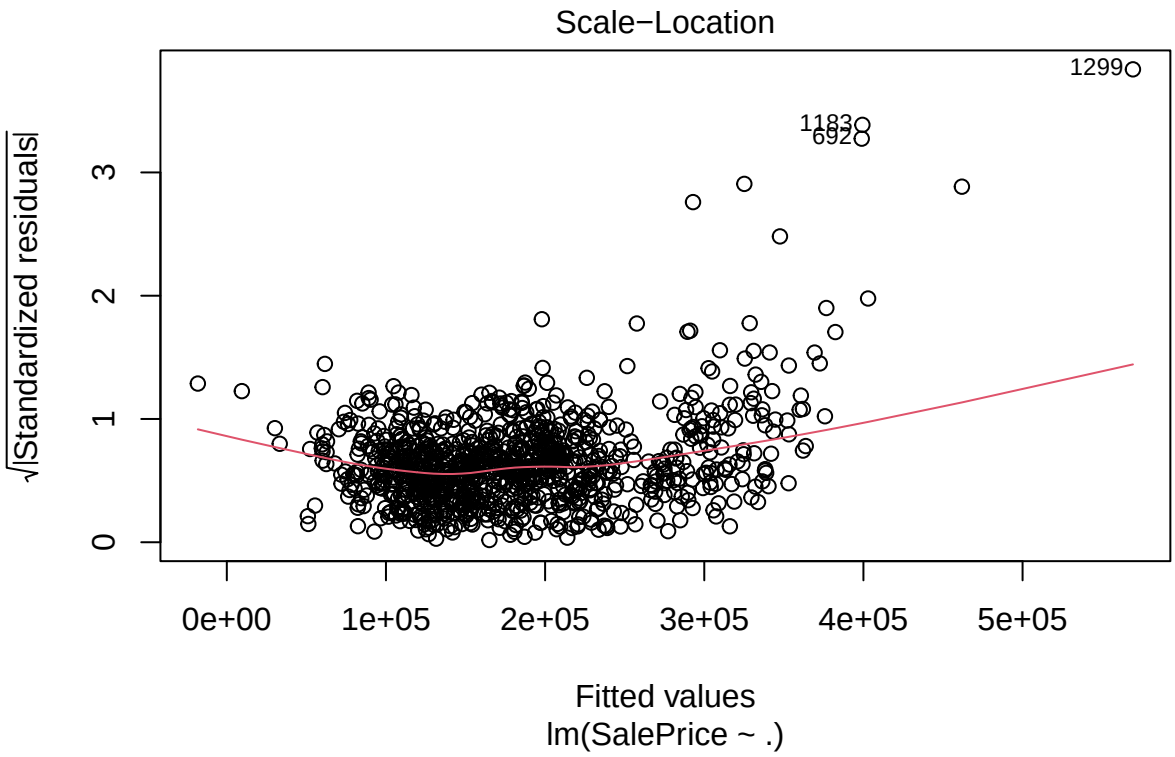
En general, hay poca correlación lineal entre las variables, aunque en algunas situaciones específicas se observan valores altos. Por lo tanto, se puede afirmar que el modelo se ajusta bien a los datos y algunas variables están altamente correlacionadas entre sí. Debido a la gran cantidad de correlaciones obtenidas en el análisis, se puede concluir que el modelo no está sobreajustado (overfitting).

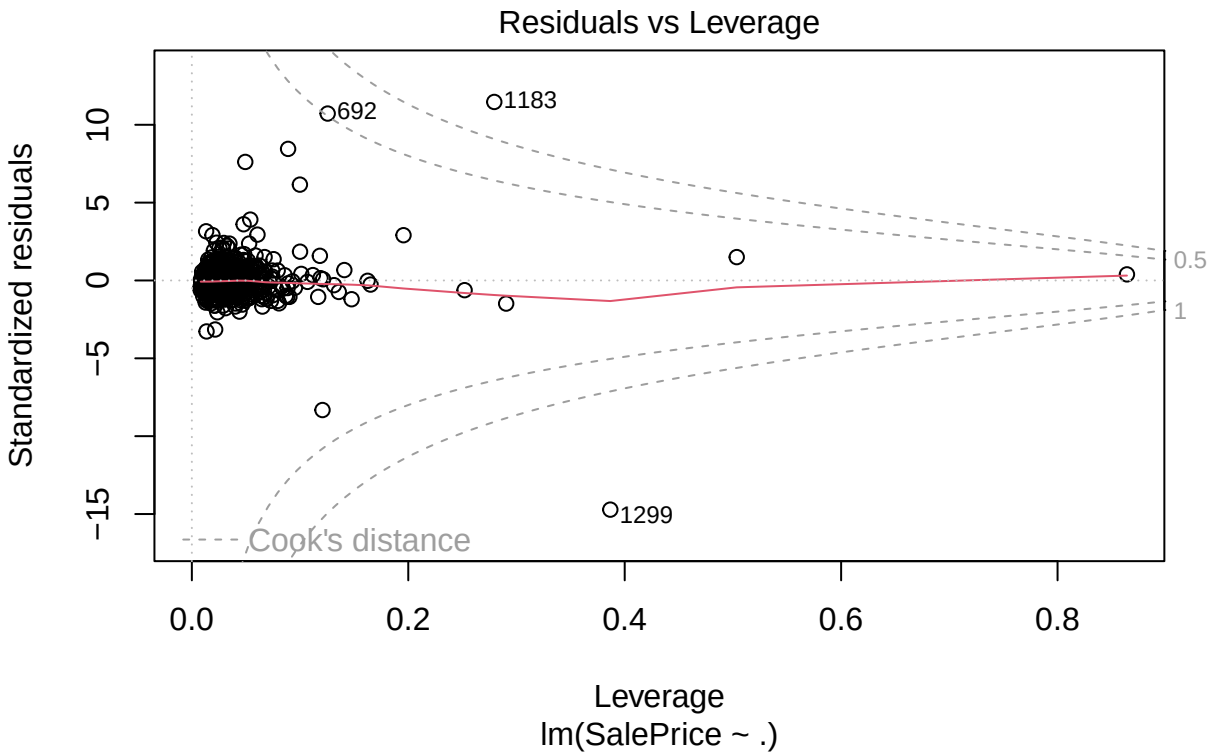
10. Si tiene multicolinealidad o sobreajuste, haga un modelo con las variables que sean mejores predictoras del precio de las casas. Determine la calidad del modelo realizando un análisis de los residuos. Muéstrelo gráficamente.

```
plot(fitLM)
```


Residuals vs Fitted
Residuals
4e+05
0e+00
−4e+05
1299
0e+00
1e+05
2e+05
3e+05
4e+05
5e+05
Fitted values
lm(SalePrice ~ .)


Normal Q−Q
Standardized residuals
10
5
0
−5
−10
−15
1183
692
1299
−3
−2
−1
0
1
2
3
Theoretical Quantiles
lm(SalePrice ~ .)


Scale−Location
1299
1183
692
√|Standardized residuals|
0
1
2
3
0e+00
1e+05
2e+05
3e+05
4e+05
5e+05
Fitted values
lm(SalePrice ~ .)



Residuals vs. fitted La gráfica se utiliza para detectar patrones no lineales en los residuos. Sin embargo, al observarla visualmente, no se puede identificar ningún patrón que sugiera la presencia de relaciones no lineales. Los residuos se distribuyen uniformemente en toda la gráfica.

Normal Q-Q La gráfica se utiliza para verificar si los residuos tienen una distribución normal, donde se considera mejor aquellos con más puntos alineados cerca de la diagonal. En la gráfica específica que se ha generado, se observa que la mayoría de los puntos o cuantiles están cercanos o alineados con la diagonal, lo que indica que la distribución de los residuos es normal.

Scale-Location la gráfica de residuos versus ajustes permite identificar la presencia de homocedasticidad o heterocedasticidad. En este caso, como la mayoría de los residuos se encuentran alrededor de cero, y no hay una tendencia clara en la dispersión de los residuos en función del ajuste, se puede concluir que no hay una violación importante de la suposición de homocedasticidad.En este caso, se observa que la mayoría de los datos están distribuidos en un rango aceptable entre 100,000 y 400,000, aunque hay algunos datos en el extremo derecho que se comportan de manera diferente.

Residuals vs Leverage es una herramienta importante en el análisis de regresión lineal, ya que permite identificar observaciones que pueden tener un impacto significativo en la línea de regresión. Si un punto está ubicado más allá de esta línea, se considera que tiene un alto leverage y puede tener un impacto significativo en la línea de regresión.En el caso específico del gráfico realizado, se identificaron dos puntos (1183 y 1299) que se encuentran más allá de la línea de Cook y que podrían tener un impacto significativo en la línea de regresión. Por lo tanto, se debe analizar la influencia de estos puntos en el modelo y considerar si deben ser eliminados o no. Es importante recordar que no siempre es necesario eliminar los puntos de alto leverage, ya que pueden ser puntos importantes en el conjunto de datos.

11. Utilice cada modelo con el conjunto de prueba y determine la eficiencia del algoritmo para predecir el precio de las casas. ¿Qué tan bien lo hizo?

12. Discuta sobre la efectividad de los modelos. ¿Cuál lo hizo mejor? ¿Cuál es el mejor modelo para predecir el precio de las casas? Haga los gráficos que crea que le pueden ayudar en la discusión.