##Class Project Phase 2

#Library  
  
library(tidyverse)

## Warning: package 'tidyverse' was built under R version 4.2.3

## Warning: package 'ggplot2' was built under R version 4.2.3

## Warning: package 'tibble' was built under R version 4.2.3

## Warning: package 'tidyr' was built under R version 4.2.3

## Warning: package 'readr' was built under R version 4.2.3

## Warning: package 'purrr' was built under R version 4.2.3

## Warning: package 'dplyr' was built under R version 4.2.3

## Warning: package 'stringr' was built under R version 4.2.3

## Warning: package 'forcats' was built under R version 4.2.3

## Warning: package 'lubridate' was built under R version 4.2.3

## ── Attaching core tidyverse packages ──────────────────────── tidyverse 2.0.0 ──  
## ✔ dplyr 1.1.2 ✔ readr 2.1.4  
## ✔ forcats 1.0.0 ✔ stringr 1.5.0  
## ✔ ggplot2 3.4.2 ✔ tibble 3.2.1  
## ✔ lubridate 1.9.2 ✔ tidyr 1.3.0  
## ✔ purrr 1.0.1   
## ── 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(tidymodels)

## Warning: package 'tidymodels' was built under R version 4.2.3

## ── Attaching packages ────────────────────────────────────── tidymodels 1.1.0 ──  
## ✔ broom 1.0.4 ✔ rsample 1.1.1  
## ✔ dials 1.2.0 ✔ tune 1.1.1  
## ✔ infer 1.0.4 ✔ workflows 1.1.3  
## ✔ modeldata 1.1.0 ✔ workflowsets 1.0.1  
## ✔ parsnip 1.1.0 ✔ yardstick 1.2.0  
## ✔ recipes 1.0.6

## Warning: package 'broom' was built under R version 4.2.3

## Warning: package 'dials' was built under R version 4.2.3

## Warning: package 'scales' was built under R version 4.2.3

## Warning: package 'infer' was built under R version 4.2.3

## Warning: package 'modeldata' was built under R version 4.2.3

## Warning: package 'parsnip' was built under R version 4.2.3

## Warning: package 'recipes' was built under R version 4.2.3

## Warning: package 'rsample' was built under R version 4.2.3

## Warning: package 'tune' was built under R version 4.2.3

## Warning: package 'workflows' was built under R version 4.2.3

## Warning: package 'workflowsets' was built under R version 4.2.3

## Warning: package 'yardstick' was built under R version 4.2.3

## ── Conflicts ───────────────────────────────────────── tidymodels\_conflicts() ──  
## ✖ scales::discard() masks purrr::discard()  
## ✖ dplyr::filter() masks stats::filter()  
## ✖ recipes::fixed() masks stringr::fixed()  
## ✖ dplyr::lag() masks stats::lag()  
## ✖ yardstick::spec() masks readr::spec()  
## ✖ recipes::step() masks stats::step()  
## • Dig deeper into tidy modeling with R at https://www.tmwr.org

library(glmnet)

## Warning: package 'glmnet' was built under R version 4.2.3

## Loading required package: Matrix  
##   
## Attaching package: 'Matrix'  
##   
## The following objects are masked from 'package:tidyr':  
##   
## expand, pack, unpack  
##   
## Loaded glmnet 4.1-7

library(e1071)

## Warning: package 'e1071' was built under R version 4.2.3

##   
## Attaching package: 'e1071'  
##   
## The following object is masked from 'package:tune':  
##   
## tune  
##   
## The following object is masked from 'package:rsample':  
##   
## permutations  
##   
## The following object is masked from 'package:parsnip':  
##   
## tune

library(ROCR)

## Warning: package 'ROCR' was built under R version 4.2.3

library(GGally)

## Warning: package 'GGally' was built under R version 4.2.3

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

library(ggcorrplot)

## Warning: package 'ggcorrplot' was built under R version 4.2.3

library(leaps)

## Warning: package 'leaps' was built under R version 4.2.3

library(lmtest)

## Warning: package 'lmtest' was built under R version 4.2.3

## Loading required package: zoo

## Warning: package 'zoo' was built under R version 4.2.3

##   
## Attaching package: 'zoo'  
##   
## The following objects are masked from 'package:base':  
##   
## as.Date, as.Date.numeric

library(splines)   
library(car)

## Warning: package 'car' was built under R version 4.2.3

## Loading required package: carData

## Warning: package 'carData' was built under R version 4.2.3

##   
## Attaching package: 'car'  
##   
## The following object is masked from 'package:dplyr':  
##   
## recode  
##   
## The following object is masked from 'package:purrr':  
##   
## some

library(VIM)

## Warning: package 'VIM' was built under R version 4.2.3

## Loading required package: colorspace

## Warning: package 'colorspace' was built under R version 4.2.3

## Loading required package: grid  
## The legacy packages maptools, rgdal, and rgeos, underpinning this package  
## will retire shortly. Please refer to R-spatial evolution reports on  
## https://r-spatial.org/r/2023/05/15/evolution4.html for details.  
## This package is now running under evolution status 0   
## VIM is ready to use.  
##   
## Suggestions and bug-reports can be submitted at: https://github.com/statistikat/VIM/issues  
##   
## Attaching package: 'VIM'  
##   
## The following object is masked from 'package:recipes':  
##   
## prepare  
##   
## The following object is masked from 'package:datasets':  
##   
## sleep

library(mice)

##   
## Attaching package: 'mice'  
##   
## The following object is masked from 'package:stats':  
##   
## filter  
##   
## The following objects are masked from 'package:base':  
##   
## cbind, rbind

library(skimr)

## Warning: package 'skimr' was built under R version 4.2.3

library(naniar)

## Warning: package 'naniar' was built under R version 4.2.3

##   
## Attaching package: 'naniar'  
##   
## The following object is masked from 'package:skimr':  
##   
## n\_complete

library(reshape2)

## Warning: package 'reshape2' was built under R version 4.2.3

##   
## Attaching package: 'reshape2'  
##   
## The following object is masked from 'package:tidyr':  
##   
## smiths

library(esquisse)

## Warning: package 'esquisse' was built under R version 4.2.3

library(rpart) #for classification trees

##   
## Attaching package: 'rpart'  
##   
## The following object is masked from 'package:dials':  
##   
## prune

library(rpart.plot) #for plotting trees

## Warning: package 'rpart.plot' was built under R version 4.2.3

library(RColorBrewer) #better visualization of classification trees  
library(rattle) #better visualization of classification trees

## Warning: package 'rattle' was built under R version 4.2.3

## Loading required package: bitops  
##   
## Attaching package: 'bitops'  
##   
## The following object is masked from 'package:Matrix':  
##   
## %&%  
##   
## Rattle: A free graphical interface for data science with R.  
## Version 5.5.1 Copyright (c) 2006-2021 Togaware Pty Ltd.  
## Type 'rattle()' to shake, rattle, and roll your data.  
##   
## Attaching package: 'rattle'  
##   
## The following object is masked from 'package:VIM':  
##   
## wine

library(ranger) #for random forests

## Warning: package 'ranger' was built under R version 4.2.3

##   
## Attaching package: 'ranger'  
##   
## The following object is masked from 'package:rattle':  
##   
## importance

library(randomForest) #also for random forests

## Warning: package 'randomForest' was built under R version 4.2.3

## randomForest 4.7-1.1  
## Type rfNews() to see new features/changes/bug fixes.  
##   
## Attaching package: 'randomForest'  
##   
## The following object is masked from 'package:ranger':  
##   
## importance  
##   
## The following object is masked from 'package:rattle':  
##   
## importance  
##   
## The following object is masked from 'package:dplyr':  
##   
## combine  
##   
## The following object is masked from 'package:ggplot2':  
##   
## margin

library(caret)

## Warning: package 'caret' was built under R version 4.2.3

## Loading required package: lattice  
##   
## Attaching package: 'caret'  
##   
## The following objects are masked from 'package:yardstick':  
##   
## precision, recall, sensitivity, specificity  
##   
## The following object is masked from 'package:purrr':  
##   
## lift

library(vip)

## Warning: package 'vip' was built under R version 4.2.3

##   
## Attaching package: 'vip'  
##   
## The following object is masked from 'package:utils':  
##   
## vi

#read in data  
  
ames = read.csv("ames\_student-1.csv")  
  
ames = ames%>%  
 mutate\_if(is.character, as.factor)  
  
  
ames = ames %>% mutate(Above\_Median = fct\_relevel(Above\_Median, c("No","Yes")))  
levels(ames$Above\_Median)

## [1] "No" "Yes"

summary(ames)

## MS\_SubClass MS\_Zoning   
## One\_Story\_1946\_and\_Newer\_All\_Styles :772 A\_agr : 2   
## Two\_Story\_1946\_and\_Newer :383 C\_all : 17   
## One\_and\_Half\_Story\_Finished\_All\_Ages:204 Floating\_Village\_Residential: 87   
## One\_Story\_PUD\_1946\_and\_Newer :129 I\_all : 1   
## One\_Story\_1945\_and\_Older : 98 Residential\_High\_Density : 20   
## Two\_Story\_1945\_and\_Older : 95 Residential\_Low\_Density :1600   
## (Other) :372 Residential\_Medium\_Density : 326   
## Lot\_Frontage Lot\_Area Street Alley   
## Min. : 0.00 Min. : 1300 Grvl: 7 Gravel : 94   
## 1st Qu.: 43.00 1st Qu.: 7500 Pave:2046 No\_Alley\_Access:1914   
## Median : 62.00 Median : 9548 Paved : 45   
## Mean : 57.38 Mean : 10258   
## 3rd Qu.: 78.00 3rd Qu.: 11600   
## Max. :313.00 Max. :215245   
##   
## Lot\_Shape Land\_Contour Utilities Lot\_Config   
## Irregular : 11 Bnk: 81 AllPub:2052 Corner : 359   
## Moderately\_Irregular: 53 HLS: 94 NoSewr: 1 CulDSac: 135   
## Regular :1275 Low: 45 FR2 : 56   
## Slightly\_Irregular : 714 Lvl:1833 FR3 : 8   
## Inside :1495   
##   
##   
## Land\_Slope Neighborhood Condition\_1 Condition\_2 Bldg\_Type   
## Gtl:1951 North\_Ames : 327 Norm :1771 Norm :2027 Duplex : 76   
## Mod: 89 College\_Creek: 183 Feedr : 113 Feedr : 12 OneFam :1706   
## Sev: 13 Old\_Town : 181 Artery : 67 Artery : 4 Twnhs : 67   
## Edwards : 129 RRAn : 35 PosA : 4 TwnhsE : 157   
## Somerset : 119 PosN : 24 PosN : 3 TwoFmCon: 47   
## Gilbert : 109 RRAe : 19 RRAe : 1   
## (Other) :1005 (Other): 24 (Other): 2   
## House\_Style Overall\_Qual Overall\_Cond   
## One\_Story :1052 Average :587 Average :1143   
## Two\_Story : 590 Above\_Average:518 Above\_Average: 376   
## One\_and\_Half\_Fin: 225 Good :411 Good : 286   
## SLvl : 90 Very\_Good :237 Very\_Good : 98   
## SFoyer : 56 Below\_Average:169 Below\_Average: 73   
## Two\_and\_Half\_Unf: 19 Excellent : 70 Fair : 35   
## (Other) : 21 (Other) : 61 (Other) : 42   
## Year\_Built Year\_Remod\_Add Roof\_Style Roof\_Matl Exterior\_1st  
## Min. :1875 Min. :1950 Flat : 14 CompShg:2023 VinylSd:705   
## 1st Qu.:1953 1st Qu.:1965 Gable :1607 Metal : 1 MetalSd:319   
## Median :1972 Median :1993 Gambrel: 14 Roll : 1 Wd Sdng:313   
## Mean :1971 Mean :1984 Hip : 404 Tar&Grv: 17 HdBoard:303   
## 3rd Qu.:2000 3rd Qu.:2004 Mansard: 9 WdShake: 8 Plywood:151   
## Max. :2010 Max. :2010 Shed : 5 WdShngl: 3 CemntBd: 90   
## (Other):172   
## Exterior\_2nd Mas\_Vnr\_Type Mas\_Vnr\_Area Exter\_Qual   
## VinylSd:699 BrkCmn : 17 Min. : 0.0 Excellent: 78   
## MetalSd:317 BrkFace: 638 1st Qu.: 0.0 Fair : 21   
## Wd Sdng:302 CBlock : 1 Median : 0.0 Good : 682   
## HdBoard:277 None :1231 Mean : 103.8 Typical :1272   
## Plywood:190 Stone : 166 3rd Qu.: 164.0   
## CmentBd: 90 Max. :1600.0   
## (Other):178   
## Exter\_Cond Foundation Bsmt\_Qual Bsmt\_Cond   
## Excellent: 9 BrkTil:216 Excellent :178 Excellent : 3   
## Fair : 43 CBlock:880 Fair : 57 Fair : 76   
## Good : 213 PConc :911 Good :849 Good : 80   
## Poor : 1 Slab : 36 No\_Basement: 57 No\_Basement: 57   
## Typical :1787 Stone : 6 Poor : 1 Poor : 4   
## Wood : 4 Typical :911 Typical :1833   
##   
## Bsmt\_Exposure BsmtFin\_Type\_1 BsmtFin\_SF\_1 BsmtFin\_Type\_2  
## Av : 284 ALQ :298 Min. :1.00 ALQ : 42   
## Gd : 199 BLQ :196 1st Qu.:3.00 BLQ : 47   
## Mn : 179 GLQ :578 Median :3.00 GLQ : 23   
## No :1331 LwQ :106 Mean :4.21 LwQ : 64   
## No\_Basement: 60 No\_Basement: 57 3rd Qu.:7.00 No\_Basement: 58   
## Rec :216 Max. :7.00 Rec : 79   
## Unf :602 Unf :1740   
## BsmtFin\_SF\_2 Bsmt\_Unf\_SF Total\_Bsmt\_SF Heating   
## Min. : 0.00 Min. : 0.0 Min. : 0 Floor: 1   
## 1st Qu.: 0.00 1st Qu.: 226.0 1st Qu.: 793 GasA :2019   
## Median : 0.00 Median : 460.0 Median : 988 GasW : 21   
## Mean : 52.57 Mean : 561.2 Mean :1055 Grav : 6   
## 3rd Qu.: 0.00 3rd Qu.: 801.0 3rd Qu.:1304 OthW : 1   
## Max. :1526.00 Max. :2336.0 Max. :5095 Wall : 5   
##   
## Heating\_QC Central\_Air Electrical First\_Flr\_SF Second\_Flr\_SF   
## Excellent:1040 N: 137 FuseA : 126 Min. : 432 Min. : 0.0   
## Fair : 61 Y:1916 FuseF : 33 1st Qu.: 882 1st Qu.: 0.0   
## Good : 333 FuseP : 6 Median :1088 Median : 0.0   
## Poor : 1 SBrkr :1887 Mean :1168 Mean : 326.1   
## Typical : 618 Unknown: 1 3rd Qu.:1402 3rd Qu.: 701.0   
## Max. :5095 Max. :1862.0   
##   
## Low\_Qual\_Fin\_SF Gr\_Liv\_Area Bsmt\_Full\_Bath Bsmt\_Half\_Bath   
## Min. : 0.000 Min. : 480 Min. :0.0000 Min. :0.00000   
## 1st Qu.: 0.000 1st Qu.:1137 1st Qu.:0.0000 1st Qu.:0.00000   
## Median : 0.000 Median :1447 Median :0.0000 Median :0.00000   
## Mean : 4.973 Mean :1499 Mean :0.4301 Mean :0.05796   
## 3rd Qu.: 0.000 3rd Qu.:1737 3rd Qu.:1.0000 3rd Qu.:0.00000   
## Max. :1064.000 Max. :5095 Max. :3.0000 Max. :2.00000   
##   
## Full\_Bath Half\_Bath Bedroom\_AbvGr Kitchen\_AbvGr   
## Min. :0.000 Min. :0.0000 Min. :0.000 Min. :1.000   
## 1st Qu.:1.000 1st Qu.:0.0000 1st Qu.:2.000 1st Qu.:1.000   
## Median :2.000 Median :0.0000 Median :3.000 Median :1.000   
## Mean :1.564 Mean :0.3751 Mean :2.855 Mean :1.047   
## 3rd Qu.:2.000 3rd Qu.:1.0000 3rd Qu.:3.000 3rd Qu.:1.000   
## Max. :4.000 Max. :2.0000 Max. :6.000 Max. :3.000   
##   
## Kitchen\_Qual TotRms\_AbvGrd Functional Fireplaces   
## Excellent: 142 Min. : 3.000 Typ :1896 Min. :0.000   
## Fair : 50 1st Qu.: 5.000 Min2 : 54 1st Qu.:0.000   
## Good : 790 Median : 6.000 Min1 : 51 Median :1.000   
## Poor : 1 Mean : 6.442 Mod : 27 Mean :0.603   
## Typical :1070 3rd Qu.: 7.000 Maj1 : 15 3rd Qu.:1.000   
## Max. :15.000 Maj2 : 6 Max. :4.000   
## (Other): 4   
## Fireplace\_Qu Garage\_Type Garage\_Finish Garage\_Cars   
## Excellent : 21 Attchd :1204 Fin :509 Min. :0.000   
## Fair : 56 Basment : 29 No\_Garage:109 1st Qu.:1.000   
## Good :538 BuiltIn : 127 RFn :563 Median :2.000   
## No\_Fireplace:993 CarPort : 15 Unf :872 Mean :1.774   
## Poor : 36 Detchd : 549 3rd Qu.:2.000   
## Typical :409 More\_Than\_Two\_Types: 21 Max. :5.000   
## No\_Garage : 108   
## Garage\_Area Garage\_Qual Garage\_Cond Paved\_Drive   
## Min. : 0 Excellent: 2 Excellent: 1 Dirt\_Gravel : 163   
## 1st Qu.: 320 Fair : 85 Fair : 53 Partial\_Pavement: 42   
## Median : 478 Good : 16 Good : 10 Paved :1848   
## Mean : 472 No\_Garage: 109 No\_Garage: 109   
## 3rd Qu.: 576 Poor : 2 Poor : 8   
## Max. :1488 Typical :1839 Typical :1872   
##   
## Wood\_Deck\_SF Open\_Porch\_SF Enclosed\_Porch Three\_season\_porch  
## 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 : 27.00 Median : 0.00 Median : 0.000   
## Mean : 93.52 Mean : 48.17 Mean : 23.02 Mean : 2.799   
## 3rd Qu.: 168.00 3rd Qu.: 72.00 3rd Qu.: 0.00 3rd Qu.: 0.000   
## Max. :1424.00 Max. :742.00 Max. :584.00 Max. :407.000   
##   
## Screen\_Porch Pool\_Area Pool\_QC Fence   
## Min. : 0.00 Min. : 0.000 Excellent: 2 Good\_Privacy : 81   
## 1st Qu.: 0.00 1st Qu.: 0.000 Fair : 1 Good\_Wood : 77   
## Median : 0.00 Median : 0.000 Good : 1 Minimum\_Privacy : 225   
## Mean : 16.68 Mean : 1.339 No\_Pool :2047 Minimum\_Wood\_Wire: 9   
## 3rd Qu.: 0.00 3rd Qu.: 0.000 Typical : 2 No\_Fence :1661   
## Max. :576.00 Max. :800.000   
##   
## Misc\_Feature Misc\_Val Mo\_Sold Year\_Sold Sale\_Type   
## Elev: 1 Min. : 0.00 Min. : 1.000 Min. :2006 WD :1789   
## Gar2: 5 1st Qu.: 0.00 1st Qu.: 4.000 1st Qu.:2007 New : 163   
## None:1978 Median : 0.00 Median : 6.000 Median :2008 COD : 54   
## Othr: 3 Mean : 60.12 Mean : 6.189 Mean :2008 ConLD : 16   
## Shed: 66 3rd Qu.: 0.00 3rd Qu.: 8.000 3rd Qu.:2009 ConLI : 8   
## Max. :17000.00 Max. :12.000 Max. :2010 CWD : 8   
## (Other): 15   
## Sale\_Condition Longitude Latitude Above\_Median  
## Abnorml: 121 Min. :-93.69 Min. :41.99 No :1010   
## AdjLand: 5 1st Qu.:-93.66 1st Qu.:42.02 Yes:1043   
## Alloca : 16 Median :-93.64 Median :42.03   
## Family : 30 Mean :-93.64 Mean :42.03   
## Normal :1712 3rd Qu.:-93.62 3rd Qu.:42.05   
## Partial: 169 Max. :-93.58 Max. :42.06   
##

ames = ames%>%  
 filter(Gr\_Liv\_Area < 3000)%>%  
 filter(Garage\_Area < 1000)  
  
summary(ames)

## MS\_SubClass MS\_Zoning   
## One\_Story\_1946\_and\_Newer\_All\_Styles :758 A\_agr : 2   
## Two\_Story\_1946\_and\_Newer :370 C\_all : 16   
## One\_and\_Half\_Story\_Finished\_All\_Ages:201 Floating\_Village\_Residential: 85   
## One\_Story\_PUD\_1946\_and\_Newer :128 I\_all : 1   
## One\_Story\_1945\_and\_Older : 96 Residential\_High\_Density : 20   
## Two\_Story\_1945\_and\_Older : 93 Residential\_Low\_Density :1565   
## (Other) :367 Residential\_Medium\_Density : 324   
## Lot\_Frontage Lot\_Area Street Alley   
## Min. : 0.00 Min. : 1300 Grvl: 6 Gravel : 93   
## 1st Qu.: 43.00 1st Qu.: 7425 Pave:2007 No\_Alley\_Access:1876   
## Median : 62.00 Median : 9500 Paved : 44   
## Mean : 56.89 Mean : 10082   
## 3rd Qu.: 78.00 3rd Qu.: 11435   
## Max. :313.00 Max. :215245   
##   
## Lot\_Shape Land\_Contour Utilities Lot\_Config   
## Irregular : 11 Bnk: 80 AllPub:2012 Corner : 354   
## Moderately\_Irregular: 49 HLS: 90 NoSewr: 1 CulDSac: 126   
## Regular :1256 Low: 43 FR2 : 56   
## Slightly\_Irregular : 697 Lvl:1800 FR3 : 8   
## Inside :1469   
##   
##   
## Land\_Slope Neighborhood Condition\_1 Condition\_2 Bldg\_Type   
## Gtl:1916 North\_Ames :326 Norm :1738 Norm :1988 Duplex : 76   
## Mod: 84 College\_Creek:180 Feedr : 113 Feedr : 12 OneFam :1670   
## Sev: 13 Old\_Town :178 Artery : 64 Artery : 4 Twnhs : 66   
## Edwards :127 RRAn : 34 PosA : 4 TwnhsE : 156   
## Somerset :115 PosN : 21 PosN : 2 TwoFmCon: 45   
## Gilbert :109 RRAe : 19 RRAe : 1   
## (Other) :978 (Other): 24 (Other): 2   
## House\_Style Overall\_Qual Overall\_Cond   
## One\_Story :1034 Average :582 Average :1113   
## Two\_Story : 574 Above\_Average:517 Above\_Average: 375   
## One\_and\_Half\_Fin: 221 Good :407 Good : 283   
## SLvl : 90 Very\_Good :230 Very\_Good : 98   
## SFoyer : 56 Below\_Average:168 Below\_Average: 70   
## Two\_and\_Half\_Unf: 19 Excellent : 58 Fair : 34   
## (Other) : 19 (Other) : 51 (Other) : 40   
## Year\_Built Year\_Remod\_Add Roof\_Style Roof\_Matl Exterior\_1st  
## Min. :1875 Min. :1950 Flat : 14 CompShg:1985 VinylSd:693   
## 1st Qu.:1953 1st Qu.:1965 Gable :1590 Metal : 1 MetalSd:311   
## Median :1972 Median :1992 Gambrel: 14 Roll : 1 Wd Sdng:308   
## Mean :1970 Mean :1984 Hip : 382 Tar&Grv: 17 HdBoard:302   
## 3rd Qu.:2000 3rd Qu.:2004 Mansard: 8 WdShake: 7 Plywood:149   
## Max. :2010 Max. :2010 Shed : 5 WdShngl: 2 CemntBd: 81   
## (Other):169   
## Exterior\_2nd Mas\_Vnr\_Type Mas\_Vnr\_Area Exter\_Qual   
## VinylSd:687 BrkCmn : 17 Min. : 0.00 Excellent: 63   
## MetalSd:308 BrkFace: 620 1st Qu.: 0.00 Fair : 20   
## Wd Sdng:298 CBlock : 1 Median : 0.00 Good : 668   
## HdBoard:276 None :1216 Mean : 98.19 Typical :1262   
## Plywood:187 Stone : 159 3rd Qu.: 160.00   
## CmentBd: 82 Max. :1600.00   
## (Other):175   
## Exter\_Cond Foundation Bsmt\_Qual Bsmt\_Cond   
## Excellent: 9 BrkTil:211 Excellent :158 Excellent : 3   
## Fair : 41 CBlock:875 Fair : 57 Fair : 75   
## Good : 206 PConc :882 Good :840 Good : 80   
## Poor : 1 Slab : 35 No\_Basement: 55 No\_Basement: 55   
## Typical :1756 Stone : 6 Poor : 1 Poor : 4   
## Wood : 4 Typical :902 Typical :1796   
##   
## Bsmt\_Exposure BsmtFin\_Type\_1 BsmtFin\_SF\_1 BsmtFin\_Type\_2  
## Av : 276 ALQ :296 Min. :1.000 ALQ : 42   
## Gd : 187 BLQ :194 1st Qu.:3.000 BLQ : 47   
## Mn : 173 GLQ :555 Median :3.000 GLQ : 22   
## No :1319 LwQ :105 Mean :4.216 LwQ : 64   
## No\_Basement: 58 No\_Basement: 55 3rd Qu.:7.000 No\_Basement: 56   
## Rec :214 Max. :7.000 Rec : 79   
## Unf :594 Unf :1703   
## BsmtFin\_SF\_2 Bsmt\_Unf\_SF Total\_Bsmt\_SF Heating   
## Min. : 0.00 Min. : 0.0 Min. : 0 Floor: 1   
## 1st Qu.: 0.00 1st Qu.: 226.0 1st Qu.: 791 GasA :1979   
## Median : 0.00 Median : 460.0 Median : 982 GasW : 21   
## Mean : 52.92 Mean : 558.9 Mean :1043 Grav : 6   
## 3rd Qu.: 0.00 3rd Qu.: 798.0 3rd Qu.:1290 OthW : 1   
## Max. :1526.00 Max. :2336.0 Max. :3206 Wall : 5   
##   
## Heating\_QC Central\_Air Electrical First\_Flr\_SF Second\_Flr\_SF   
## Excellent:1006 N: 137 FuseA : 126 Min. : 432 Min. : 0.0   
## Fair : 61 Y:1876 FuseF : 33 1st Qu.: 879 1st Qu.: 0.0   
## Good : 332 FuseP : 6 Median :1078 Median : 0.0   
## Poor : 1 SBrkr :1847 Mean :1153 Mean : 318.7   
## Typical : 613 Unknown: 1 3rd Qu.:1384 3rd Qu.: 689.0   
## Max. :2726 Max. :1788.0   
##   
## Low\_Qual\_Fin\_SF Gr\_Liv\_Area Bsmt\_Full\_Bath Bsmt\_Half\_Bath   
## Min. : 0.000 Min. : 480 Min. :0.0000 Min. :0.00000   
## 1st Qu.: 0.000 1st Qu.:1127 1st Qu.:0.0000 1st Qu.:0.00000   
## Median : 0.000 Median :1436 Median :0.0000 Median :0.00000   
## Mean : 4.591 Mean :1477 Mean :0.4247 Mean :0.05713   
## 3rd Qu.: 0.000 3rd Qu.:1724 3rd Qu.:1.0000 3rd Qu.:0.00000   
## Max. :1064.000 Max. :2978 Max. :3.0000 Max. :2.00000   
##   
## Full\_Bath Half\_Bath Bedroom\_AbvGr Kitchen\_AbvGr   
## Min. :0.000 Min. :0.0000 Min. :0.000 Min. :1.000   
## 1st Qu.:1.000 1st Qu.:0.0000 1st Qu.:2.000 1st Qu.:1.000   
## Median :2.000 Median :0.0000 Median :3.000 Median :1.000   
## Mean :1.554 Mean :0.3686 Mean :2.849 Mean :1.048   
## 3rd Qu.:2.000 3rd Qu.:1.0000 3rd Qu.:3.000 3rd Qu.:1.000   
## Max. :4.000 Max. :2.0000 Max. :6.000 Max. :3.000   
##   
## Kitchen\_Qual TotRms\_AbvGrd Functional Fireplaces   
## Excellent: 122 Min. : 3.000 Typ :1862 Min. :0.0000   
## Fair : 50 1st Qu.: 5.000 Min2 : 53 1st Qu.:0.0000   
## Good : 778 Median : 6.000 Min1 : 49 Median :1.0000   
## Poor : 1 Mean : 6.392 Mod : 25 Mean :0.5922   
## Typical :1062 3rd Qu.: 7.000 Maj1 : 14 3rd Qu.:1.0000   
## Max. :12.000 Maj2 : 6 Max. :4.0000   
## (Other): 4   
## Fireplace\_Qu Garage\_Type Garage\_Finish Garage\_Cars   
## Excellent : 17 Attchd :1182 Fin :487 Min. :0.000   
## Fair : 56 Basment : 27 No\_Garage:109 1st Qu.:1.000   
## Good :515 BuiltIn : 118 RFn :552 Median :2.000   
## No\_Fireplace:988 CarPort : 15 Unf :865 Mean :1.748   
## Poor : 36 Detchd : 545 3rd Qu.:2.000   
## Typical :401 More\_Than\_Two\_Types: 18 Max. :4.000   
## No\_Garage : 108   
## Garage\_Area Garage\_Qual Garage\_Cond Paved\_Drive   
## Min. : 0.0 Excellent: 1 Excellent: 1 Dirt\_Gravel : 160   
## 1st Qu.:318.0 Fair : 83 Fair : 53 Partial\_Pavement: 41   
## Median :474.0 Good : 13 Good : 9 Paved :1812   
## Mean :461.2 No\_Garage: 109 No\_Garage: 109   
## 3rd Qu.:576.0 Poor : 2 Poor : 8   
## Max. :995.0 Typical :1805 Typical :1833   
##   
## Wood\_Deck\_SF Open\_Porch\_SF Enclosed\_Porch Three\_season\_porch  
## 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 : 26.00 Median : 0.00 Median : 0.000   
## Mean : 91.47 Mean : 47.18 Mean : 22.96 Mean : 2.855   
## 3rd Qu.: 168.00 3rd Qu.: 70.00 3rd Qu.: 0.00 3rd Qu.: 0.000   
## Max. :1424.00 Max. :742.00 Max. :584.00 Max. :407.000   
##   
## Screen\_Porch Pool\_Area Pool\_QC Fence   
## Min. : 0.00 Min. : 0.000 Excellent: 2 Good\_Privacy : 79   
## 1st Qu.: 0.00 1st Qu.: 0.000 Fair : 1 Good\_Wood : 75   
## Median : 0.00 Median : 0.000 Good : 1 Minimum\_Privacy : 224   
## Mean : 15.68 Mean : 1.087 No\_Pool :2008 Minimum\_Wood\_Wire: 9   
## 3rd Qu.: 0.00 3rd Qu.: 0.000 Typical : 1 No\_Fence :1626   
## Max. :576.00 Max. :800.000   
##   
## Misc\_Feature Misc\_Val Mo\_Sold Year\_Sold Sale\_Type   
## Elev: 0 Min. : 0.00 Min. : 1.000 Min. :2006 WD :1763   
## Gar2: 5 1st Qu.: 0.00 1st Qu.: 4.000 1st Qu.:2007 New : 150   
## None:1940 Median : 0.00 Median : 6.000 Median :2008 COD : 54   
## Othr: 3 Mean : 52.59 Mean : 6.174 Mean :2008 ConLD : 15   
## Shed: 65 3rd Qu.: 0.00 3rd Qu.: 8.000 3rd Qu.:2009 ConLI : 8   
## Max. :15500.00 Max. :12.000 Max. :2010 CWD : 8   
## (Other): 15   
## Sale\_Condition Longitude Latitude Above\_Median  
## Abnorml: 120 Min. :-93.69 Min. :41.99 No :1006   
## AdjLand: 5 1st Qu.:-93.66 1st Qu.:42.02 Yes:1007   
## Alloca : 15 Median :-93.64 Median :42.03   
## Family : 29 Mean :-93.64 Mean :42.03   
## Normal :1688 3rd Qu.:-93.62 3rd Qu.:42.05   
## Partial: 156 Max. :-93.58 Max. :42.06   
##

#log reg series  
  
ames1 = ames%>%  
 select(Above\_Median, Neighborhood, Year\_Built, Overall\_Qual, Garage\_Area, First\_Flr\_SF, Gr\_Liv\_Area)

#split  
  
set.seed(123)   
ames\_split = initial\_split(ames1, prob = 0.80, strata = Above\_Median)  
train = training(ames\_split)  
test = testing(ames\_split)

ames1\_train\_model =   
 logistic\_reg() %>% #note the use of logistic\_reg  
 set\_engine("glm") #standard logistic regression engine is glm  
  
ames1\_train\_recipe = recipe(Above\_Median ~ ., train) %>%  
 step\_dummy(all\_nominal(), -all\_outcomes()) #exclude the response variable from being dummy converted   
  
logreg\_wf1\_train = workflow() %>%  
 add\_recipe(ames1\_train\_recipe) %>%   
 add\_model(ames1\_train\_model)  
  
ames\_fit1\_train = fit(logreg\_wf1\_train, train)

## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred

summary(ames\_fit1\_train$fit$fit$fit)

##   
## Call:  
## stats::glm(formula = ..y ~ ., family = stats::binomial, data = data)  
##   
## Deviance Residuals:   
## Min 1Q Median 3Q Max   
## -3.9267 -0.3082 0.0000 0.2595 2.5570   
##   
## Coefficients:  
## Estimate Std. Error  
## (Intercept) -6.074e+01 1.469e+01  
## Year\_Built 2.795e-02 7.289e-03  
## Garage\_Area 2.076e-03 6.742e-04  
## First\_Flr\_SF 1.102e-03 3.969e-04  
## Gr\_Liv\_Area 3.069e-03 3.547e-04  
## Neighborhood\_Blueste -2.393e+00 1.947e+00  
## Neighborhood\_Briardale -1.840e+01 2.736e+03  
## Neighborhood\_Brookside -1.252e+00 1.328e+00  
## Neighborhood\_Clear\_Creek 2.453e-01 1.311e+00  
## Neighborhood\_College\_Creek -4.233e-01 1.118e+00  
## Neighborhood\_Crawford 7.114e-01 1.250e+00  
## Neighborhood\_Edwards -1.252e+00 1.165e+00  
## Neighborhood\_Gilbert 1.109e+00 1.240e+00  
## Neighborhood\_Green\_Hills 1.783e+01 1.075e+04  
## Neighborhood\_Greens 1.560e+01 4.755e+03  
## Neighborhood\_Iowa\_DOT\_and\_Rail\_Road -1.456e+00 1.435e+00  
## Neighborhood\_Landmark -2.028e+01 1.075e+04  
## Neighborhood\_Meadow\_Village -1.683e+01 2.426e+03  
## Neighborhood\_Mitchell -6.519e-01 1.150e+00  
## Neighborhood\_North\_Ames -1.259e+00 1.131e+00  
## Neighborhood\_Northpark\_Villa -2.009e+01 3.170e+03  
## Neighborhood\_Northridge 1.341e+01 1.539e+03  
## Neighborhood\_Northridge\_Heights 1.524e+01 1.022e+03  
## Neighborhood\_Northwest\_Ames -7.001e-01 1.143e+00  
## Neighborhood\_Old\_Town -2.419e+00 1.308e+00  
## Neighborhood\_Sawyer -1.232e+00 1.166e+00  
## Neighborhood\_Sawyer\_West -8.844e-01 1.141e+00  
## Neighborhood\_Somerset -3.327e-01 1.165e+00  
## Neighborhood\_South\_and\_West\_of\_Iowa\_State\_University -1.162e+00 1.347e+00  
## Neighborhood\_Stone\_Brook 1.497e+01 1.694e+03  
## Neighborhood\_Timberland 1.104e+00 1.503e+00  
## Neighborhood\_Veenker 7.527e-02 1.622e+00  
## Overall\_Qual\_Average -1.063e+00 2.340e-01  
## Overall\_Qual\_Below\_Average -2.004e+00 5.501e-01  
## Overall\_Qual\_Excellent -1.167e+00 1.248e+00  
## Overall\_Qual\_Fair -1.724e+01 1.951e+03  
## Overall\_Qual\_Good 9.157e-01 2.908e-01  
## Overall\_Qual\_Poor -1.474e+01 4.730e+03  
## Overall\_Qual\_Very\_Excellent 1.498e+01 2.585e+03  
## Overall\_Qual\_Very\_Good 3.371e+00 9.983e-01  
## Overall\_Qual\_Very\_Poor -1.843e+01 4.987e+03  
## z value Pr(>|z|)   
## (Intercept) -4.133 3.57e-05 \*\*\*  
## Year\_Built 3.834 0.000126 \*\*\*  
## Garage\_Area 3.080 0.002069 \*\*   
## First\_Flr\_SF 2.775 0.005516 \*\*   
## Gr\_Liv\_Area 8.654 < 2e-16 \*\*\*  
## Neighborhood\_Blueste -1.229 0.219073   
## Neighborhood\_Briardale -0.007 0.994633   
## Neighborhood\_Brookside -0.942 0.346045   
## Neighborhood\_Clear\_Creek 0.187 0.851529   
## Neighborhood\_College\_Creek -0.379 0.705028   
## Neighborhood\_Crawford 0.569 0.569336   
## Neighborhood\_Edwards -1.075 0.282561   
## Neighborhood\_Gilbert 0.895 0.370881   
## Neighborhood\_Green\_Hills 0.002 0.998677   
## Neighborhood\_Greens 0.003 0.997381   
## Neighborhood\_Iowa\_DOT\_and\_Rail\_Road -1.014 0.310353   
## Neighborhood\_Landmark -0.002 0.998495   
## Neighborhood\_Meadow\_Village -0.007 0.994466   
## Neighborhood\_Mitchell -0.567 0.570912   
## Neighborhood\_North\_Ames -1.113 0.265639   
## Neighborhood\_Northpark\_Villa -0.006 0.994942   
## Neighborhood\_Northridge 0.009 0.993043   
## Neighborhood\_Northridge\_Heights 0.015 0.988097   
## Neighborhood\_Northwest\_Ames -0.612 0.540223   
## Neighborhood\_Old\_Town -1.849 0.064387 .   
## Neighborhood\_Sawyer -1.056 0.290781   
## Neighborhood\_Sawyer\_West -0.775 0.438366   
## Neighborhood\_Somerset -0.286 0.775223   
## Neighborhood\_South\_and\_West\_of\_Iowa\_State\_University -0.863 0.388209   
## Neighborhood\_Stone\_Brook 0.009 0.992947   
## Neighborhood\_Timberland 0.735 0.462500   
## Neighborhood\_Veenker 0.046 0.962977   
## Overall\_Qual\_Average -4.545 5.48e-06 \*\*\*  
## Overall\_Qual\_Below\_Average -3.643 0.000270 \*\*\*  
## Overall\_Qual\_Excellent -0.935 0.349770   
## Overall\_Qual\_Fair -0.009 0.992951   
## Overall\_Qual\_Good 3.149 0.001637 \*\*   
## Overall\_Qual\_Poor -0.003 0.997513   
## Overall\_Qual\_Very\_Excellent 0.006 0.995375   
## Overall\_Qual\_Very\_Good 3.376 0.000735 \*\*\*  
## Overall\_Qual\_Very\_Poor -0.004 0.997052   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 2091.92 on 1508 degrees of freedom  
## Residual deviance: 705.86 on 1468 degrees of freedom  
## AIC: 787.86  
##   
## Number of Fisher Scoring iterations: 18

ames\_fit1\_train %>% predict(test) %>% bind\_cols(test) %>% metrics(truth = Above\_Median, estimate = .pred\_class)

## # A tibble: 2 × 3  
## .metric .estimator .estimate  
## <chr> <chr> <dbl>  
## 1 accuracy binary 0.907  
## 2 kap binary 0.813

print(train)

## Above\_Median Neighborhood Year\_Built  
## 16 No North\_Ames 1970  
## 18 No North\_Ames 1968  
## 19 No North\_Ames 1970  
## 21 No Briardale 1971  
## 23 No Briardale 1971  
## 55 No Sawyer\_West 1979  
## 56 No Sawyer\_West 1984  
## 59 No Sawyer 1965  
## 62 No Somerset 2004  
## 63 No Somerset 2004  
## 64 No Somerset 1999  
## 65 No Somerset 2003  
## 69 No Sawyer 1976  
## 77 No North\_Ames 1966  
## 80 No North\_Ames 1962  
## 82 No North\_Ames 1954  
## 84 No North\_Ames 1954  
## 90 No North\_Ames 1959  
## 91 No North\_Ames 1957  
## 92 No North\_Ames 1959  
## 94 No North\_Ames 1959  
## 95 No North\_Ames 1952  
## 97 No North\_Ames 1958  
## 98 No North\_Ames 1953  
## 99 No North\_Ames 1920  
## 100 No North\_Ames 1955  
## 101 No North\_Ames 1948  
## 102 No Old\_Town 1980  
## 110 No Old\_Town 1900  
## 111 No Old\_Town 1910  
## 113 No Old\_Town 1927  
## 114 No Old\_Town 1957  
## 115 No Old\_Town 1915  
## 116 No Old\_Town 1945  
## 117 No Old\_Town 1940  
## 118 No Old\_Town 1923  
## 119 No Old\_Town 1900  
## 120 No Old\_Town 1910  
## 121 No Old\_Town 1957  
## 122 No Old\_Town 1910  
## 123 No Old\_Town 1885  
## 124 No Old\_Town 1922  
## 126 No Brookside 1925  
## 129 No Old\_Town 1921  
## 130 No Old\_Town 1920  
## 132 No Old\_Town 1900  
## 134 No Clear\_Creek 1917  
## 135 No South\_and\_West\_of\_Iowa\_State\_University 1915  
## 137 No South\_and\_West\_of\_Iowa\_State\_University 1907  
## 138 No Sawyer 1875  
## 140 No Sawyer 1957  
## 142 No Sawyer 1968  
## 143 No Sawyer 1966  
## 144 No Sawyer 1969  
## 148 No Sawyer 1950  
## 151 No Edwards 1956  
## 153 No Edwards 1964  
## 160 No College\_Creek 1996  
## 162 No College\_Creek 1977  
## 163 No College\_Creek 1976  
## 168 No College\_Creek 2004  
## 171 No Edwards 1954  
## 172 No Edwards 1965  
## 173 No Edwards 1968  
## 174 No Edwards 2003  
## 176 No Edwards 1957  
## 177 No South\_and\_West\_of\_Iowa\_State\_University 1924  
## 178 No South\_and\_West\_of\_Iowa\_State\_University 1915  
## 179 No South\_and\_West\_of\_Iowa\_State\_University 1939  
## 185 No Iowa\_DOT\_and\_Rail\_Road 1922  
## 186 No Iowa\_DOT\_and\_Rail\_Road 1921  
## 187 No Iowa\_DOT\_and\_Rail\_Road 1900  
## 203 No Meadow\_Village 1972  
## 204 No Meadow\_Village 1970  
## 205 No Meadow\_Village 1972  
## 207 No Mitchell 1962  
## 209 No North\_Ames 1956  
## 210 No North\_Ames 1974  
## 226 No Northwest\_Ames 1977  
## 228 No Northwest\_Ames 1978  
## 233 No Northwest\_Ames 1978  
## 240 No Northwest\_Ames 1972  
## 241 No North\_Ames 1974  
## 242 No North\_Ames 1969  
## 243 No North\_Ames 1970  
## 244 No North\_Ames 1971  
## 245 No North\_Ames 1970  
## 246 No North\_Ames 1970  
## 247 No North\_Ames 1971  
## 248 No North\_Ames 1971  
## 249 No Briardale 1970  
## 250 No Briardale 1971  
## 252 No Briardale 1972  
## 253 No Northpark\_Villa 1976  
## 254 No Northpark\_Villa 1976  
## 255 No Northpark\_Villa 1976  
## 256 No Northpark\_Villa 1975  
## 257 No Northpark\_Villa 1974  
## 259 No Northpark\_Villa 1978  
## 260 No Northpark\_Villa 1978  
## 261 No Northpark\_Villa 1976  
## 262 No North\_Ames 1967  
## 263 No North\_Ames 1966  
## 347 No Sawyer\_West 1980  
## 351 No Sawyer\_West 1950  
## 352 No Sawyer\_West 1928  
## 353 No Sawyer 1962  
## 358 No Sawyer 1963  
## 370 No Sawyer 1976  
## 371 No Northwest\_Ames 1968  
## 381 No North\_Ames 1967  
## 384 No North\_Ames 1960  
## 388 No North\_Ames 1958  
## 390 No North\_Ames 1961  
## 391 No North\_Ames 1964  
## 392 No North\_Ames 1966  
## 393 No North\_Ames 1964  
## 394 No North\_Ames 1955  
## 395 No Brookside 1940  
## 396 No Brookside 1950  
## 397 No North\_Ames 1953  
## 400 No North\_Ames 1956  
## 401 No North\_Ames 1950  
## 402 No North\_Ames 1950  
## 403 No North\_Ames 1967  
## 405 No North\_Ames 1963  
## 408 No North\_Ames 1968  
## 409 No North\_Ames 1920  
## 410 No North\_Ames 1956  
## 411 No North\_Ames 1958  
## 413 No North\_Ames 1956  
## 415 No North\_Ames 1954  
## 416 No North\_Ames 1958  
## 417 No North\_Ames 1954  
## 418 No North\_Ames 1953  
## 422 No North\_Ames 1945  
## 423 No Old\_Town 1900  
## 424 No North\_Ames 1948  
## 425 No North\_Ames 1950  
## 426 No North\_Ames 1948  
## 427 No Old\_Town 1958  
## 428 No Old\_Town 1916  
## 429 No Old\_Town 1939  
## 431 No Old\_Town 1915  
## 433 No Old\_Town 1920  
## 434 No Old\_Town 1890  
## 437 No North\_Ames 1958  
## 439 No North\_Ames 1957  
## 440 No North\_Ames 1960  
## 441 No North\_Ames 1958  
## 443 No North\_Ames 1950  
## 444 No North\_Ames 1949  
## 445 No North\_Ames 1950  
## 446 No North\_Ames 1958  
## 447 No North\_Ames 1952  
## 449 No North\_Ames 1949  
## 450 No North\_Ames 1948  
## 451 No North\_Ames 1964  
## 452 No North\_Ames 1978  
## 457 No Old\_Town 1910  
## 458 No Old\_Town 1910  
## 459 No Old\_Town 1920  
## 460 No Old\_Town 1952  
## 461 No Old\_Town 1946  
## 462 No Old\_Town 1910  
## 463 No Old\_Town 1953  
## 464 No Old\_Town 1954  
## 465 No Old\_Town 1920  
## 466 No Old\_Town 1940  
## 467 No Old\_Town 1923  
## 468 No Old\_Town 1920  
## 469 No Old\_Town 1910  
## 470 No Old\_Town 1947  
## 471 No Old\_Town 1898  
## 473 No Old\_Town 1917  
## 476 No Old\_Town 1910  
## 477 No Old\_Town 1890  
## 478 No Old\_Town 1920  
## 479 No Old\_Town 1910  
## 480 No Iowa\_DOT\_and\_Rail\_Road 1920  
## 481 No Iowa\_DOT\_and\_Rail\_Road 1900  
## 484 No Brookside 1916  
## 485 No Brookside 1936  
## 486 No Brookside 1925  
## 487 No Brookside 1939  
## 488 No Brookside 1924  
## 490 No Brookside 1924  
## 492 No Brookside 1931  
## 496 No Old\_Town 1915  
## 497 No Old\_Town 1912  
## 498 No Old\_Town 1922  
## 501 No Old\_Town 1915  
## 502 No Old\_Town 1902  
## 504 No Iowa\_DOT\_and\_Rail\_Road 1923  
## 505 No Sawyer 1946  
## 508 No Edwards 1978  
## 509 No Edwards 1922  
## 510 No Edwards 1925  
## 511 No Edwards 1934  
## 513 No Sawyer 1967  
## 514 No Sawyer 1967  
## 515 No Sawyer 1978  
## 516 No Sawyer 1982  
## 517 No Sawyer 1962  
## 521 No Sawyer 1947  
## 522 No Clear\_Creek 1968  
## 524 No Edwards 1955  
## 525 No Edwards 1954  
## 526 No Edwards 1956  
## 527 No Edwards 1946  
## 528 No Edwards 1941  
## 529 No Edwards 1957  
## 530 No Edwards 1984  
## 531 No Edwards 1949  
## 532 No Edwards 1940  
## 534 No Sawyer\_West 1983  
## 540 No Sawyer\_West 1979  
## 542 No Sawyer\_West 1979  
## 543 No Sawyer\_West 1979  
## 556 No College\_Creek 1996  
## 559 No College\_Creek 1994  
## 560 No College\_Creek 1994  
## 567 No College\_Creek 1978  
## 569 No College\_Creek 1979  
## 570 No College\_Creek 1977  
## 571 No College\_Creek 1978  
## 572 No College\_Creek 1977  
## 573 No College\_Creek 1972  
## 574 No College\_Creek 1972  
## 586 No Edwards 1949  
## 589 No Edwards 1960  
## 590 No Edwards 1976  
## 591 No Edwards 2005  
## 593 No Edwards 1945  
## 595 No Edwards 1952  
## 596 No Edwards 1956  
## 597 No Edwards 1920  
## 598 No Edwards 1941  
## 603 No Crawford 1916  
## 604 No South\_and\_West\_of\_Iowa\_State\_University 1925  
## 605 No Crawford 1918  
## 614 No Crawford 1950  
## 616 No Blueste 1980  
## 617 No Blueste 1980  
## 618 No Blueste 1980  
## 621 No Iowa\_DOT\_and\_Rail\_Road 1920  
## 622 No Iowa\_DOT\_and\_Rail\_Road 1920  
## 623 No Iowa\_DOT\_and\_Rail\_Road 1915  
## 624 No Iowa\_DOT\_and\_Rail\_Road 1925  
## 630 No Mitchell 1977  
## 631 No Mitchell 1977  
## 647 No Meadow\_Village 1973  
## 648 No Mitchell 1968  
## 650 No Meadow\_Village 1970  
## 652 No Meadow\_Village 1970  
## 653 No Mitchell 1985  
## 654 No Mitchell 1992  
## 655 No Mitchell 1993  
## 656 No Mitchell 1992  
## 669 No Gilbert 1952  
## 671 No Gilbert 1950  
## 679 No Northwest\_Ames 1976  
## 680 No Northwest\_Ames 1973  
## 682 No North\_Ames 1969  
## 683 No North\_Ames 1971  
## 686 No Briardale 1973  
## 687 No Briardale 1972  
## 688 No Briardale 1970  
## 689 No Briardale 1971  
## 692 No Northpark\_Villa 1975  
## 712 No Bloomington\_Heights 2007  
## 759 No Sawyer 1963  
## 760 No Sawyer 1968  
## 779 No Veenker 1977  
## 786 No North\_Ames 1965  
## 787 No North\_Ames 1965  
## 789 No Northwest\_Ames 1973  
## 794 No North\_Ames 1956  
## 795 No North\_Ames 1957  
## 796 No North\_Ames 1956  
## 797 No North\_Ames 1963  
## 802 No North\_Ames 1961  
## 803 No North\_Ames 1959  
## 806 No Brookside 1949  
## 807 No Brookside 1935  
## 808 No Brookside 1939  
## 810 No North\_Ames 1950  
## 811 No North\_Ames 1950  
## 816 No North\_Ames 1955  
## 817 No North\_Ames 1963  
## 818 No North\_Ames 1962  
## 819 No North\_Ames 1957  
## 823 No North\_Ames 1956  
## 825 No North\_Ames 1956  
## 826 No North\_Ames 1953  
## 827 No North\_Ames 1953  
## 828 No North\_Ames 1951  
## 829 No North\_Ames 1957  
## 831 No Old\_Town 1948  
## 832 No Old\_Town 1925  
## 833 No North\_Ames 1945  
## 834 No Old\_Town 1940  
## 835 No Old\_Town 1900  
## 839 No North\_Ames 1960  
## 840 No North\_Ames 1960  
## 842 No North\_Ames 1953  
## 843 No North\_Ames 1951  
## 845 No North\_Ames 1959  
## 846 No North\_Ames 1962  
## 848 No North\_Ames 1948  
## 850 No North\_Ames 1954  
## 851 No North\_Ames 1954  
## 852 No North\_Ames 1961  
## 853 No North\_Ames 1955  
## 854 No North\_Ames 1954  
## 857 No Old\_Town 1904  
## 858 No Old\_Town 1948  
## 861 No Old\_Town 1940  
## 862 No Old\_Town 1915  
## 863 No Old\_Town 1910  
## 866 No Old\_Town 1920  
## 867 No Old\_Town 1920  
## 868 No Old\_Town 1940  
## 870 No Old\_Town 1948  
## 871 No Old\_Town 1946  
## 872 No Old\_Town 1957  
## 873 No Old\_Town 1954  
## 875 No Old\_Town 1900  
## 876 No Old\_Town 1915  
## 877 No Old\_Town 1916  
## 878 No Old\_Town 1900  
## 879 No Old\_Town 1920  
## 880 No Old\_Town 1917  
## 881 No Old\_Town 1905  
## 884 No Old\_Town 1920  
## 886 No Old\_Town 1959  
## 887 No Old\_Town 1954  
## 888 No Old\_Town 1956  
## 890 No Brookside 1928  
## 891 No Brookside 1945  
## 892 No Brookside 1930  
## 893 No Brookside 1935  
## 894 No Brookside 1924  
## 895 No Brookside 1941  
## 896 No Brookside 1900  
## 898 No Brookside 1924  
## 901 No Brookside 1939  
## 902 No Brookside 1926  
## 903 No Brookside 1929  
## 904 No Brookside 1939  
## 905 No Old\_Town 1923  
## 907 No Brookside 1920  
## 908 No Brookside 1927  
## 909 No Brookside 1948  
## 912 No Brookside 1940  
## 913 No Brookside 1918  
## 916 No Iowa\_DOT\_and\_Rail\_Road 1930  
## 918 No Iowa\_DOT\_and\_Rail\_Road 1938  
## 919 No Iowa\_DOT\_and\_Rail\_Road 1915  
## 921 No Iowa\_DOT\_and\_Rail\_Road 1925  
## 923 No Sawyer 1948  
## 924 No Clear\_Creek 1959  
## 925 No Edwards 1940  
## 926 No Sawyer 1963  
## 927 No Sawyer 1965  
## 928 No Sawyer 1978  
## 929 No Sawyer 1966  
## 930 No Sawyer 1967  
## 931 No Sawyer 1978  
## 933 No Sawyer 1984  
## 934 No Sawyer 1969  
## 935 No Sawyer 1920  
## 937 No Sawyer 1963  
## 942 No Sawyer 1941  
## 953 No Edwards 1956  
## 954 No Edwards 1975  
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## 958 No Edwards 1941  
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## 966 No College\_Creek 1994  
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## 1024 No Edwards 1914  
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## 1028 No South\_and\_West\_of\_Iowa\_State\_University 1925  
## 1030 No South\_and\_West\_of\_Iowa\_State\_University 1911  
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## 1035 No Crawford 1923  
## 1036 No Crawford 1931  
## 1039 No Crawford 1938  
## 1045 No Iowa\_DOT\_and\_Rail\_Road 1926  
## 1046 No Iowa\_DOT\_and\_Rail\_Road 1922  
## 1047 No Iowa\_DOT\_and\_Rail\_Road 1930  
## 1048 No Iowa\_DOT\_and\_Rail\_Road 1930  
## 1052 No Iowa\_DOT\_and\_Rail\_Road 1952  
## 1053 No Iowa\_DOT\_and\_Rail\_Road 1910  
## 1054 No Iowa\_DOT\_and\_Rail\_Road 1920  
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## 1131 No Briardale 1973  
## 1132 No Briardale 1973  
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## 1170 No Gilbert 2006  
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## 1219 No Sawyer\_West 2003  
## 1225 No Sawyer 1977  
## 1226 No Sawyer 1962  
## 1228 No Sawyer 1961  
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## 1530 No Iowa\_DOT\_and\_Rail\_Road 1895  
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## 1633 No North\_Ames 1967  
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## 1709 No Sawyer 1964  
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## 1835 No Brookside 1934  
## 1837 No Brookside 1925  
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## 1839 No Brookside 1928  
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## 1841 No Old\_Town 1925  
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## 1845 No Brookside 1970  
## 1846 No Old\_Town 1941  
## 1847 No Iowa\_DOT\_and\_Rail\_Road 1910  
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## 1850 No Iowa\_DOT\_and\_Rail\_Road 1935  
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## 1855 No Edwards 1935  
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## 1880 No Edwards 1954  
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## 1886 No Edwards 1948  
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## 1917 No Landmark 1993  
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## 1936 No Edwards 2002  
## 1938 No Edwards 2005  
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## 1943 No Edwards 2004  
## 1947 No Edwards 1955  
## 1948 No Edwards 1954  
## 1949 No Edwards 1922  
## 1950 No South\_and\_West\_of\_Iowa\_State\_University 1912  
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## 1957 No South\_and\_West\_of\_Iowa\_State\_University 1920  
## 1958 No South\_and\_West\_of\_Iowa\_State\_University 1926  
## 1961 No South\_and\_West\_of\_Iowa\_State\_University 1939  
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## 1975 No Iowa\_DOT\_and\_Rail\_Road 1942  
## 1976 No Iowa\_DOT\_and\_Rail\_Road 1925  
## 1977 No Iowa\_DOT\_and\_Rail\_Road 1936  
## 1978 No Iowa\_DOT\_and\_Rail\_Road 1920  
## 1979 No Iowa\_DOT\_and\_Rail\_Road 1945  
## 1980 No Iowa\_DOT\_and\_Rail\_Road 1949  
## 1981 No Iowa\_DOT\_and\_Rail\_Road 1951  
## 1986 No Mitchell 1975  
## 1997 No Mitchell 1951  
## 2001 No Mitchell 1968  
## 2002 No Mitchell 1970  
## 2003 No Meadow\_Village 1970  
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## 2006 No Meadow\_Village 1970  
## 2007 No Meadow\_Village 1970  
## 2008 No Mitchell 1976  
## 2011 No Mitchell 1983  
## 2012 No Mitchell 1992  
## 1 Yes North\_Ames 1960  
## 3 Yes North\_Ames 1958  
## 5 Yes Gilbert 1997  
## 6 Yes Gilbert 1998  
## 7 Yes Stone\_Brook 1992  
## 9 Yes Gilbert 1992  
## 10 Yes Gilbert 1990  
## 12 Yes Gilbert 1988  
## 13 Yes Stone\_Brook 2010  
## 15 Yes Somerset 2000  
## 26 Yes Northridge\_Heights 2007  
## 27 Yes Northridge\_Heights 2005  
## 28 Yes Northridge\_Heights 2005  
## 29 Yes Northridge\_Heights 2009  
## 32 Yes Northridge\_Heights 2006  
## 34 Yes Bloomington\_Heights 2006  
## 35 Yes Bloomington\_Heights 2004  
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## 37 Yes Gilbert 2002  
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## 44 Yes Northridge 1994  
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## 47 Yes Somerset 2009  
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## 49 Yes Somerset 2008  
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## 150 Yes Clear\_Creek 1978  
## 152 Yes Edwards 2009  
## 155 Yes Sawyer\_West 1985  
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## 189 Yes Mitchell 1976  
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## 191 Yes Timberland 1948  
## 192 Yes Timberland 2009  
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## 198 Yes Mitchell 1965  
## 200 Yes Mitchell 1999  
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## 214 Yes Stone\_Brook 1998  
## 215 Yes Stone\_Brook 1995  
## 223 Yes Gilbert 1977  
## 224 Yes Northwest\_Ames 1980  
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## 227 Yes Northwest\_Ames 1977  
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## 368 Yes Veenker 1981  
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## 952 Yes Edwards 1918  
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## 1006 Yes Edwards 1976  
## 1009 Yes Edwards 2003  
## 1010 Yes Edwards 1976  
## 1011 Yes Edwards 2005  
## 1031 Yes South\_and\_West\_of\_Iowa\_State\_University 1921  
## 1032 Yes Crawford 1922  
## 1040 Yes Crawford 1935  
## 1041 Yes Crawford 1939  
## 1043 Yes Crawford 1956  
## 1044 Yes Crawford 1954  
## 1051 Yes Iowa\_DOT\_and\_Rail\_Road 1958  
## 1056 Yes Crawford 2007  
## 1057 Yes Mitchell 1996  
## 1062 Yes Mitchell 1991  
## 1063 Yes Timberland 1965  
## 1064 Yes Timberland 1986  
## 1066 Yes Timberland 2007  
## 1067 Yes Timberland 2007  
## 1070 Yes Timberland 2008  
## 1072 Yes Timberland 1986  
## 1073 Yes Timberland 1986  
## 1075 Yes Timberland 2003  
## 1076 Yes Timberland 2007  
## 1077 Yes Mitchell 1997  
## 1078 Yes Mitchell 1997  
## 1081 Yes Mitchell 1964  
## 1089 Yes Mitchell 1940  
## 1090 Yes Mitchell 1969  
## 1092 Yes North\_Ames 1971  
## 1093 Yes North\_Ames 1973  
## 1094 Yes North\_Ames 1970  
## 1095 Yes Gilbert 1995  
## 1096 Yes Gilbert 1997  
## 1097 Yes Gilbert 1997  
## 1098 Yes Gilbert 1997  
## 1099 Yes Stone\_Brook 2000  
## 1101 Yes Gilbert 1999  
## 1102 Yes Gilbert 1996  
## 1103 Yes Gilbert 1999  
## 1104 Yes Gilbert 1992  
## 1106 Yes Stone\_Brook 1986  
## 1108 Yes Stone\_Brook 1990  
## 1109 Yes Stone\_Brook 2006  
## 1111 Yes Stone\_Brook 2006  
## 1114 Yes Northwest\_Ames 1981  
## 1115 Yes Northwest\_Ames 1979  
## 1116 Yes Northwest\_Ames 1977  
## 1119 Yes Northwest\_Ames 1979  
## 1124 Yes North\_Ames 1972  
## 1129 Yes North\_Ames 1997  
## 1136 Yes Northridge\_Heights 2006  
## 1137 Yes Northridge\_Heights 2007  
## 1138 Yes Northridge\_Heights 2007  
## 1140 Yes Northridge\_Heights 2005  
## 1141 Yes Northridge\_Heights 2006  
## 1142 Yes Northridge\_Heights 2006  
## 1143 Yes Northridge\_Heights 2006  
## 1144 Yes Northridge\_Heights 2005  
## 1145 Yes Northridge\_Heights 2007  
## 1146 Yes Northridge\_Heights 2007  
## 1147 Yes Northridge\_Heights 2006  
## 1148 Yes Northridge\_Heights 2004  
## 1150 Yes Northridge\_Heights 2007  
## 1152 Yes Northridge\_Heights 2005  
## 1153 Yes Northridge\_Heights 2006  
## 1155 Yes Northridge\_Heights 2005  
## 1156 Yes Northridge\_Heights 2006  
## 1157 Yes Northridge\_Heights 2006  
## 1158 Yes Northridge\_Heights 2006  
## 1159 Yes Northridge\_Heights 2005  
## 1161 Yes Northridge\_Heights 2007  
## 1162 Yes Northridge\_Heights 2006  
## 1163 Yes Gilbert 2005  
## 1164 Yes Gilbert 2005  
## 1165 Yes Gilbert 2006  
## 1166 Yes Gilbert 2006  
## 1168 Yes Gilbert 2007  
## 1169 Yes Gilbert 2007  
## 1171 Yes Gilbert 2007  
## 1172 Yes Gilbert 2007  
## 1173 Yes Gilbert 2007  
## 1174 Yes Bloomington\_Heights 2006  
## 1175 Yes Bloomington\_Heights 2006  
## 1176 Yes Bloomington\_Heights 2003  
## 1177 Yes Bloomington\_Heights 2007  
## 1178 Yes Gilbert 2004  
## 1179 Yes Gilbert 2004  
## 1180 Yes Gilbert 2004  
## 1183 Yes Gilbert 2003  
## 1184 Yes Gilbert 2000  
## 1185 Yes Gilbert 2002  
## 1186 Yes Gilbert 1999  
## 1187 Yes Gilbert 2000  
## 1190 Yes Gilbert 1999  
## 1191 Yes Northridge 2000  
## 1193 Yes Northridge 1998  
## 1194 Yes Northridge 1998  
## 1195 Yes Northridge 1996  
## 1196 Yes Northridge 1995  
## 1197 Yes Northridge 1995  
## 1198 Yes Northridge 1992  
## 1199 Yes Somerset 2007  
## 1200 Yes Somerset 2007  
## 1204 Yes Somerset 2007  
## 1206 Yes Somerset 2007  
## 1208 Yes Somerset 2006  
## 1210 Yes Somerset 2006  
## 1211 Yes Somerset 2007  
## 1212 Yes Somerset 2007  
## 1214 Yes Somerset 2006  
## 1215 Yes Somerset 2006  
## 1220 Yes Sawyer\_West 2006  
## 1221 Yes Sawyer\_West 1994  
## 1222 Yes Sawyer\_West 2000  
## 1223 Yes Sawyer\_West 1998  
## 1232 Yes Veenker 1974  
## 1234 Yes Sawyer 1975  
## 1236 Yes Northridge 1990  
## 1237 Yes Northridge 1992  
## 1238 Yes Somerset 2004  
## 1239 Yes Somerset 2006  
## 1240 Yes Somerset 2006  
## 1241 Yes Somerset 2006  
## 1242 Yes Somerset 1999  
## 1243 Yes Somerset 1999  
## 1245 Yes Somerset 2000  
## 1246 Yes Somerset 2000  
## 1248 Yes Somerset 1997  
## 1249 Yes Somerset 2003  
## 1251 Yes Veenker 1978  
## 1252 Yes Greens 1978  
## 1253 Yes Veenker 1976  
## 1254 Yes Veenker 1981  
## 1255 Yes Sawyer 1977  
## 1256 Yes Somerset 2001  
## 1258 Yes Northwest\_Ames 1970  
## 1259 Yes Northwest\_Ames 1969  
## 1260 Yes Northwest\_Ames 1968  
## 1261 Yes Northwest\_Ames 1972  
## 1262 Yes Northwest\_Ames 1993  
## 1263 Yes Northwest\_Ames 1993  
## 1279 Yes North\_Ames 1966  
## 1282 Yes North\_Ames 1964  
## 1283 Yes North\_Ames 1959  
## 1284 Yes North\_Ames 1960  
## 1289 Yes North\_Ames 1964  
## 1294 Yes North\_Ames 1966  
## 1304 Yes North\_Ames 1957  
## 1306 Yes North\_Ames 1970  
## 1323 Yes North\_Ames 1963  
## 1337 Yes North\_Ames 1962  
## 1352 Yes Old\_Town 1910  
## 1360 Yes Old\_Town 1879  
## 1376 Yes Brookside 1920  
## 1384 Yes Iowa\_DOT\_and\_Rail\_Road 1950  
## 1385 Yes Iowa\_DOT\_and\_Rail\_Road 1915  
## 1392 Yes Sawyer 1937  
## 1396 Yes Sawyer 1964  
## 1405 Yes Sawyer 1956  
## 1408 Yes Sawyer 1940  
## 1412 Yes Clear\_Creek 1984  
## 1414 Yes Edwards 1948  
## 1417 Yes Clear\_Creek 1954  
## 1418 Yes Edwards 1950  
## 1428 Yes Sawyer\_West 1991  
## 1429 Yes Sawyer\_West 1994  
## 1430 Yes College\_Creek 2007  
## 1431 Yes College\_Creek 2007  
## 1432 Yes College\_Creek 2007  
## 1433 Yes College\_Creek 2005  
## 1436 Yes College\_Creek 2005  
## 1437 Yes College\_Creek 2005  
## 1439 Yes College\_Creek 2006  
## 1440 Yes Sawyer\_West 1988  
## 1441 Yes Clear\_Creek 1958  
## 1442 Yes Clear\_Creek 1992  
## 1443 Yes Clear\_Creek 1966  
## 1444 Yes Clear\_Creek 1976  
## 1447 Yes College\_Creek 1998  
## 1450 Yes College\_Creek 1997  
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## 1452 Yes College\_Creek 1998  
## 1453 Yes College\_Creek 2001  
## 1454 Yes College\_Creek 2000  
## 1455 Yes College\_Creek 2003  
## 1458 Yes College\_Creek 1977  
## 1463 Yes College\_Creek 2004  
## 1464 Yes College\_Creek 2002  
## 1466 Yes College\_Creek 2002  
## 1467 Yes College\_Creek 2003  
## 1468 Yes College\_Creek 2002  
## 1471 Yes College\_Creek 1996  
## 1472 Yes College\_Creek 2002  
## 1474 Yes College\_Creek 1999  
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## 1478 Yes College\_Creek 2006  
## 1479 Yes College\_Creek 2005  
## 1490 Yes Edwards 2005  
## 1501 Yes Crawford 1923  
## 1504 Yes South\_and\_West\_of\_Iowa\_State\_University 1937  
## 1507 Yes Crawford 1918  
## 1514 Yes Crawford 1927  
## 1515 Yes Crawford 1918  
## 1516 Yes Crawford 1930  
## 1520 Yes Crawford 1940  
## 1522 Yes Crawford 1960  
## 1524 Yes Blueste 1988  
## 1525 Yes Crawford 1957  
## 1526 Yes Crawford 1986  
## 1532 Yes Crawford 2006  
## 1533 Yes Mitchell 1979  
## 1536 Yes Mitchell 2002  
## 1537 Yes Mitchell 2002  
## 1544 Yes Timberland 2006  
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## 1546 Yes Timberland 2006  
## 1547 Yes Timberland 1985  
## 1549 Yes Timberland 1996  
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## 1553 Yes Timberland 1996  
## 1554 Yes Timberland 2003  
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## 1557 Yes Timberland 2006  
## 1570 Yes Mitchell 1977  
## 1581 Yes North\_Ames 1957  
## 1583 Yes Gilbert 1997  
## 1584 Yes Gilbert 1997  
## 1585 Yes Gilbert 1995  
## 1586 Yes Gilbert 1996  
## 1588 Yes Gilbert 2005  
## 1589 Yes Gilbert 2006  
## 1591 Yes Gilbert 2005  
## 1592 Yes Stone\_Brook 1994  
## 1594 Yes Gilbert 1998  
## 1595 Yes Stone\_Brook 1987  
## 1596 Yes Stone\_Brook 2005  
## 1597 Yes Stone\_Brook 2006  
## 1598 Yes Stone\_Brook 2005  
## 1599 Yes Stone\_Brook 2006  
## 1601 Yes Stone\_Brook 2005  
## 1602 Yes Stone\_Brook 2006  
## 1603 Yes Gilbert 1948  
## 1604 Yes Stone\_Brook 2005  
## 1605 Yes Stone\_Brook 2005  
## 1606 Yes Stone\_Brook 2005  
## 1607 Yes Northwest\_Ames 1984  
## 1608 Yes Northwest\_Ames 1988  
## 1609 Yes Northwest\_Ames 1977  
## 1611 Yes Northwest\_Ames 1980  
## 1616 Yes Northwest\_Ames 1976  
## 1617 Yes Northwest\_Ames 1975  
## 1619 Yes Northwest\_Ames 1976  
## 1625 Yes North\_Ames 2002  
## 1635 Yes Northridge\_Heights 2004  
## 1636 Yes Northridge\_Heights 2006  
## 1637 Yes Northridge\_Heights 2004  
## 1638 Yes Northridge\_Heights 2005  
## 1639 Yes Northridge\_Heights 2005  
## 1640 Yes Northridge\_Heights 2005  
## 1641 Yes Northridge\_Heights 2005  
## 1642 Yes Northridge\_Heights 2006  
## 1643 Yes Northridge\_Heights 2005  
## 1644 Yes Northridge\_Heights 2006  
## 1645 Yes Northridge\_Heights 2004  
## 1647 Yes Northridge\_Heights 2005  
## 1648 Yes Northridge\_Heights 2004  
## 1649 Yes Northridge\_Heights 2005  
## 1650 Yes Northridge\_Heights 2005  
## 1654 Yes Gilbert 2005  
## 1655 Yes Gilbert 2006  
## 1656 Yes Gilbert 2006  
## 1657 Yes Gilbert 2006  
## 1658 Yes Gilbert 2006  
## 1660 Yes Gilbert 2004  
## 1661 Yes Bloomington\_Heights 2003  
## 1663 Yes Bloomington\_Heights 2004  
## 1664 Yes Bloomington\_Heights 2005  
## 1666 Yes Bloomington\_Heights 2005  
## 1667 Yes Gilbert 2002  
## 1668 Yes Gilbert 2004  
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## 1674 Yes Northridge 1998  
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## 1683 Yes Somerset 2006  
## 1684 Yes Somerset 2006  
## 1685 Yes Somerset 2005  
## 1687 Yes Somerset 2006  
## 1689 Yes Sawyer\_West 2005  
## 1693 Yes Sawyer\_West 2005  
## 1694 Yes Sawyer\_West 2005  
## 1695 Yes Sawyer\_West 1997  
## 1696 Yes Sawyer\_West 1992  
## 1711 Yes Veenker 1974  
## 1712 Yes Northridge 1992  
## 1713 Yes Northridge 1994  
## 1716 Yes Somerset 2000  
## 1717 Yes Somerset 1999  
## 1718 Yes Somerset 2000  
## 1721 Yes Veenker 1995  
## 1722 Yes Veenker 1977  
## 1723 Yes Greens 1980  
## 1724 Yes Greens 1980  
## 1725 Yes Greens 1980  
## 1728 Yes Northwest\_Ames 1968  
## 1730 Yes Northwest\_Ames 1972  
## 1731 Yes Northwest\_Ames 1967  
## 1742 Yes North\_Ames 1965  
## 1743 Yes North\_Ames 1964  
## 1756 Yes North\_Ames 1961  
## 1762 Yes North\_Ames 1966  
## 1766 Yes North\_Ames 1958  
## 1776 Yes North\_Ames 1941  
## 1787 Yes Old\_Town 1936  
## 1788 Yes North\_Ames 1965  
## 1789 Yes North\_Ames 1963  
## 1795 Yes North\_Ames 1961  
## 1797 Yes North\_Ames 1957  
## 1808 Yes Old\_Town 1900  
## 1823 Yes Old\_Town 1914  
## 1844 Yes Old\_Town 1962  
## 1862 Yes Sawyer 1966  
## 1866 Yes Sawyer 1967  
## 1867 Yes Sawyer 1968  
## 1870 Yes Sawyer 1955  
## 1872 Yes Sawyer 1956  
## 1873 Yes Clear\_Creek 1967  
## 1875 Yes Clear\_Creek 1953  
## 1879 Yes Clear\_Creek 1986  
## 1881 Yes Edwards 1928  
## 1888 Yes Sawyer\_West 1993  
## 1889 Yes College\_Creek 2005  
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## 1894 Yes College\_Creek 2005  
## 1895 Yes College\_Creek 2005  
## 1896 Yes College\_Creek 2005  
## 1898 Yes Clear\_Creek 1964  
## 1899 Yes Clear\_Creek 1969  
## 1903 Yes College\_Creek 1995  
## 1905 Yes College\_Creek 1997  
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## 1907 Yes College\_Creek 1999  
## 1910 Yes College\_Creek 2002  
## 1912 Yes College\_Creek 1978  
## 1918 Yes College\_Creek 2002  
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## 1922 Yes College\_Creek 1999  
## 1923 Yes College\_Creek 1996  
## 1924 Yes College\_Creek 1998  
## 1926 Yes College\_Creek 2003  
## 1927 Yes College\_Creek 2003  
## 1928 Yes College\_Creek 2006  
## 1930 Yes College\_Creek 2005  
## 1931 Yes College\_Creek 2004  
## 1932 Yes College\_Creek 2005  
## 1934 Yes College\_Creek 2005  
## 1937 Yes Edwards 2003  
## 1955 Yes South\_and\_West\_of\_Iowa\_State\_University 1926  
## 1962 Yes Crawford 1920  
## 1964 Yes Crawford 1940  
## 1966 Yes Crawford 1936  
## 1967 Yes Crawford 1929  
## 1969 Yes Crawford 1930  
## 1970 Yes Crawford 1956  
## 1971 Yes Crawford 1977  
## 1972 Yes Crawford 1950  
## 1974 Yes Crawford 1969  
## 1985 Yes Mitchell 2001  
## 1989 Yes Green\_Hills 1986  
## 1990 Yes Timberland 1958  
## 1991 Yes Timberland 1981  
## 1993 Yes Timberland 1990  
## 1994 Yes Timberland 1990  
## 1998 Yes Mitchell 1997  
## 1999 Yes Mitchell 1998  
## 2009 Yes Mitchell 1977  
## 2013 Yes Mitchell 1974  
## Overall\_Qual Garage\_Area First\_Flr\_SF Gr\_Liv\_Area  
## 16 Above\_Average 480 1004 1004  
## 18 Average 304 1056 1056  
## 19 Below\_Average 525 882 882  
## 21 Above\_Average 264 483 987  
## 23 Above\_Average 264 525 1092  
## 55 Above\_Average 264 918 918  
## 56 Above\_Average 480 1097 1097  
## 59 Average 336 894 894  
## 62 Good 480 600 1200  
## 63 Good 480 600 1200  
## 64 Good 484 696 1416  
## 65 Good 496 530 1080  
## 69 Above\_Average 475 725 1479  
## 77 Average 490 1232 1232  
## 80 Average 0 1728 1728  
## 82 Average 280 1063 1063  
## 84 Average 244 1268 1268  
## 90 Average 308 1143 1143  
## 91 Average 294 1314 1314  
## 92 Above\_Average 312 1194 1194  
## 94 Above\_Average 440 1580 1580  
## 95 Average 318 1064 1064  
## 97 Average 264 988 988  
## 98 Average 246 1057 1057  
## 99 Below\_Average 676 985 985  
## 100 Average 392 827 827  
## 101 Above\_Average 330 912 1458  
## 102 Above\_Average 576 1056 1056  
## 110 Below\_Average 240 1157 1844  
## 111 Below\_Average 0 792 1140  
## 113 Average 360 1028 1028  
## 114 Average 551 1347 1347  
## 115 Fair 379 840 1605  
## 116 Below\_Average 220 747 747  
## 117 Average 240 804 804  
## 118 Poor 780 832 832  
## 119 Very\_Good 288 930 1566  
## 120 Average 0 1128 2256  
## 121 Above\_Average 923 1236 1236  
## 122 Below\_Average 528 741 1363  
## 123 Below\_Average 560 1246 2290  
## 124 Above\_Average 624 868 1470  
## 126 Below\_Average 200 765 765  
## 129 Good 480 902 1710  
## 130 Above\_Average 180 662 1324  
## 132 Average 672 1032 1812  
## 134 Average 180 725 1224  
## 135 Average 0 1212 1392  
## 137 Below\_Average 0 942 1884  
## 138 Average 0 780 1020  
## 140 Average 528 1392 1392  
## 142 Average 270 1060 1060  
## 143 Average 416 892 892  
## 144 Above\_Average 299 663 1352  
## 148 Below\_Average 436 1067 1067  
## 151 Average 596 1144 1144  
## 153 Average 504 1298 1298  
## 160 Average 580 965 965  
## 162 Average 308 1026 1026  
## 163 Average 308 894 894  
## 168 Above\_Average 420 848 848  
## 171 Average 319 992 992  
## 172 Average 0 1664 1664  
## 173 Average 336 1196 1196  
## 174 Below\_Average 440 1121 1121  
## 176 Average 364 1526 1526  
## 177 Average 260 1296 1296  
## 178 Above\_Average 216 841 1647  
## 179 Above\_Average 399 856 856  
## 185 Below\_Average 240 796 1154  
## 186 Above\_Average 625 727 1107  
## 187 Below\_Average 384 859 1178  
## 203 Below\_Average 0 630 630  
## 204 Below\_Average 0 546 1092  
## 205 Below\_Average 286 546 1092  
## 207 Average 312 1188 1188  
## 209 Above\_Average 502 882 882  
## 210 Above\_Average 528 1434 1434  
## 226 Good 544 1411 1411  
## 228 Good 529 1154 2050  
## 233 Good 478 1601 1601  
## 240 Above\_Average 583 1378 2119  
## 241 Average 0 896 1792  
## 242 Above\_Average 440 1026 1026  
## 243 Average 477 1180 1180  
## 244 Average 336 1050 1050  
## 245 Below\_Average 576 864 864  
## 246 Below\_Average 660 864 864  
## 247 Below\_Average 576 864 864  
## 248 Below\_Average 576 864 864  
## 249 Average 440 765 1365  
## 250 Average 280 630 1302  
## 252 Average 264 630 1302  
## 253 Above\_Average 440 958 958  
## 254 Above\_Average 440 804 1548  
## 255 Above\_Average 440 855 1456  
## 256 Good 440 1055 1055  
## 257 Above\_Average 440 855 1322  
## 259 Above\_Average 440 855 1441  
## 260 Above\_Average 440 855 1456  
## 261 Good 345 836 836  
## 262 Average 288 892 892  
## 263 Average 656 1120 1120  
## 347 Above\_Average 288 626 1217  
## 351 Below\_Average 294 841 841  
## 352 Above\_Average 360 784 784  
## 353 Average 400 980 980  
## 358 Average 300 912 912  
## 370 Below\_Average 490 1620 1620  
## 371 Above\_Average 441 829 1556  
## 381 Average 440 1568 1568  
## 384 Below\_Average 396 894 894  
## 388 Average 888 1776 1776  
## 390 Average 610 1313 1313  
## 391 Average 520 1292 1292  
## 392 Average 480 1154 1154  
## 393 Above\_Average 645 1445 1445  
## 394 Average 330 960 960  
## 395 Below\_Average 0 708 708  
## 396 Average 352 979 1203  
## 397 Above\_Average 505 1505 1505  
## 400 Average 338 1050 1050  
## 401 Above\_Average 271 1112 1668  
## 402 Average 264 1113 1113  
## 403 Average 792 1584 1584  
## 405 Above\_Average 514 1394 1394  
## 408 Above\_Average 576 1392 1392  
## 409 Below\_Average 368 1281 1738  
## 410 Average 286 1144 1144  
## 411 Above\_Average 338 1632 1632  
## 413 Below\_Average 294 1200 1200  
## 415 Average 498 1297 1297  
## 416 Average 495 1866 1866  
## 417 Above\_Average 297 1062 1062  
## 418 Average 270 1319 1319  
## 422 Average 240 793 793  
## 423 Fair 420 1014 1699  
## 424 Good 410 801 1527  
## 425 Average 246 1200 1200  
## 426 Above\_Average 240 972 972  
## 427 Fair 366 792 792  
## 428 Average 180 808 1656  
## 429 Average 720 676 1352  
## 431 Below\_Average 528 1313 2377  
## 433 Average 576 846 846  
## 434 Fair 320 725 725  
## 437 Above\_Average 480 951 951  
## 439 Average 756 1306 1306  
## 440 Above\_Average 498 1478 1478  
## 441 Above\_Average 384 1142 1142  
## 443 Fair 400 1040 1040  
## 444 Below\_Average 420 1040 1040  
## 445 Average 240 1136 1904  
## 446 Average 294 1339 1339  
## 447 Average 240 732 732  
## 449 Below\_Average 384 832 1461  
## 450 Above\_Average 576 1064 1495  
## 451 Above\_Average 483 993 1806  
## 452 Average 564 941 941  
## 457 Above\_Average 324 972 1944  
## 458 Average 0 764 1464  
## 459 Below\_Average 0 1101 1701  
## 460 Average 400 960 1960  
## 461 Good 240 707 1389  
## 462 Average 0 801 1447  
## 463 Below\_Average 576 936 936  
## 464 Average 256 811 1387  
## 465 Below\_Average 288 861 861  
## 466 Poor 308 612 612  
## 467 Average 287 792 792  
## 468 Below\_Average 0 736 1452  
## 469 Below\_Average 720 833 1510  
## 470 Average 240 720 1284  
## 471 Average 360 1075 2138  
## 473 Above\_Average 280 664 1288  
## 476 Average 280 1022 1022  
## 477 Average 456 1188 1869  
## 478 Above\_Average 207 1044 1480  
## 479 Above\_Average 640 780 1521  
## 480 Below\_Average 0 720 720  
## 481 Fair 0 797 797  
## 484 Above\_Average 192 952 952  
## 485 Below\_Average 240 757 1324  
## 486 Average 216 884 1348  
## 487 Above\_Average 280 825 1412  
## 488 Average 320 822 1142  
## 490 Average 440 1301 1301  
## 492 Average 180 875 875  
## 496 Above\_Average 576 1048 1768  
## 497 Above\_Average 0 929 2229  
## 498 Average 0 1088 2128  
## 501 Above\_Average 379 741 1427  
## 502 Good 0 978 1864  
## 504 Below\_Average 0 892 892  
## 505 Below\_Average 220 704 704  
## 508 Average 252 1152 1152  
## 509 Very\_Poor 0 904 904  
## 510 Above\_Average 300 697 1369  
## 511 Average 226 687 1112  
## 513 Average 668 1052 1052  
## 514 Average 288 899 899  
## 515 Above\_Average 504 1034 1034  
## 516 Average 576 858 858  
## 517 Average 288 1092 1092  
## 521 Poor 0 660 660  
## 522 Average 452 1473 1473  
## 524 Fair 452 1733 1733  
## 525 Below\_Average 498 1383 1383  
## 526 Above\_Average 480 1689 1689  
## 527 Above\_Average 240 892 1639  
## 528 Below\_Average 234 672 672  
## 529 Below\_Average 290 845 845  
## 530 Average 266 1049 1049  
## 531 Average 281 1148 1716  
## 532 Below\_Average 296 755 1510  
## 534 Above\_Average 576 1338 1338  
## 540 Average 410 1535 1535  
## 542 Average 400 1535 1535  
## 543 Average 400 1535 1535  
## 556 Average 576 1040 1040  
## 559 Average 672 1097 1097  
## 560 Average 480 990 990  
## 567 Average 0 1040 1040  
## 569 Average 444 914 914  
## 570 Average 484 1040 1040  
## 571 Average 336 864 864  
## 572 Average 252 1268 1268  
## 573 Average 338 864 864  
## 574 Average 396 768 768  
## 586 Below\_Average 520 1126 1126  
## 589 Below\_Average 544 1149 1149  
## 590 Above\_Average 352 1125 1125  
## 591 Above\_Average 525 1072 1072  
## 593 Below\_Average 240 1088 1529  
## 595 Fair 528 944 944  
## 596 Average 313 1560 1560  
## 597 Above\_Average 528 684 1196  
## 598 Average 256 854 1298  
## 603 Above\_Average 440 1232 1232  
## 604 Above\_Average 216 1160 1608  
## 605 Good 215 628 1228  
## 614 Above\_Average 300 1152 1152  
## 616 Above\_Average 452 516 1032  
## 617 Above\_Average 462 561 1229  
## 618 Above\_Average 462 561 1229  
## 621 Average 468 672 1344  
## 622 Average 189 596 1192  
## 623 Fair 0 1013 1526  
## 624 Below\_Average 200 572 572  
## 630 Above\_Average 351 926 926  
## 631 Average 539 1302 1734  
## 647 Below\_Average 297 526 988  
## 648 Average 288 874 874  
## 650 Below\_Average 286 630 630  
## 652 Below\_Average 286 546 1092  
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## 654 Average 698 883 883  
## 655 Average 480 796 1362  
## 656 Average 440 624 1287  
## 669 Above\_Average 495 1474 1474  
## 671 Above\_Average 738 1488 1488  
## 679 Above\_Average 473 1444 1444  
## 680 Average 439 1178 1178  
## 682 Above\_Average 460 1054 1054  
## 683 Average 576 864 864  
## 686 Above\_Average 264 483 987  
## 687 Above\_Average 352 483 987  
## 688 Above\_Average 280 483 987  
## 689 Above\_Average 264 483 987  
## 692 Above\_Average 460 855 1456  
## 712 Good 388 1266 1266  
## 759 Average 384 984 984  
## 760 Average 308 890 890  
## 779 Excellent 864 1599 2944  
## 786 Average 576 912 912  
## 787 Average 576 925 925  
## 789 Average 506 1656 1656  
## 794 Average 267 1014 1014  
## 795 Below\_Average 352 907 907  
## 796 Below\_Average 283 952 952  
## 797 Average 525 1128 1128  
## 802 Average 451 1114 1114  
## 803 Average 312 1053 1053  
## 806 Fair 287 720 720  
## 807 Fair 0 729 729  
## 808 Average 205 1077 1077  
## 810 Above\_Average 288 1032 1252  
## 811 Average 264 1337 1337  
## 816 Average 260 1098 1098  
## 817 Average 336 1144 1144  
## 818 Average 506 1283 1283  
## 819 Average 292 1176 1176  
## 823 Above\_Average 297 1196 1196  
## 825 Average 384 1104 1104  
## 826 Average 636 1152 1152  
## 827 Average 400 950 950  
## 828 Average 840 952 952  
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## 831 Below\_Average 390 869 869  
## 832 Average 288 747 1159  
## 833 Average 288 1048 1558  
## 834 Below\_Average 308 672 672  
## 835 Below\_Average 0 694 1294  
## 839 Above\_Average 352 1253 1253  
## 840 Above\_Average 401 1081 1081  
## 842 Average 414 910 910  
## 843 Average 576 876 876  
## 845 Average 311 1256 1256  
## 846 Average 299 1027 1027  
## 848 Above\_Average 576 819 1320  
## 850 Above\_Average 528 832 832  
## 851 Above\_Average 240 854 1278  
## 852 Average 0 1800 1800  
## 853 Average 480 1024 1588  
## 854 Average 350 825 825  
## 857 Average 686 958 1539  
## 858 Average 400 948 1323  
## 861 Average 256 672 672  
## 862 Above\_Average 308 728 1456  
## 863 Below\_Average 0 828 1594  
## 866 Average 225 960 1740  
## 867 Good 0 1027 1027  
## 868 Above\_Average 828 884 1436  
## 870 Average 250 789 789  
## 871 Average 869 904 1499  
## 872 Average 288 928 928  
## 873 Below\_Average 281 901 901  
## 875 Average 420 830 1627  
## 876 Average 720 876 1416  
## 877 Average 513 624 1344  
## 878 Average 308 709 1017  
## 879 Average 393 1377 2350  
## 880 Above\_Average 396 1134 2058  
## 881 Average 0 884 1540  
## 884 Poor 400 723 1086  
## 886 Average 308 984 984  
## 887 Average 352 1050 1795  
## 888 Average 308 882 882  
## 890 Average 288 1143 1143  
## 891 Good 252 1195 1668  
## 892 Average 308 779 935  
## 893 Average 240 1144 1738  
## 894 Average 0 784 784  
## 895 Average 240 832 1210  
## 896 Above\_Average 200 736 1290  
## 898 Average 370 949 949  
## 901 Above\_Average 240 874 1342  
## 902 Above\_Average 160 1013 1013  
## 903 Below\_Average 336 624 1136  
## 904 Good 400 1245 2009  
## 905 Average 576 1226 1902  
## 907 Above\_Average 502 751 1362  
## 908 Below\_Average 240 520 520  
## 909 Average 240 1072 1285  
## 912 Average 240 988 1505  
## 913 Above\_Average 275 838 838  
## 916 Above\_Average 440 768 768  
## 918 Above\_Average 400 1272 1969  
## 919 Average 400 880 1308  
## 921 Above\_Average 384 788 1236  
## 923 Average 312 720 1271  
## 924 Below\_Average 680 1120 1588  
## 925 Average 0 808 1355  
## 926 Average 440 1075 1075  
## 927 Average 384 1040 1040  
## 928 Above\_Average 484 1096 1096  
## 929 Average 408 904 904  
## 930 Average 450 894 894  
## 931 Above\_Average 504 1034 1034  
## 933 Average 506 1126 1126  
## 934 Below\_Average 400 1258 1258  
## 935 Average 400 1140 1140  
## 937 Average 300 960 960  
## 942 Average 627 864 1350  
## 953 Average 322 1509 1509  
## 954 Average 0 864 864  
## 956 Average 0 820 1347  
## 957 Above\_Average 0 572 1096  
## 958 Average 200 616 1111  
## 964 Average 528 990 990  
## 966 Average 672 990 990  
## 975 Average 576 1076 1076  
## 977 Average 280 924 924  
## 979 Average 352 780 780  
## 991 Above\_Average 420 848 848  
## 992 Above\_Average 420 848 848  
## 1002 Above\_Average 420 848 848  
## 1003 Above\_Average 420 848 848  
## 1007 Above\_Average 480 1127 1127  
## 1008 Below\_Average 588 1181 1181  
## 1014 Below\_Average 0 784 784  
## 1016 Average 0 929 1137  
## 1017 Below\_Average 286 930 930  
## 1018 Average 240 768 1200  
## 1019 Below\_Average 548 997 1470  
## 1021 Below\_Average 312 1204 1204  
## 1023 Average 0 864 864  
## 1024 Fair 0 864 864  
## 1025 Average 0 936 1716  
## 1026 Above\_Average 400 810 1482  
## 1028 Above\_Average 576 1390 1694  
## 1030 Average 0 1024 1964  
## 1034 Above\_Average 400 676 1264  
## 1035 Above\_Average 599 819 1603  
## 1036 Good 270 851 1502  
## 1039 Average 225 932 1374  
## 1045 Above\_Average 195 919 919  
## 1046 Below\_Average 0 796 796  
## 1047 Above\_Average 432 816 816  
## 1048 Average 0 780 1200  
## 1052 Very\_Poor 487 733 733  
## 1053 Below\_Average 195 671 1049  
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## 1071 Above\_Average 438 1495 1495  
## 1079 Average 0 1092 1092  
## 1084 Below\_Average 297 526 988  
## 1085 Average 257 1160 1160  
## 1086 Below\_Average 0 630 630  
## 1087 Average 520 988 988  
## 1088 Average 264 816 816  
## 1091 Average 288 1150 1836  
## 1117 Above\_Average 564 1032 1032  
## 1118 Above\_Average 495 1177 1177  
## 1120 Average 462 780 1620  
## 1123 Above\_Average 576 981 981  
## 1125 Below\_Average 480 872 872  
## 1127 Below\_Average 528 864 864  
## 1128 Good 367 767 767  
## 1130 Above\_Average 264 525 1092  
## 1131 Above\_Average 264 672 1218  
## 1132 Above\_Average 264 672 1218  
## 1135 Above\_Average 440 958 958  
## 1170 Above\_Average 432 616 1412  
## 1203 Very\_Good 895 1795 1795  
## 1218 Good 0 1143 1143  
## 1219 Average 576 1094 1094  
## 1225 Average 308 894 894  
## 1226 Average 576 1057 1057  
## 1228 Below\_Average 544 1120 1120  
## 1229 Average 349 1696 1696  
## 1233 Average 431 1037 1037  
## 1235 Above\_Average 542 1055 1055  
## 1264 Average 528 1680 1680  
## 1265 Average 308 1107 1107  
## 1266 Average 318 1214 1214  
## 1269 Below\_Average 530 1224 1224  
## 1270 Average 286 1422 1422  
## 1273 Above\_Average 264 1138 1138  
## 1274 Average 297 912 912  
## 1275 Average 396 1074 1074  
## 1277 Average 440 1187 1187  
## 1278 Average 312 894 894  
## 1281 Above\_Average 309 1302 1302  
## 1285 Average 624 1327 1327  
## 1286 Below\_Average 462 1224 1224  
## 1287 Average 512 908 908  
## 1288 Fair 0 442 670  
## 1290 Average 288 1150 1150  
## 1292 Average 240 968 1376  
## 1295 Above\_Average 525 1254 1254  
## 1296 Average 275 912 912  
## 1297 Average 315 874 1524  
## 1298 Above\_Average 596 1465 2380  
## 1299 Above\_Average 315 936 936  
## 1300 Average 308 1008 1008  
## 1301 Average 692 1053 1053  
## 1302 Average 308 1056 1056  
## 1303 Average 260 1056 1056  
## 1305 Average 308 922 922  
## 1310 Above\_Average 410 948 948  
## 1312 Below\_Average 352 1040 1540  
## 1313 Average 252 928 928  
## 1314 Below\_Average 280 1647 1647  
## 1315 Average 420 924 924  
## 1317 Average 576 893 893  
## 1318 Average 371 1216 1728  
## 1320 Below\_Average 580 845 1281  
## 1321 Below\_Average 216 968 968  
## 1322 Average 0 751 1534  
## 1325 Average 504 1040 2080  
## 1327 Above\_Average 240 1082 1082  
## 1328 Above\_Average 315 1168 1846  
## 1329 Average 276 988 988  
## 1330 Average 357 1238 1238  
## 1332 Average 338 1170 1170  
## 1333 Average 324 1242 1242  
## 1334 Average 351 1377 1377  
## 1335 Average 0 1800 1800  
## 1340 Above\_Average 576 866 1296  
## 1341 Average 184 1022 1022  
## 1342 Average 672 936 936  
## 1343 Average 180 967 967  
## 1344 Average 379 1072 1072  
## 1345 Average 576 680 1174  
## 1346 Fair 308 679 1183  
## 1347 Below\_Average 672 1131 1131  
## 1348 Below\_Average 252 761 1141  
## 1349 Below\_Average 308 960 960  
## 1350 Below\_Average 342 1156 1798  
## 1351 Average 480 968 968  
## 1353 Above\_Average 374 914 1642  
## 1354 Average 250 842 1472  
## 1355 Average 480 616 1232  
## 1356 Average 560 1422 2337  
## 1357 Above\_Average 468 991 1650  
## 1358 Above\_Average 205 1178 2210  
## 1359 Average 336 687 1358  
## 1361 Above\_Average 506 1260 2291  
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## 1364 Average 160 912 1248  
## 1365 Below\_Average 384 1382 1382  
## 1368 Above\_Average 217 608 1232  
## 1369 Average 240 884 884  
## 1370 Average 280 899 1322  
## 1371 Average 230 1014 1426  
## 1372 Average 379 903 1281  
## 1373 Average 180 939 1513  
## 1374 Above\_Average 180 986 986  
## 1377 Above\_Average 384 698 1396  
## 1379 Average 240 933 1173  
## 1380 Average 216 969 1214  
## 1382 Good 280 1108 1108  
## 1387 Average 288 581 1111  
## 1388 Average 660 854 1382  
## 1389 Good 308 964 1889  
## 1390 Average 0 840 840  
## 1391 Below\_Average 264 866 1484  
## 1393 Average 240 778 1282  
## 1394 Average 572 1452 1452  
## 1395 Below\_Average 440 1005 1005  
## 1397 Average 264 1040 1040  
## 1398 Above\_Average 240 913 913  
## 1399 Average 384 894 894  
## 1402 Average 528 943 943  
## 1403 Above\_Average 528 1285 1285  
## 1404 Average 315 912 912  
## 1406 Average 638 1567 2654  
## 1407 Average 576 1416 1416  
## 1409 Above\_Average 494 1299 1299  
## 1410 Average 303 1176 1176  
## 1415 Average 649 1630 1630  
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## 1421 Below\_Average 308 943 943  
## 1422 Below\_Average 0 1440 1440  
## 1423 Average 264 1038 1038  
## 1424 Average 253 1080 1480  
## 1425 Average 252 1340 1340  
## 1434 Good 440 728 1456  
## 1445 Average 299 990 990  
## 1448 Average 242 1097 1097  
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## 1456 Average 440 894 894  
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## 1493 Below\_Average 0 1152 1152  
## 1494 Below\_Average 248 948 948  
## 1496 Below\_Average 384 796 1346  
## 1498 Below\_Average 528 864 864  
## 1499 Below\_Average 280 948 948  
## 1502 Average 352 1422 1422  
## 1503 Above\_Average 240 759 1298  
## 1505 Good 216 567 1098  
## 1506 Above\_Average 228 851 1436  
## 1510 Average 552 661 1250  
## 1511 Average 240 954 954  
## 1512 Above\_Average 492 979 1958  
## 1513 Average 871 1001 2002  
## 1518 Average 528 760 1355  
## 1523 Above\_Average 462 529 1045  
## 1527 Average 0 997 1517  
## 1528 Average 0 936 1601  
## 1529 Average 282 910 1558  
## 1530 Average 0 1034 1991  
## 1534 Above\_Average 470 912 912  
## 1535 Above\_Average 484 1080 1080  
## 1538 Above\_Average 528 1026 1026  
## 1559 Above\_Average 460 936 936  
## 1560 Average 576 1632 1632  
## 1561 Average 572 1060 1060  
## 1562 Average 528 1142 1142  
## 1564 Below\_Average 297 530 992  
## 1566 Below\_Average 286 546 1092  
## 1567 Above\_Average 539 1062 1062  
## 1568 Average 678 1008 1008  
## 1571 Average 531 716 1432  
## 1572 Average 624 768 768  
## 1573 Below\_Average 444 1608 1608  
## 1574 Below\_Average 360 845 845  
## 1575 Average 502 1178 1178  
## 1578 Average 0 974 974  
## 1580 Above\_Average 313 1024 1024  
## 1618 Average 495 1074 1074  
## 1621 Above\_Average 462 1103 1103  
## 1624 Below\_Average 576 874 874  
## 1626 Above\_Average 264 494 1030  
## 1628 Above\_Average 264 672 1218  
## 1629 Above\_Average 264 483 948  
## 1632 Average 300 1387 1387  
## 1633 Average 288 900 900  
## 1634 Above\_Average 460 855 1456  
## 1690 Above\_Average 0 1131 1131  
## 1699 Above\_Average 484 1217 1217  
## 1700 Above\_Average 472 636 1320  
## 1702 Average 300 965 965  
## 1703 Average 504 1728 1728  
## 1704 Above\_Average 528 1286 1654  
## 1705 Average 576 1211 1211  
## 1706 Above\_Average 492 1212 1212  
## 1707 Average 294 909 909  
## 1708 Average 288 935 935  
## 1709 Average 0 912 912  
## 1710 Average 288 941 941  
## 1714 Good 480 520 1223  
## 1715 Good 480 520 1200  
## 1726 Average 501 1193 1193  
## 1732 Good 528 1164 1164  
## 1733 Average 384 980 980  
## 1734 Average 504 1051 1051  
## 1735 Average 530 884 1770  
## 1738 Average 884 1200 1200  
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## 1751 Average 273 1043 1043  
## 1752 Below\_Average 305 774 1230  
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## 1755 Average 576 936 1252  
## 1757 Average 240 1624 1624  
## 1758 Average 528 2136 2136  
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## 1760 Average 234 1024 1728  
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## 1768 Above\_Average 353 1124 1124  
## 1769 Average 447 1236 1236  
## 1770 Above\_Average 286 1050 1050  
## 1771 Average 280 1008 1008  
## 1773 Average 684 1145 1145  
## 1775 Average 270 884 884  
## 1777 Average 896 1384 1384  
## 1778 Above\_Average 398 865 1310  
## 1779 Fair 371 713 713  
## 1780 Average 326 1073 1073  
## 1783 Above\_Average 528 774 1595  
## 1790 Above\_Average 264 1207 1207  
## 1791 Average 288 912 912  
## 1792 Above\_Average 539 1194 1194  
## 1793 Above\_Average 288 864 864  
## 1794 Average 308 816 816  
## 1796 Good 484 1472 1472  
## 1798 Below\_Average 0 720 1192  
## 1799 Average 625 1040 1040  
## 1801 Average 286 1040 1040  
## 1802 Fair 400 1040 1040  
## 1803 Fair 400 1040 1040  
## 1806 Average 300 999 999  
## 1807 Average 336 864 864  
## 1809 Below\_Average 210 810 1328  
## 1811 Above\_Average 400 940 1416  
## 1812 Good 576 848 1428  
## 1813 Above\_Average 270 813 813  
## 1814 Below\_Average 576 1084 1951  
## 1815 Average 216 844 844  
## 1817 Average 576 960 960  
## 1818 Average 450 816 1566  
## 1820 Fair 220 1163 1163  
## 1821 Fair 250 840 840  
## 1822 Below\_Average 779 1095 1774  
## 1825 Good 225 815 1690  
## 1826 Above\_Average 216 684 1368  
## 1827 Good 576 998 1762  
## 1828 Above\_Average 312 1200 1200  
## 1829 Average 0 624 1248  
## 1830 Average 624 960 960  
## 1831 Fair 0 1020 1020  
## 1833 Above\_Average 420 1004 1664  
## 1834 Average 410 793 1118  
## 1835 Above\_Average 528 816 1176  
## 1837 Average 450 1015 1015  
## 1838 Below\_Average 0 672 912  
## 1839 Average 225 1042 1576  
## 1840 Average 180 741 1324  
## 1841 Above\_Average 440 1103 1103  
## 1842 Average 205 616 616  
## 1845 Below\_Average 576 960 960  
## 1846 Below\_Average 0 693 693  
## 1847 Average 390 665 1330  
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## 1850 Above\_Average 0 520 754  
## 1852 Average 288 1081 1422  
## 1853 Above\_Average 576 1921 1921  
## 1855 Average 260 1032 1032  
## 1856 Average 180 879 879  
## 1857 Good 246 1073 1073  
## 1858 Below\_Average 459 1382 1382  
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## 1861 Average 528 1064 1064  
## 1863 Above\_Average 336 934 934  
## 1864 Average 286 1059 1059  
## 1865 Average 336 1159 1159  
## 1869 Average 484 1803 1803  
## 1876 Average 576 810 810  
## 1878 Good 450 880 1700  
## 1880 Below\_Average 504 1350 1350  
## 1883 Above\_Average 325 1216 1855  
## 1885 Average 0 1124 1124  
## 1886 Average 280 1002 1456  
## 1902 Average 462 1100 1100  
## 1911 Average 576 954 954  
## 1913 Average 300 971 971  
## 1915 Average 552 894 894  
## 1917 Above\_Average 484 630 1320  
## 1925 Above\_Average 420 848 848  
## 1935 Below\_Average 396 1220 1220  
## 1936 Above\_Average 0 914 914  
## 1938 Average 525 1072 1072  
## 1940 Good 380 970 1709  
## 1941 Good 380 970 1709  
## 1943 Good 380 970 1709  
## 1947 Average 572 864 864  
## 1948 Below\_Average 609 1482 1482  
## 1949 Below\_Average 0 964 1414  
## 1950 Below\_Average 440 954 2230  
## 1952 Above\_Average 240 1192 1595  
## 1957 Above\_Average 216 755 1510  
## 1958 Average 0 1008 1522  
## 1961 Average 240 992 1465  
## 1965 Below\_Average 252 1180 1180  
## 1975 Average 215 976 976  
## 1976 Below\_Average 272 641 641  
## 1977 Below\_Average 327 951 951  
## 1978 Below\_Average 570 897 1336  
## 1979 Fair 0 729 729  
## 1980 Poor 308 480 480  
## 1981 Average 0 1060 1396  
## 1986 Above\_Average 528 1210 1210  
## 1997 Very\_Poor 270 1600 1600  
## 2001 Average 288 874 874  
## 2002 Average 928 1652 1652  
## 2003 Below\_Average 0 630 630  
## 2005 Below\_Average 286 546 1092  
## 2006 Below\_Average 0 546 1092  
## 2007 Below\_Average 286 546 1092  
## 2008 Above\_Average 574 1728 1728  
## 2011 Average 484 902 902  
## 2012 Average 0 970 970  
## 1 Above\_Average 528 1656 1656  
## 3 Above\_Average 312 1329 1329  
## 5 Average 482 928 1629  
## 6 Above\_Average 470 926 1604  
## 7 Very\_Good 506 1280 1280  
## 9 Above\_Average 420 1187 1187  
## 10 Good 506 1341 1341  
## 12 Very\_Good 492 1080 1752  
## 13 Excellent 834 1856 1856  
## 15 Good 663 814 1674  
## 26 Very\_Good 772 1704 1704  
## 27 Good 532 1541 1541  
## 28 Very\_Good 678 1822 1822  
## 29 Excellent 820 2364 2364  
## 32 Very\_Good 484 1370 1370  
## 34 Good 437 1145 1145  
## 35 Very\_Good 430 1269 1269  
## 36 Good 400 744 1374  
## 37 Above\_Average 440 860 1960  
## 38 Good 433 847 1733  
## 39 Good 400 774 1430  
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## 42 Very\_Good 962 1645 2475  
## 43 Good 527 1720 1720  
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## 46 Very\_Good 880 1595 1595  
## 47 Good 676 1218 1218  
## 48 Good 614 764 1547  
## 49 Very\_Good 750 1566 1566  
## 51 Good 618 956 2084  
## 53 Good 463 1222 2110  
## 54 Above\_Average 462 1055 1845  
## 57 Above\_Average 476 888 1564  
## 61 Very\_Good 713 1402 2225  
## 66 Very\_Good 852 1418 1418  
## 70 Good 596 1492 1492  
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## 103 Good 564 1898 2978  
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## 145 Average 591 1373 1373  
## 146 Average 480 720 1440  
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## 149 Good 586 1332 1524  
## 150 Above\_Average 522 1117 1981  
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## 155 Above\_Average 476 977 1732  
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## 157 Very\_Good 776 1694 1694  
## 158 Good 740 1226 1226  
## 159 Good 615 1222 1222  
## 161 Above\_Average 523 804 1682  
## 166 Good 621 1044 2098  
## 167 Good 598 1661 1661  
## 169 Very\_Good 502 1668 1668  
## 170 Good 494 1414 1414  
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## 234 Average 484 1088 1868  
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## 273 Excellent 927 1743 1743  
## 274 Excellent 850 1808 1808  
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## 379 Above\_Average 630 1334 1334  
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## 383 Above\_Average 457 1342 1342  
## 387 Average 576 1728 1728  
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## 474 Very\_Good 424 916 1742  
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## 535 Good 701 2196 2196  
## 536 Good 425 1006 1775  
## 537 Good 473 1079 1879  
## 538 Very\_Good 466 1142 2020  
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## 549 Excellent 702 1800 1800  
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## 625 Very\_Good 482 1648 1648  
## 629 Above\_Average 560 804 1961  
## 632 Good 497 1217 1217  
## 634 Good 513 2036 2036  
## 635 Excellent 912 1620 1620  
## 638 Above\_Average 576 1412 1412  
## 639 Above\_Average 440 1375 2237  
## 640 Good 578 1479 1479  
## 641 Very\_Good 471 1296 1296  
## 642 Good 486 1072 2014  
## 643 Excellent 765 1838 1838  
## 644 Excellent 920 1978 1978  
## 649 Average 504 1404 1404  
## 659 Above\_Average 420 680 1470  
## 661 Above\_Average 386 916 1636  
## 663 Good 406 729 1446  
## 664 Very\_Good 682 1593 1593  
## 665 Very\_Good 462 1337 1337  
## 666 Very\_Good 506 1280 1280  
## 667 Very\_Good 472 1228 1228  
## 672 Good 542 1236 2093  
## 673 Good 528 1688 1688  
## 674 Good 550 2064 2064  
## 675 Above\_Average 619 1542 2872  
## 676 Above\_Average 461 1211 1211  
## 677 Average 540 1126 1126  
## 681 Very\_Good 787 1236 2340  
## 694 Very\_Good 774 1932 1932  
## 696 Very\_Good 866 1710 1710  
## 697 Very\_Good 650 2464 2464  
## 698 Excellent 706 1950 1950  
## 699 Very\_Good 656 948 2088  
## 700 Very\_Excellent 789 2470 2470  
## 701 Excellent 726 1572 2668  
## 702 Good 871 1006 2046  
## 703 Very\_Good 732 1575 1575  
## 705 Excellent 870 1866 1866  
## 707 Very\_Good 588 1518 1518  
## 708 Excellent 564 1684 1684  
## 710 Good 668 1576 1576  
## 713 Good 428 1246 1246  
## 714 Above\_Average 393 813 1515  
## 715 Above\_Average 398 864 1593  
## 716 Good 400 1166 1166  
## 718 Good 434 847 1986  
## 719 Above\_Average 451 962 1792  
## 720 Good 431 1008 1892  
## 721 Good 388 788 1490  
## 722 Good 403 707 1414  
## 725 Excellent 687 1533 2172  
## 727 Very\_Good 751 1251 2501  
## 728 Very\_Good 839 2113 2113  
## 729 Good 783 1108 2197  
## 730 Good 525 1223 2127  
## 731 Very\_Good 830 1580 1580  
## 735 Very\_Good 758 1563 1563  
## 736 Good 554 1428 1428  
## 737 Very\_Good 880 955 1874  
## 738 Very\_Good 480 1460 1460  
## 739 Very\_Good 588 1372 1372  
## 740 Good 529 1372 1372  
## 742 Good 603 866 1768  
## 744 Very\_Good 836 1050 2078  
## 745 Good 562 822 1665  
## 746 Very\_Good 660 1660 1660  
## 747 Good 462 1218 1218  
## 749 Above\_Average 542 835 1696  
## 752 Good 483 1162 1162  
## 754 Above\_Average 575 1679 1679  
## 755 Good 483 832 1657  
## 756 Above\_Average 627 827 1677  
## 757 Good 506 844 1737  
## 763 Above\_Average 473 1364 2683  
## 764 Good 530 1391 1391  
## 766 Good 495 1245 1245  
## 767 Above\_Average 480 600 1200  
## 770 Above\_Average 440 757 1549  
## 772 Excellent 545 1310 1310  
## 774 Excellent 484 1557 1557  
## 776 Very\_Excellent 846 1469 2393  
## 778 Very\_Good 477 1239 1239  
## 780 Very\_Good 550 1671 1671  
## 781 Good 530 1682 1682  
## 782 Above\_Average 516 1427 1427  
## 784 Good 578 1620 1620  
## 785 Above\_Average 624 1548 2614  
## 790 Good 464 845 1670  
## 791 Very\_Good 831 1175 2715  
## 792 Good 588 999 999  
## 793 Good 486 1098 1978  
## 798 Above\_Average 576 1425 1425  
## 799 Above\_Average 490 1165 1165  
## 801 Average 502 1265 1265  
## 812 Above\_Average 377 1661 1661  
## 814 Above\_Average 504 1362 1362  
## 815 Above\_Average 296 1431 1431  
## 820 Average 480 1440 1440  
## 821 Above\_Average 433 1261 1261  
## 822 Above\_Average 441 1570 1570  
## 836 Above\_Average 490 858 1716  
## 841 Good 505 2069 2069  
## 860 Above\_Average 520 1584 2792  
## 883 Very\_Excellent 880 1521 2775  
## 885 Good 342 1313 2495  
## 910 Good 240 1133 1820  
## 911 Above\_Average 672 1170 1716  
## 914 Above\_Average 360 1242 1984  
## 915 Very\_Good 228 833 1666  
## 938 Average 354 1383 1383  
## 939 Above\_Average 564 1252 1252  
## 944 Above\_Average 431 1291 1291  
## 947 Above\_Average 312 1357 1357  
## 950 Above\_Average 360 1307 2358  
## 951 Average 0 1518 1518  
## 952 Above\_Average 396 1163 1674  
## 959 Good 534 1626 1626  
## 960 Good 453 1101 2200  
## 961 Good 472 1302 2037  
## 963 Above\_Average 438 1643 1643  
## 967 Good 558 1418 1418  
## 968 Good 532 782 1652  
## 969 Good 527 880 1724  
## 970 Good 577 1479 1479  
## 971 Good 530 1494 1494  
## 972 Good 626 928 1823  
## 976 Average 440 1558 1558  
## 982 Good 570 1290 2161  
## 983 Very\_Good 660 1004 1852  
## 984 Good 541 1153 2031  
## 985 Very\_Good 905 1055 2263  
## 986 Very\_Good 715 1786 1786  
## 987 Good 543 884 1768  
## 988 Good 596 1129 2327  
## 989 Good 595 798 1640  
## 994 Good 532 1536 1536  
## 995 Good 548 856 1710  
## 997 Good 520 770 1582  
## 998 Very\_Good 484 1234 1234  
## 999 Good 814 1564 1564  
## 1001 Good 410 728 1456  
## 1006 Average 504 1033 1033  
## 1009 Good 397 760 1656  
## 1010 Above\_Average 440 684 1398  
## 1011 Below\_Average 451 1132 1132  
## 1031 Average 621 990 2601  
## 1032 Above\_Average 672 1423 2555  
## 1040 Very\_Good 786 983 1873  
## 1041 Good 431 1137 1954  
## 1043 Average 484 1898 1898  
## 1044 Above\_Average 924 1640 1640  
## 1051 Average 356 1151 1955  
## 1056 Very\_Good 525 1648 1648  
## 1057 Good 786 2032 2032  
## 1062 Below\_Average 432 1689 1689  
## 1063 Average 529 1619 1786  
## 1064 Good 512 1501 1501  
## 1066 Very\_Good 800 1646 1646  
## 1067 Very\_Good 612 920 1780  
## 1070 Good 666 796 1612  
## 1072 Above\_Average 616 1651 1651  
## 1073 Above\_Average 578 1256 1256  
## 1075 Very\_Good 749 1482 2262  
## 1076 Very\_Good 520 1728 1728  
## 1077 Good 784 1344 1344  
## 1078 Good 784 1344 1344  
## 1081 Below\_Average 850 1200 1200  
## 1089 Above\_Average 423 983 1750  
## 1090 Average 530 1168 1968  
## 1092 Above\_Average 525 1587 1587  
## 1093 Good 516 2223 2223  
## 1094 Very\_Good 621 2217 2217  
## 1095 Above\_Average 373 806 1572  
## 1096 Above\_Average 388 794 1470  
## 1097 Above\_Average 460 916 1600  
## 1098 Above\_Average 390 754 1384  
## 1099 Very\_Good 499 1652 1652  
## 1101 Above\_Average 451 947 1714  
## 1102 Good 420 691 1553  
## 1103 Above\_Average 482 957 2299  
## 1104 Good 420 1187 1187  
## 1106 Very\_Good 461 1088 1088  
## 1108 Very\_Good 484 1321 1321  
## 1109 Excellent 556 1612 1612  
## 1111 Very\_Good 724 2234 2234  
## 1114 Good 484 725 1479  
## 1115 Good 481 1085 1930  
## 1116 Good 534 1161 1969  
## 1119 Good 550 1040 1725  
## 1124 Good 484 725 1479  
## 1129 Above\_Average 522 1337 1337  
## 1136 Excellent 730 1816 1816  
## 1137 Excellent 774 1828 1828  
## 1138 Very\_Good 818 1694 1694  
## 1140 Very\_Excellent 878 2046 2046  
## 1141 Excellent 694 2069 2643  
## 1142 Very\_Good 866 1634 1634  
## 1143 Very\_Good 908 1976 1976  
## 1144 Excellent 814 1722 2758  
## 1145 Very\_Good 728 1582 2152  
## 1146 Very\_Good 789 1610 2161  
## 1147 Excellent 843 1802 1802  
## 1148 Very\_Good 872 1136 2468  
## 1150 Very\_Good 774 895 1818  
## 1152 Very\_Good 554 1721 1721  
## 1153 Very\_Good 876 1298 1828  
## 1155 Above\_Average 460 1362 1362  
## 1156 Very\_Good 627 1554 1554  
## 1157 Very\_Good 627 1554 1554  
## 1158 Very\_Good 484 1370 1370  
## 1159 Excellent 564 1577 1577  
## 1161 Excellent 617 1869 1869  
## 1162 Very\_Good 550 1324 1324  
## 1163 Above\_Average 400 768 1536  
## 1164 Above\_Average 393 783 1484  
## 1165 Above\_Average 440 738 1495  
## 1166 Above\_Average 350 698 1746  
## 1168 Good 400 728 1456  
## 1169 Good 436 1302 1302  
## 1171 Above\_Average 440 752 1504  
## 1172 Good 400 728 1456  
## 1173 Good 462 1258 1258  
## 1174 Good 648 1258 1258  
## 1175 Good 648 1402 1402  
## 1176 Very\_Good 630 1589 1589  
## 1177 Good 388 1266 1266  
## 1178 Good 630 1530 1530  
## 1179 Good 400 744 1374  
## 1180 Good 434 847 1959  
## 1183 Good 434 847 1948  
## 1184 Above\_Average 463 948 1690  
## 1185 Good 435 864 1995  
## 1186 Above\_Average 460 953 1647  
## 1187 Good 400 774 1430  
## 1190 Above\_Average 460 961 1644  
## 1191 Very\_Good 648 997 2285  
## 1193 Very\_Good 758 1411 2582  
## 1194 Good 600 1108 2385  
## 1195 Good 834 1383 2398  
## 1196 Good 721 1214 2520  
## 1197 Very\_Good 752 1328 2531  
## 1198 Very\_Good 517 1105 2202  
## 1199 Good 605 1369 1369  
## 1200 Very\_Good 852 1542 1542  
## 1204 Good 786 1726 1726  
## 1206 Very\_Good 474 1496 1496  
## 1208 Good 574 982 1977  
## 1210 Good 575 1335 1335  
## 1211 Very\_Good 590 896 1792  
## 1212 Average 561 725 1588  
## 1214 Very\_Good 826 1656 1656  
## 1215 Very\_Good 658 1685 1685  
## 1220 Good 566 1486 1486  
## 1221 Above\_Average 471 936 1721  
## 1222 Good 539 1349 1349  
## 1223 Good 514 1494 1494  
## 1232 Good 518 1516 2167  
## 1234 Average 611 1701 1701  
## 1236 Very\_Good 750 1453 2810  
## 1237 Very\_Good 541 2129 2872  
## 1238 Very\_Good 540 1378 1378  
## 1239 Good 466 1352 1352  
## 1240 Very\_Good 528 1550 1550  
## 1241 Good 569 1241 1241  
## 1242 Above\_Average 440 757 1501  
## 1243 Above\_Average 440 729 1458  
## 1245 Above\_Average 440 769 1573  
## 1246 Above\_Average 440 769 1525  
## 1248 Good 576 975 1950  
## 1249 Very\_Good 552 1072 2048  
## 1251 Average 588 1432 1432  
## 1252 Very\_Good 571 1295 1295  
## 1253 Above\_Average 460 1262 1262  
## 1254 Very\_Good 676 2497 2497  
## 1255 Average 600 1361 2620  
## 1256 Good 650 1057 1929  
## 1258 Above\_Average 570 1403 2411  
## 1259 Above\_Average 480 1082 1082  
## 1260 Above\_Average 528 1295 1295  
## 1261 Good 515 1610 1610  
## 1262 Good 472 1594 1594  
## 1263 Good 473 1091 2075  
## 1279 Good 440 1200 1200  
## 1282 Above\_Average 539 845 2154  
## 1283 Above\_Average 510 1652 1652  
## 1284 Above\_Average 572 1429 1429  
## 1289 Above\_Average 540 1127 1977  
## 1294 Average 432 1280 1280  
## 1304 Above\_Average 464 1721 1721  
## 1306 Above\_Average 484 1657 1657  
## 1323 Good 276 1035 1651  
## 1337 Average 264 876 1812  
## 1352 Very\_Good 816 909 1772  
## 1360 Good 576 1312 2454  
## 1376 Above\_Average 576 752 1376  
## 1384 Good 299 976 1952  
## 1385 Above\_Average 720 1138 2180  
## 1392 Good 498 1262 2267  
## 1396 Average 528 1020 1020  
## 1405 Average 323 1375 1375  
## 1408 Good 224 798 1302  
## 1412 Above\_Average 552 1522 1522  
## 1414 Average 576 1325 1325  
## 1417 Above\_Average 527 2422 2422  
## 1418 Above\_Average 576 2158 2158  
## 1428 Good 833 912 2127  
## 1429 Good 499 1029 1958  
## 1430 Good 440 1316 1316  
## 1431 Very\_Good 870 1651 1651  
## 1432 Very\_Good 868 1482 2574  
## 1433 Good 508 1274 1274  
## 1436 Good 796 1546 1546  
## 1437 Good 524 1270 1270  
## 1439 Above\_Average 440 1314 1314  
## 1440 Good 454 1180 2062  
## 1441 Above\_Average 389 1444 2144  
## 1442 Above\_Average 501 1079 1953  
## 1443 Above\_Average 444 976 2087  
## 1444 Very\_Good 529 1743 1743  
## 1447 Above\_Average 546 882 1796  
## 1450 Above\_Average 684 905 1786  
## 1451 Good 597 988 1873  
## 1452 Good 534 853 1753  
## 1453 Good 517 845 1690  
## 1454 Good 486 985 1842  
## 1455 Good 558 1479 1479  
## 1458 Average 576 1009 1009  
## 1463 Very\_Good 888 2000 2000  
## 1464 Very\_Good 647 1284 2169  
## 1466 Good 527 1459 1459  
## 1467 Good 610 992 1932  
## 1468 Good 542 860 1729  
## 1471 Good 608 1212 1992  
## 1472 Excellent 702 1668 1668  
## 1474 Very\_Good 482 1341 1341  
## 1476 Good 639 939 1797  
## 1477 Above\_Average 437 1330 1330  
## 1478 Good 484 738 1491  
## 1479 Average 400 768 1536  
## 1490 Average 489 734 1408  
## 1501 Above\_Average 180 900 1502  
## 1504 Average 240 981 1768  
## 1507 Good 216 912 1426  
## 1514 Good 264 867 1718  
## 1515 Above\_Average 864 1370 2624  
## 1516 Below\_Average 231 1230 1755  
## 1520 Good 240 960 1740  
## 1522 Above\_Average 580 1560 1560  
## 1524 Very\_Good 509 1020 1020  
## 1525 Above\_Average 484 2515 2515  
## 1526 Very\_Good 691 2726 2726  
## 1532 Very\_Good 538 1625 1625  
## 1533 Above\_Average 486 1299 1299  
## 1536 Average 650 1392 1392  
## 1537 Good 576 1409 1409  
## 1544 Very\_Good 472 1484 1484  
## 1545 Very\_Good 722 1571 1571  
## 1546 Very\_Good 870 1646 1646  
## 1547 Good 528 1240 1240  
## 1549 Above\_Average 422 888 1756  
## 1551 Good 438 1146 1146  
## 1552 Very\_Good 692 1922 1922  
## 1553 Above\_Average 571 1491 1491  
## 1554 Good 452 1146 2486  
## 1555 Average 995 1572 1572  
## 1556 Very\_Good 712 1776 1776  
## 1557 Very\_Excellent 932 1824 1824  
## 1570 Average 672 1676 1676  
## 1581 Above\_Average 550 1390 1390  
## 1583 Above\_Average 400 813 1525  
## 1584 Good 642 993 2236  
## 1585 Above\_Average 423 781 1671  
## 1586 Above\_Average 443 821 1776  
## 1588 Good 576 1392 2462  
## 1589 Good 690 1670 1670  
## 1591 Very\_Good 800 901 1801  
## 1592 Very\_Good 618 2079 2687  
## 1594 Good 462 955 1632  
## 1595 Good 504 1064 1767  
## 1596 Excellent 670 1414 2798  
## 1597 Excellent 675 1102 2473  
## 1598 Excellent 716 1992 2868  
## 1599 Very\_Good 666 1264 2576  
## 1601 Excellent 660 1390 2795  
## 1602 Very\_Excellent 641 1426 2945  
## 1603 Average 672 1547 2320  
## 1604 Excellent 517 1714 1714  
## 1605 Very\_Good 758 1826 1826  
## 1606 Excellent 722 2000 2000  
## 1607 Good 440 1621 1621  
## 1608 Good 786 1377 2183  
## 1609 Good 539 1468 2263  
## 1611 Above\_Average 582 1102 1102  
## 1616 Good 596 1083 1083  
## 1617 Above\_Average 485 1109 1875  
## 1619 Good 528 832 1664  
## 1625 Above\_Average 543 1419 1419  
## 1635 Excellent 770 1980 1980  
## 1636 Very\_Excellent 850 2076 2076  
## 1637 Very\_Good 691 1132 2452  
## 1638 Excellent 670 1117 2206  
## 1639 Very\_Good 878 1038 2098  
## 1640 Excellent 736 1182 2324  
## 1641 Very\_Good 575 1209 2253  
## 1642 Very\_Good 672 1054 2389  
## 1643 Very\_Good 784 1544 2358  
## 1644 Very\_Good 753 1120 1970  
## 1645 Excellent 816 1780 1780  
## 1647 Very\_Good 736 1058 1904  
## 1648 Very\_Good 746 1426 1914  
## 1649 Excellent 556 1565 1565  
## 1650 Good 474 1368 1368  
## 1654 Above\_Average 390 728 1456  
## 1655 Good 440 738 1492  
## 1656 Good 426 664 1496  
## 1657 Good 660 879 1863  
## 1658 Above\_Average 427 1326 1326  
## 1660 Very\_Good 632 1052 2373  
## 1661 Good 420 1557 1557  
## 1663 Good 388 1548 1548  
## 1664 Good 438 1248 1248  
## 1666 Good 440 1506 1506  
## 1667 Above\_Average 393 807 1509  
## 1668 Very\_Good 403 707 1414  
## 1669 Good 433 848 1598  
## 1671 Above\_Average 431 1008 1889  
## 1672 Good 431 956 1886  
## 1673 Very\_Good 870 1407 2392  
## 1674 Very\_Good 885 1079 1976  
## 1675 Very\_Good 768 1205 2234  
## 1676 Excellent 774 1540 2855  
## 1677 Very\_Good 592 1086 1924  
## 1678 Very\_Good 803 1305 2494  
## 1680 Very\_Good 928 1670 1670  
## 1682 Good 834 1616 1616  
## 1683 Very\_Good 584 1278 1278  
## 1684 Very\_Good 776 1489 1489  
## 1685 Good 615 756 1553  
## 1687 Above\_Average 572 1262 1262  
## 1689 Good 612 1400 1400  
## 1693 Good 462 891 1686  
## 1694 Good 449 831 1585  
## 1695 Above\_Average 688 941 1837  
## 1696 Above\_Average 484 810 1603  
## 1711 Good 550 2151 2646  
## 1712 Good 590 1166 2295  
## 1713 Very\_Good 757 1624 1624  
## 1716 Above\_Average 440 768 1524  
## 1717 Good 506 713 1452  
## 1718 Good 490 673 1382  
## 1721 Very\_Good 481 1494 1494  
## 1722 Above\_Average 546 1208 1208  
## 1723 Very\_Good 484 1235 1235  
## 1724 Very\_Good 484 1036 1036  
## 1725 Very\_Good 484 1226 1226  
## 1728 Good 508 2156 2156  
## 1730 Above\_Average 484 1012 1790  
## 1731 Good 477 1334 1334  
## 1742 Above\_Average 299 1565 1565  
## 1743 Above\_Average 461 1251 1251  
## 1756 Average 441 1433 1433  
## 1762 Good 487 1216 2157  
## 1766 Above\_Average 488 1336 1336  
## 1776 Good 791 2039 2039  
## 1787 Average 566 1096 1466  
## 1788 Above\_Average 440 1324 1324  
## 1789 Above\_Average 294 1146 1146  
## 1795 Above\_Average 418 1773 1773  
## 1797 Average 319 1600 1600  
## 1808 Average 624 1007 2014  
## 1823 Good 320 880 1768  
## 1844 Above\_Average 576 1611 2486  
## 1862 Average 564 1320 1320  
## 1866 Average 512 1458 1458  
## 1867 Average 440 1721 1721  
## 1870 Average 454 1779 1779  
## 1872 Average 576 1437 1437  
## 1873 Good 521 1830 1830  
## 1875 Good 667 1304 2287  
## 1879 Good 445 1453 1453  
## 1881 Above\_Average 795 1337 2009  
## 1888 Very\_Good 471 1065 1911  
## 1889 Good 848 1308 1876  
## 1891 Good 675 1498 1498  
## 1892 Good 868 1391 1962  
## 1894 Good 660 1734 1734  
## 1895 Very\_Good 754 1590 1590  
## 1896 Good 638 945 1809  
## 1898 Average 390 1582 1582  
## 1899 Above\_Average 540 988 988  
## 1903 Above\_Average 473 795 1499  
## 1905 Above\_Average 576 1494 1494  
## 1906 Good 472 1588 1588  
## 1907 Good 515 856 1749  
## 1910 Good 474 936 1776  
## 1912 Above\_Average 672 1282 1282  
## 1918 Very\_Good 586 1091 1989  
## 1919 Good 591 878 1762  
## 1922 Very\_Good 646 1090 2214  
## 1923 Good 467 1065 2049  
## 1924 Good 555 1070 1939  
## 1926 Good 545 1390 1390  
## 1927 Above\_Average 544 1700 1700  
## 1928 Good 578 851 1737  
## 1930 Good 782 1552 1552  
## 1931 Good 565 860 1720  
## 1932 Above\_Average 564 750 1500  
## 1934 Good 400 1310 1310  
## 1937 Good 502 1164 2314  
## 1955 Good 312 743 1479  
## 1962 Above\_Average 318 940 1550  
## 1964 Average 410 1125 1717  
## 1966 Good 180 1020 2057  
## 1967 Good 451 1122 1671  
## 1969 Above\_Average 365 1104 1801  
## 1970 Above\_Average 470 1811 1811  
## 1971 Average 621 1647 1647  
## 1972 Average 342 1278 2315  
## 1974 Above\_Average 540 1844 1844  
## 1985 Very\_Good 490 1491 1491  
## 1989 Good 312 1295 1295  
## 1990 Above\_Average 518 1650 1650  
## 1991 Very\_Good 511 1707 1707  
## 1993 Good 484 1339 1339  
## 1994 Good 693 1298 2514  
## 1998 Good 784 1368 1368  
## 1999 Above\_Average 402 1216 1216  
## 2009 Average 484 1126 1126  
## 2013 Average 418 1389 1389

#predictions  
summary(ames1)

## Above\_Median Neighborhood Year\_Built Overall\_Qual  
## No :1006 North\_Ames :326 Min. :1875 Average :582   
## Yes:1007 College\_Creek:180 1st Qu.:1953 Above\_Average:517   
## Old\_Town :178 Median :1972 Good :407   
## Edwards :127 Mean :1970 Very\_Good :230   
## Somerset :115 3rd Qu.:2000 Below\_Average:168   
## Gilbert :109 Max. :2010 Excellent : 58   
## (Other) :978 (Other) : 51   
## Garage\_Area First\_Flr\_SF Gr\_Liv\_Area   
## Min. : 0.0 Min. : 432 Min. : 480   
## 1st Qu.:318.0 1st Qu.: 879 1st Qu.:1127   
## Median :474.0 Median :1078 Median :1436   
## Mean :461.2 Mean :1153 Mean :1477   
## 3rd Qu.:576.0 3rd Qu.:1384 3rd Qu.:1724   
## Max. :995.0 Max. :2726 Max. :2978   
##

newdata = data.frame(Neighborhood = "Gilbert", Year\_Built = 1990, Gr\_Liv\_Area = 2500, Overall\_Qual = "Above\_Average", Garage\_Area = 800, First\_Flr\_SF = 1380 )  
newdata = mutate\_if(newdata, is.numeric, as.integer)  
predict(ames\_fit1\_train, newdata, type="prob")

## # A tibble: 1 × 2  
## .pred\_No .pred\_Yes  
## <dbl> <dbl>  
## 1 0.00107 0.999

newdata1 = data.frame(Neighborhood = "Old\_Town", Year\_Built = 1950, Gr\_Liv\_Area = 2000, Overall\_Qual = "Average", Garage\_Area = 0, First\_Flr\_SF = 1000 )  
newdata1 = mutate\_if(newdata1, is.numeric, as.integer)  
predict(ames\_fit1\_train, newdata1, type="prob")

## # A tibble: 1 × 2  
## .pred\_No .pred\_Yes  
## <dbl> <dbl>  
## 1 0.923 0.0772

newdata2 = data.frame(Neighborhood = "Crawford", Year\_Built = 1995, Gr\_Liv\_Area = 2700, Overall\_Qual = "Excellent", Garage\_Area = 600, First\_Flr\_SF = 2000 )  
newdata2 = mutate\_if(newdata2, is.numeric, as.integer)  
predict(ames\_fit1\_train, newdata2, type="prob")

## # A tibble: 1 × 2  
## .pred\_No .pred\_Yes  
## <dbl> <dbl>  
## 1 0.00183 0.998

newdata3 = data.frame(Neighborhood = "Mitchell", Year\_Built = 1980, Gr\_Liv\_Area = 1400, Overall\_Qual = "Good", Garage\_Area = 400, First\_Flr\_SF = 1000 )  
newdata3 = mutate\_if(newdata3, is.numeric, as.integer)  
predict(ames\_fit1\_train, newdata3, type="prob")

## # A tibble: 1 × 2  
## .pred\_No .pred\_Yes  
## <dbl> <dbl>  
## 1 0.251 0.749

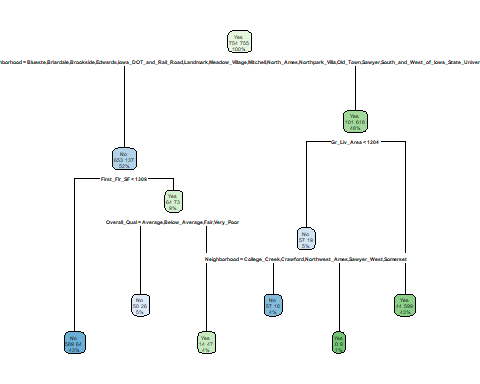
#Classification Trees  
  
ames1\_tree\_recipe = recipe(Above\_Median ~., train)  
  
ames1\_tree\_model = decision\_tree() %>%   
 set\_engine("rpart", model = TRUE) %>% #don't forget the model = TRUE flag  
 set\_mode("classification")  
  
ames1\_tree\_wflow =   
 workflow() %>%   
 add\_model(ames1\_tree\_model) %>%   
 add\_recipe(ames1\_tree\_recipe)  
  
ames1\_tree\_fit = fit(ames1\_tree\_wflow, train)

#look at the tree's fit  
ames1\_tree\_fit %>%  
 pull\_workflow\_fit() %>%  
 pluck("fit")

## Warning: `pull\_workflow\_fit()` was deprecated in workflows 0.2.3.  
## ℹ Please use `extract\_fit\_parsnip()` instead.  
## This warning is displayed once every 8 hours.  
## Call `lifecycle::last\_lifecycle\_warnings()` to see where this warning was  
## generated.

## n= 1509   
##   
## node), split, n, loss, yval, (yprob)  
## \* denotes terminal node  
##   
## 1) root 1509 754 Yes (0.49966865 0.50033135)   
## 2) Neighborhood=Blueste,Briardale,Brookside,Edwards,Iowa\_DOT\_and\_Rail\_Road,Landmark,Meadow\_Village,Mitchell,North\_Ames,Northpark\_Villa,Old\_Town,Sawyer,South\_and\_West\_of\_Iowa\_State\_University 790 137 No (0.82658228 0.17341772)   
## 4) First\_Flr\_SF< 1309 653 64 No (0.90199081 0.09800919) \*  
## 5) First\_Flr\_SF>=1309 137 64 Yes (0.46715328 0.53284672)   
## 10) Overall\_Qual=Average,Below\_Average,Fair,Very\_Poor 76 26 No (0.65789474 0.34210526) \*  
## 11) Overall\_Qual=Above\_Average,Good,Very\_Excellent,Very\_Good 61 14 Yes (0.22950820 0.77049180) \*  
## 3) Neighborhood=Bloomington\_Heights,Clear\_Creek,College\_Creek,Crawford,Gilbert,Green\_Hills,Greens,Northridge,Northridge\_Heights,Northwest\_Ames,Sawyer\_West,Somerset,Stone\_Brook,Timberland,Veenker 719 101 Yes (0.14047288 0.85952712)   
## 6) Gr\_Liv\_Area< 1204 76 19 No (0.75000000 0.25000000)   
## 12) Neighborhood=College\_Creek,Crawford,Northwest\_Ames,Sawyer\_West,Somerset 67 10 No (0.85074627 0.14925373) \*  
## 13) Neighborhood=Bloomington\_Heights,Clear\_Creek,Gilbert,Greens,Stone\_Brook,Timberland 9 0 Yes (0.00000000 1.00000000) \*  
## 7) Gr\_Liv\_Area>=1204 643 44 Yes (0.06842924 0.93157076) \*

#extract the tree's fit from the fit object  
tree = ames1\_tree\_fit %>%   
 pull\_workflow\_fit() %>%   
 pluck("fit")  
  
#plot the tree  
rpart.plot(tree, extra = 101, uniform = TRUE)  
tree\_image = rpart.plot(tree, extra = 101, uniform = TRUE)



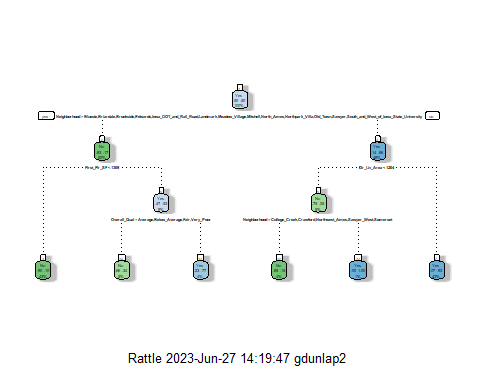
png("tree\_image.png")  
print(tree\_image)

## $obj  
## n= 1509   
##   
## node), split, n, loss, yval, (yprob)  
## \* denotes terminal node  
##   
## 1) root 1509 754 Yes (0.49966865 0.50033135)   
## 2) Neighborhood=Blueste,Briardale,Brookside,Edwards,Iowa\_DOT\_and\_Rail\_Road,Landmark,Meadow\_Village,Mitchell,North\_Ames,Northpark\_Villa,Old\_Town,Sawyer,South\_and\_West\_of\_Iowa\_State\_University 790 137 No (0.82658228 0.17341772)   
## 4) First\_Flr\_SF< 1309 653 64 No (0.90199081 0.09800919) \*  
## 5) First\_Flr\_SF>=1309 137 64 Yes (0.46715328 0.53284672)   
## 10) Overall\_Qual=Average,Below\_Average,Fair,Very\_Poor 76 26 No (0.65789474 0.34210526) \*  
## 11) Overall\_Qual=Above\_Average,Good,Very\_Excellent,Very\_Good 61 14 Yes (0.22950820 0.77049180) \*  
## 3) Neighborhood=Bloomington\_Heights,Clear\_Creek,College\_Creek,Crawford,Gilbert,Green\_Hills,Greens,Northridge,Northridge\_Heights,Northwest\_Ames,Sawyer\_West,Somerset,Stone\_Brook,Timberland,Veenker 719 101 Yes (0.14047288 0.85952712)   
## 6) Gr\_Liv\_Area< 1204 76 19 No (0.75000000 0.25000000)   
## 12) Neighborhood=College\_Creek,Crawford,Northwest\_Ames,Sawyer\_West,Somerset 67 10 No (0.85074627 0.14925373) \*  
## 13) Neighborhood=Bloomington\_Heights,Clear\_Creek,Gilbert,Greens,Stone\_Brook,Timberland 9 0 Yes (0.00000000 1.00000000) \*  
## 7) Gr\_Liv\_Area>=1204 643 44 Yes (0.06842924 0.93157076) \*  
##   
## $snipped.nodes  
## NULL  
##   
## $xlim  
## [1] 0 1  
##   
## $ylim  
## [1] 0 1  
##   
## $x  
## [1] 0.50000000 0.21717178 0.09595969 0.33838387 0.25757581 0.41919194  
## [7] 0.78282822 0.66161613 0.58080806 0.74242419 0.90404031  
##   
## $y  
## [1] 0.96205006 0.59569891 0.02186946 0.46306793 0.13872955 0.02186946  
## [7] 0.71255899 0.34620784 0.13872955 0.02186946 0.13872955  
##   
## $branch.x  
## [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8]  
## x 0.5 0.2171718 0.09595969 0.3383839 0.2575758 0.4191919 0.7828282 0.6616161  
## NA 0.2171718 0.09595969 0.3383839 0.2575758 0.4191919 0.7828282 0.6616161  
## NA 0.5000000 0.21717178 0.2171718 0.3383839 0.3383839 0.5000000 0.7828282  
## [,9] [,10] [,11]  
## x 0.5808081 0.7424242 0.9040403  
## 0.5808081 0.7424242 0.9040403  
## 0.6616161 0.6616161 0.7828282  
##   
## $branch.y  
## [,1] [,2] [,3] [,4] [,5] [,6] [,7]  
## y 1.004238 0.6378864 0.06405697 0.5052554 0.1809171 0.06405697 0.7547465  
## NA 0.9073625 0.54101139 0.5410114 0.4083804 0.40838041 0.9073625  
## NA 0.9073625 0.54101139 0.5410114 0.4083804 0.40838041 0.9073625  
## [,8] [,9] [,10] [,11]  
## y 0.3883954 0.1809171 0.06405697 0.1809171  
## 0.6578715 0.2915203 0.29152033 0.6578715  
## 0.6578715 0.2915203 0.29152033 0.6578715  
##   
## $labs  
## [1] "Yes\n754 755\n100%" "No\n653 137\n52%" "No\n589 64\n43%"   
## [4] "Yes\n64 73\n9%" "No\n50 26\n5%" "Yes\n14 47\n4%"   
## [7] "Yes\n101 618\n48%" "No\n57 19\n5%" "No\n57 10\n4%"   
## [10] "Yes\n0 9\n1%" "Yes\n44 599\n43%"   
##   
## $cex  
## [1] 0.3125  
##   
## $boxes  
## $boxes$x1  
## [1] 0.47065217 0.18782395 0.07028033 0.31637300 0.23556494 0.39718106  
## [7] 0.75348039 0.63960525 0.55879719 0.72652744 0.87836096  
##   
## $boxes$y1  
## [1] 0.93548755 0.56913640 -0.00469305 0.43650542 0.11216704 -0.00469305  
## [7] 0.68599649 0.31964533 0.11216704 -0.00469305 0.11216704  
##   
## $boxes$x2  
## [1] 0.5293478 0.2465196 0.1216390 0.3603947 0.2795867 0.4412028 0.8121761  
## [8] 0.6836270 0.6028189 0.7583209 0.9297197  
##   
## $boxes$y2  
## [1] 1.00423757 0.63788642 0.06405697 0.50525544 0.18091706 0.06405697  
## [7] 0.75474651 0.38839535 0.18091706 0.06405697 0.18091706  
##   
##   
## $split.labs  
## [1] ""  
##   
## $split.cex  
## [1] 1 1 1 1 1 1 1 1 1 1 1  
##   
## $split.box  
## $split.box$x1  
## [1] -0.1175273 0.1560305 NA 0.1708567 NA NA  
## [7] 0.7192412 0.4097139 NA NA NA  
##   
## $split.box$y1  
## [1] 0.8917375 0.5253864 NA 0.3927554 NA NA 0.6422465  
## [8] 0.2758953 NA NA NA  
##   
## $split.box$x2  
## [1] 1.1175273 0.2783131 NA 0.5059111 NA NA 0.8464152  
## [8] 0.9135184 NA NA NA  
##   
## $split.box$y2  
## [1] 0.9229875 0.5566364 NA 0.4240054 NA NA 0.6734965  
## [8] 0.3071453 NA NA NA

dev.off()

## png   
## 2

#alternative  
fancyRpartPlot(tree)  
tree\_image\_2 = fancyRpartPlot(tree)



print(tree\_image\_2)

## $obj  
## n= 1509   
##   
## node), split, n, loss, yval, (yprob)  
## \* denotes terminal node  
##   
## 1) root 1509 754 Yes (0.49966865 0.50033135)   
## 2) Neighborhood=Blueste,Briardale,Brookside,Edwards,Iowa\_DOT\_and\_Rail\_Road,Landmark,Meadow\_Village,Mitchell,North\_Ames,Northpark\_Villa,Old\_Town,Sawyer,South\_and\_West\_of\_Iowa\_State\_University 790 137 No (0.82658228 0.17341772)   
## 4) First\_Flr\_SF< 1309 653 64 No (0.90199081 0.09800919) \*  
## 5) First\_Flr\_SF>=1309 137 64 Yes (0.46715328 0.53284672)   
## 10) Overall\_Qual=Average,Below\_Average,Fair,Very\_Poor 76 26 No (0.65789474 0.34210526) \*  
## 11) Overall\_Qual=Above\_Average,Good,Very\_Excellent,Very\_Good 61 14 Yes (0.22950820 0.77049180) \*  
## 3) Neighborhood=Bloomington\_Heights,Clear\_Creek,College\_Creek,Crawford,Gilbert,Green\_Hills,Greens,Northridge,Northridge\_Heights,Northwest\_Ames,Sawyer\_West,Somerset,Stone\_Brook,Timberland,Veenker 719 101 Yes (0.14047288 0.85952712)   
## 6) Gr\_Liv\_Area< 1204 76 19 No (0.75000000 0.25000000)   
## 12) Neighborhood=College\_Creek,Crawford,Northwest\_Ames,Sawyer\_West,Somerset 67 10 No (0.85074627 0.14925373) \*  
## 13) Neighborhood=Bloomington\_Heights,Clear\_Creek,Gilbert,Greens,Stone\_Brook,Timberland 9 0 Yes (0.00000000 1.00000000) \*  
## 7) Gr\_Liv\_Area>=1204 643 44 Yes (0.06842924 0.93157076) \*  
##   
## $snipped.nodes  
## NULL  
##   
## $xlim  
## [1] 0 1  
##   
## $ylim  
## [1] 0 1  
##   
## $x  
## [1] 0.50000000 0.16298162 0.01854517 0.30741807 0.21112710 0.40370903  
## [7] 0.83701838 0.69258193 0.59629097 0.78887290 0.98145483  
##   
## $y  
## [1] 0.92105746 0.65214540 0.03364764 0.38323333 0.03364764 0.03364764  
## [7] 0.65214540 0.38323333 0.03364764 0.03364764 0.03364764  
##   
## $branch.x  
## [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8]  
## x 0.5 0.1629816 0.01854517 0.3074181 0.2111271 0.4037090 0.8370184 0.6925819  
## NA 0.1629816 0.01854517 0.3074181 0.2111271 0.4037090 0.8370184 0.6925819  
## NA 0.5000000 0.16298162 0.1629816 0.3074181 0.3074181 0.5000000 0.8370184  
## [,9] [,10] [,11]  
## x 0.5962910 0.7888729 0.9814548  
## 0.5962910 0.7888729 0.9814548  
## 0.6925819 0.6925819 0.8370184  
##   
## $branch.y  
## [,1] [,2] [,3] [,4] [,5] [,6] [,7]  
## y 0.9798075 0.7108954 0.09239767 0.4419834 0.09239767 0.09239767 0.7108954  
## NA 0.8481408 0.57922869 0.5792287 0.31031663 0.31031663 0.8481408  
## NA 0.8481408 0.57922869 0.5792287 0.31031663 0.31031663 0.8481408  
## [,8] [,9] [,10] [,11]  
## y 0.4419834 0.09239767 0.09239767 0.09239767  
## 0.5792287 0.31031663 0.31031663 0.57922869  
## 0.5792287 0.31031663 0.31031663 0.57922869  
##   
## $labs  
## [1] "Yes\n.50 .50\n100%" "No\n.83 .17\n52%" "No\n.90 .10\n43%"   
## [4] "Yes\n.47 .53\n9%" "No\n.66 .34\n5%" "Yes\n.23 .77\n4%"   
## [7] "Yes\n.14 .86\n48%" "No\n.75 .25\n5%" "No\n.85 .15\n4%"   
## [10] "Yes\n.00 1.00\n1%" "Yes\n.07 .93\n43%"   
##   
## $cex  
## [1] 0.275  
##   
## $boxes  
## $boxes$x1  
## [1] 0.4816576045 0.1446392257 0.0002027777 0.2890756738 0.1927847084  
## [6] 0.3853666392 0.8186759833 0.6742395353 0.5779485699 0.7680848479  
## [11] 0.9631124314  
##   
## $boxes$y1  
## [1] 0.883140778 0.614228710 -0.004269046 0.345316642 -0.004269046  
## [6] -0.004269046 0.614228710 0.345316642 -0.004269046 -0.004269046  
## [11] -0.004269046  
##   
## $boxes$x2  
## [1] 0.51834240 0.18132402 0.03688757 0.32576046 0.22946950 0.42205143  
## [7] 0.85536077 0.71092433 0.61463336 0.80966094 0.99979722  
##   
## $boxes$y2  
## [1] 0.97980749 0.71089542 0.09239767 0.44198336 0.09239767 0.09239767  
## [7] 0.71089542 0.44198336 0.09239767 0.09239767 0.09239767  
##   
##   
## $split.labs  
## [1] ""  
##   
## $split.cex  
## [1] 1 1 1 1 1 1 1 1 1 1 1  
##   
## $split.box  
## $split.box$x1  
## [1] 0.04877707 0.11773705 NA 0.18146695 NA NA  
## [7] 0.79055098 0.50671232 NA NA NA  
##   
## $split.box$y1  
## [1] 0.8273074 0.5583953 NA 0.2894833 NA NA 0.5583953  
## [8] 0.2894833 NA NA NA  
##   
## $split.box$x2  
## [1] 0.9512229 0.2082262 NA 0.4333692 NA NA 0.8834858  
## [8] 0.8784515 NA NA NA  
##   
## $split.box$y2  
## [1] 0.8689741 0.6000620 NA 0.3311500 NA NA 0.6000620  
## [8] 0.3311500 NA NA NA

ames1\_tree\_fit$fit$fit$fit$cptable

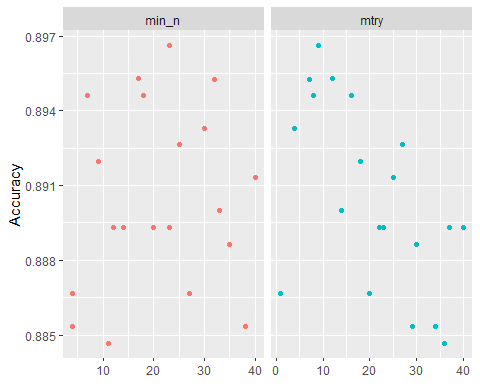
## CP nsplit rel error xerror xstd  
## 1 0.68435013 0 1.0000000 1.0503979 0.02572801  
## 2 0.05039788 1 0.3156499 0.3169761 0.01880983  
## 3 0.02188329 2 0.2652520 0.2705570 0.01761588  
## 4 0.01193634 4 0.2214854 0.2427056 0.01681827  
## 5 0.01000000 5 0.2095491 0.2413793 0.01677858

#set up k folds  
set.seed(123)  
rf\_folds = vfold\_cv(train, v = 5)

#building random forest  
aims\_forest\_recipe = recipe(Above\_Median ~., train) %>%  
 step\_dummy(all\_nominal(), -all\_outcomes())  
  
rf\_forest\_model = rand\_forest(mtry = tune(), min\_n = tune(), trees = 100) %>% #add tuning of mtry and min\_n parameters  
 #setting trees to 100 here should also speed things up a bit, but more trees might be better  
 set\_engine("ranger", importance = "permutation") %>% #added importance metric  
 set\_mode("classification")  
  
aims\_forest\_wflow =   
 workflow() %>%   
 add\_model(rf\_forest\_model) %>%   
 add\_recipe(aims\_forest\_recipe)  
  
set.seed(123)  
rf\_res = tune\_grid(  
 aims\_forest\_wflow,  
 resamples = rf\_folds,  
 grid = 20 #try 20 different combinations of the random forest tuning parameters  
)

## i Creating pre-processing data to finalize unknown parameter: mtry

#parameter performance  
rf\_res %>%  
 collect\_metrics() %>%  
 filter(.metric == "accuracy") %>%  
 select(mean, min\_n, mtry) %>%  
 pivot\_longer(min\_n:mtry,  
 values\_to = "value",  
 names\_to = "parameter"  
 ) %>%  
 ggplot(aes(value, mean, color = parameter)) +  
 geom\_point(show.legend = FALSE) +  
 facet\_wrap(~parameter, scales = "free\_x") +  
 labs(x = NULL, y = "Accuracy")

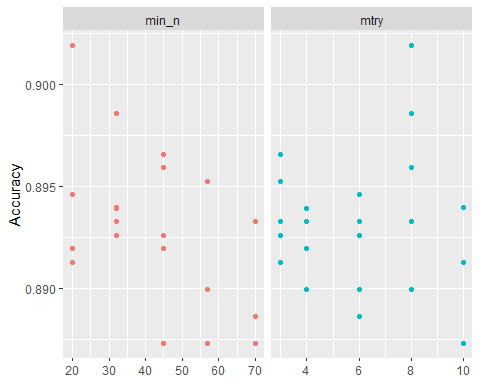


#refine parameters  
aims\_forest\_recipe = recipe(Above\_Median ~., train) %>%  
 step\_dummy(all\_nominal(), -all\_outcomes())  
  
rf\_forest\_model = rand\_forest(mtry = tune(), min\_n = tune(), trees = 100) %>% #add tuning of mtry and min\_n parameters  
 #setting trees to 100 here should also speed things up a bit, but more trees might be better  
 set\_engine("ranger", importance = "permutation") %>% #added importance metric  
 set\_mode("classification")  
  
aims\_forest\_wflow =   
 workflow() %>%   
 add\_model(rf\_forest\_model) %>%   
 add\_recipe(aims\_forest\_recipe)  
  
set.seed(123)  
rf\_res = tune\_grid(  
 aims\_forest\_wflow,  
 resamples = rf\_folds,  
 grid = 20 #try 20 different combinations of the random forest tuning parameters  
)

## i Creating pre-processing data to finalize unknown parameter: mtry

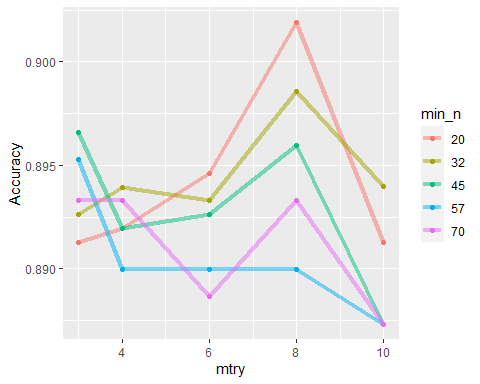
rf\_grid = grid\_regular(  
 mtry(range = c(3, 10)), #these values determined through significant trial and error  
 min\_n(range = c(20, 70)), #these values determined through significant trial and error  
 levels = 5  
)  
  
set.seed(123)  
rf\_res\_tuned = tune\_grid(  
 aims\_forest\_wflow,  
 resamples = rf\_folds,  
 grid = rf\_grid #use the tuning grid  
)

rf\_res\_tuned %>%  
 collect\_metrics() %>%  
 filter(.metric == "accuracy") %>%  
 select(mean, min\_n, mtry) %>%  
 pivot\_longer(min\_n:mtry,  
 values\_to = "value",  
 names\_to = "parameter"  
 ) %>%  
 ggplot(aes(value, mean, color = parameter)) +  
 geom\_point(show.legend = FALSE) +  
 facet\_wrap(~parameter, scales = "free\_x") +  
 labs(x = NULL, y = "Accuracy")



#alt view of parameters  
rf\_res\_tuned %>%  
 collect\_metrics() %>%  
 filter(.metric == "accuracy") %>%  
 mutate(min\_n = factor(min\_n)) %>%  
 ggplot(aes(mtry, mean, color = min\_n)) +  
 geom\_line(alpha = 0.5, size = 1.5) +  
 geom\_point() +  
 labs(y = "Accuracy")

## Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.  
## ℹ Please use `linewidth` instead.  
## This warning is displayed once every 8 hours.  
## Call `lifecycle::last\_lifecycle\_warnings()` to see where this warning was  
## generated.

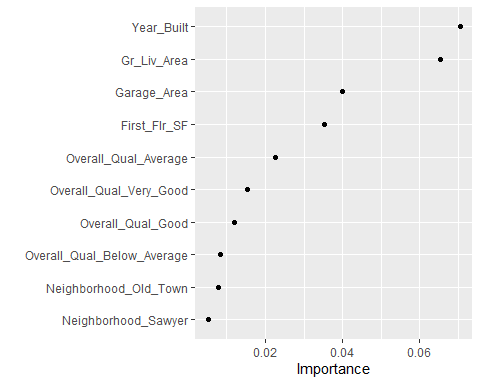


#select best  
best\_rf = select\_best(rf\_res\_tuned, "accuracy")  
  
final\_rf = finalize\_workflow(  
 aims\_forest\_wflow,  
 best\_rf  
)  
  
final\_rf

## ══ Workflow ════════════════════════════════════════════════════════════════════  
## Preprocessor: Recipe  
## Model: rand\_forest()  
##   
## ── Preprocessor ────────────────────────────────────────────────────────────────  
## 1 Recipe Step  
##   
## • step\_dummy()  
##   
## ── Model ───────────────────────────────────────────────────────────────────────  
## Random Forest Model Specification (classification)  
##   
## Main Arguments:  
## mtry = 8  
## trees = 100  
## min\_n = 20  
##   
## Engine-Specific Arguments:  
## importance = permutation  
##   
## Computational engine: ranger

#fit the finalized workflow to our training data  
final\_rf\_fit = fit(final\_rf, train)

#check variable importance  
final\_rf\_fit %>% pull\_workflow\_fit() %>% vip(geom = "point")



#predictions  
trainpredrf = predict(final\_rf\_fit, train)  
head(trainpredrf)

## # A tibble: 6 × 1  
## .pred\_class  
## <fct>   
## 1 No   
## 2 No   
## 3 No   
## 4 No   
## 5 No   
## 6 No

#confusion matrix  
confusionMatrix(trainpredrf$.pred\_class, train$Above\_Median, positive = "Yes")

## Confusion Matrix and Statistics  
##   
## Reference  
## Prediction No Yes  
## No 719 41  
## Yes 35 714  
##   
## Accuracy : 0.9496   
## 95% CI : (0.9374, 0.9601)  
## No Information Rate : 0.5003   
## P-Value [Acc > NIR] : <2e-16   
##   
## Kappa : 0.8993   
##   
## Mcnemar's Test P-Value : 0.5663   
##   
## Sensitivity : 0.9457   
## Specificity : 0.9536   
## Pos Pred Value : 0.9533   
## Neg Pred Value : 0.9461   
## Prevalence : 0.5003   
## Detection Rate : 0.4732   
## Detection Prevalence : 0.4964   
## Balanced Accuracy : 0.9496   
##   
## 'Positive' Class : Yes   
##

#predictions on test  
testpredrf = predict(final\_rf\_fit, test)  
head(testpredrf)

## # A tibble: 6 × 1  
## .pred\_class  
## <fct>   
## 1 No   
## 2 Yes   
## 3 Yes   
## 4 Yes   
## 5 Yes   
## 6 No

confusionMatrix(testpredrf$.pred\_class, test$Above\_Median,   
 positive = "Yes")

## Confusion Matrix and Statistics  
##   
## Reference  
## Prediction No Yes  
## No 236 21  
## Yes 16 231  
##   
## Accuracy : 0.9266   
## 95% CI : (0.9002, 0.9478)  
## No Information Rate : 0.5   
## P-Value [Acc > NIR] : <2e-16   
##   
## Kappa : 0.8532   
##   
## Mcnemar's Test P-Value : 0.5108   
##   
## Sensitivity : 0.9167   
## Specificity : 0.9365   
## Pos Pred Value : 0.9352   
## Neg Pred Value : 0.9183   
## Prevalence : 0.5000   
## Detection Rate : 0.4583   
## Detection Prevalence : 0.4901   
## Balanced Accuracy : 0.9266   
##   
## 'Positive' Class : Yes   
##

#save the model for later  
saveRDS(final\_rf\_fit, "final\_rf\_fit.rds")