KNN Prediction

require(tidyverse)

## Loading required package: tidyverse

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

## v ggplot2 3.3.0 v purrr 0.3.4  
## v tibble 3.0.1 v dplyr 0.8.5  
## v tidyr 1.0.2 v stringr 1.4.0  
## v readr 1.3.1 v forcats 0.5.0

## -- Conflicts -------------------------------------------------------------------------------------------------- tidyverse\_conflicts() --  
## x dplyr::filter() masks stats::filter()  
## x dplyr::lag() masks stats::lag()

chest\_pain=read\_csv('https://raw.githubusercontent.com/PacktPublishing/Practical-Machine-Learning-Cookbook/master/Chapter%2006/Data/Decision%20tree%20learning%20-%20Advance%20Health%20Directive%20for%20Patients%20with%20Chest%20Pain.csv')

## Warning: Missing column names filled in: 'X1' [1]

## Parsed with column specification:  
## cols(  
## X1 = col\_double(),  
## Age = col\_double(),  
## Sex = col\_double(),  
## ChestPain = col\_character(),  
## RestBP = col\_double(),  
## Chol = col\_double(),  
## Fbs = col\_double(),  
## RestECG = col\_double(),  
## MaxHR = col\_double(),  
## ExAng = col\_double(),  
## Oldpeak = col\_double(),  
## Slope = col\_double(),  
## Ca = col\_double(),  
## Thal = col\_character(),  
## AHD = col\_character()  
## )

chest\_pain%>%column\_to\_rownames('X1') %>%write\_csv('chest\_pain.csv')  
  
chest\_pain=read\_csv('chest\_pain.csv')

## Parsed with column specification:  
## cols(  
## Age = col\_double(),  
## Sex = col\_double(),  
## ChestPain = col\_character(),  
## RestBP = col\_double(),  
## Chol = col\_double(),  
## Fbs = col\_double(),  
## RestECG = col\_double(),  
## MaxHR = col\_double(),  
## ExAng = col\_double(),  
## Oldpeak = col\_double(),  
## Slope = col\_double(),  
## Ca = col\_double(),  
## Thal = col\_character(),  
## AHD = col\_character()  
## )

chest\_pain%>%head()

## # A tibble: 6 x 14  
## Age Sex ChestPain RestBP Chol Fbs RestECG MaxHR ExAng Oldpeak Slope  
## <dbl> <dbl> <chr> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 63 1 typical 145 233 1 2 150 0 2.3 3  
## 2 67 1 asymptom~ 160 286 0 2 108 1 1.5 2  
## 3 67 1 asymptom~ 120 229 0 2 129 1 2.6 2  
## 4 37 1 nonangin~ 130 250 0 0 187 0 3.5 3  
## 5 41 0 nontypic~ 130 204 0 2 172 0 1.4 1  
## 6 56 1 nontypic~ 120 236 0 0 178 0 0.8 1  
## # ... with 3 more variables: Ca <dbl>, Thal <chr>, AHD <chr>

age = age in years  
sex(1 = male; 0 = female)  
cpchest = pain type  
trestbp = sresting blood pressure (in mm Hg on admission to the hospital)  
chol = serum cholestoral in mg/dl  
fbs (fasting blood sugar > 120 mg/dl) = (1 = true; 0 = false)  
restecg = resting electrocardiographic results  
thalach = maximum heart rate achieved  
exang = exercise induced angina (1 = yes; 0 = no)  
oldpeak = ST depression induced by exercise relative to rest  
slope = the slope of the peak exercise ST segment  
ca = number of major vessels (0-3) colored by flourosopy  
thal3 = normal; 6 = fixed defect; 7 = reversable defect

AHD = atherosclerotic heart disease.

chest\_pain

## # A tibble: 303 x 14  
## Age Sex ChestPain RestBP Chol Fbs RestECG MaxHR ExAng Oldpeak Slope  
## <dbl> <dbl> <chr> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 63 1 typical 145 233 1 2 150 0 2.3 3  
## 2 67 1 asymptom~ 160 286 0 2 108 1 1.5 2  
## 3 67 1 asymptom~ 120 229 0 2 129 1 2.6 2  
## 4 37 1 nonangin~ 130 250 0 0 187 0 3.5 3  
## 5 41 0 nontypic~ 130 204 0 2 172 0 1.4 1  
## 6 56 1 nontypic~ 120 236 0 0 178 0 0.8 1  
## 7 62 0 asymptom~ 140 268 0 2 160 0 3.6 3  
## 8 57 0 asymptom~ 120 354 0 0 163 1 0.6 1  
## 9 63 1 asymptom~ 130 254 0 2 147 0 1.4 2  
## 10 53 1 asymptom~ 140 203 1 2 155 1 3.1 3  
## # ... with 293 more rows, and 3 more variables: Ca <dbl>, Thal <chr>, AHD <chr>

##Convertin thal to numeric variable since we have to find the NA values.  
chest\_pain1 = as.numeric( factor(chest\_pain$Thal) ) -1  
chest\_pain1

## [1] 0 1 2 1 1 1 1 1 2 2 0 1 0 2 2 1 2 1 1 1 1 1 1 2 2  
## [26] 1 1 1 1 2 1 2 1 2 1 1 2 0 2 1 2 2 1 1 1 2 1 2 1 1  
## [51] 1 2 1 1 2 2 2 2 1 1 2 1 2 1 2 2 1 2 2 1 1 2 2 0 1  
## [76] 1 2 1 1 2 1 1 1 2 1 1 1 NA 1 1 1 2 2 1 1 2 2 2 1 1  
## [101] 1 1 1 1 2 2 2 2 2 2 2 1 0 2 2 0 1 1 2 2 2 2 1 2 1  
## [126] 1 2 2 1 1 2 2 1 1 1 1 2 2 2 1 1 2 1 2 2 1 2 1 1 1  
## [151] 2 1 2 2 1 1 2 2 2 2 2 1 1 1 1 2 1 1 2 1 2 2 1 1 0  
## [176] 2 2 0 1 1 2 2 1 2 1 1 2 0 2 2 1 2 2 1 1 1 1 1 1 1  
## [201] 1 1 2 2 2 2 2 2 1 1 1 2 1 2 1 2 1 1 1 1 1 1 1 2 1  
## [226] 1 1 1 1 1 1 1 1 1 1 1 2 2 1 1 1 1 1 1 1 1 2 1 2 1  
## [251] 0 2 2 1 1 1 1 1 1 2 1 1 1 1 1 0 NA 0 2 1 2 0 2 1 1  
## [276] 2 1 1 1 1 2 1 2 1 2 0 0 2 2 1 2 1 0 2 1 1 0 2 2 2  
## [301] 2 1 1

chest\_pain = chest\_pain %>% mutate(Thal1 = chest\_pain1)  
chest\_pain = chest\_pain %>% select(-Thal)  
chest\_pain

## # A tibble: 303 x 14  
## Age Sex ChestPain RestBP Chol Fbs RestECG MaxHR ExAng Oldpeak Slope  
## <dbl> <dbl> <chr> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 63 1 typical 145 233 1 2 150 0 2.3 3  
## 2 67 1 asymptom~ 160 286 0 2 108 1 1.5 2  
## 3 67 1 asymptom~ 120 229 0 2 129 1 2.6 2  
## 4 37 1 nonangin~ 130 250 0 0 187 0 3.5 3  
## 5 41 0 nontypic~ 130 204 0 2 172 0 1.4 1  
## 6 56 1 nontypic~ 120 236 0 0 178 0 0.8 1  
## 7 62 0 asymptom~ 140 268 0 2 160 0 3.6 3  
## 8 57 0 asymptom~ 120 354 0 0 163 1 0.6 1  
## 9 63 1 asymptom~ 130 254 0 2 147 0 1.4 2  
## 10 53 1 asymptom~ 140 203 1 2 155 1 3.1 3  
## # ... with 293 more rows, and 3 more variables: Ca <dbl>, AHD <chr>,  
## # Thal1 <dbl>

## Create a knn model to predict whether a patient has AHD following the steps below

## Preprocessing

Are there any missing values? Define a strategy to manage missing values.

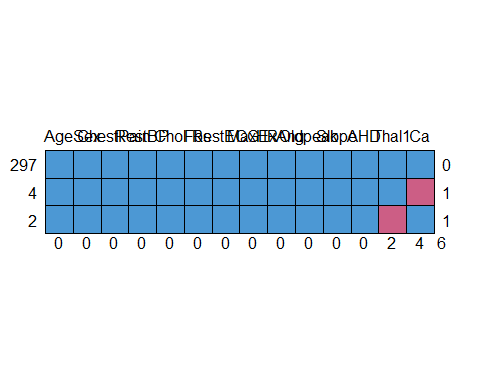
##Yes it seems that there are some missing values   
  
#install.packages("mice")  
require(mice)

## Loading required package: mice

##   
## Attaching package: 'mice'

## The following objects are masked from 'package:base':  
##   
## cbind, rbind

md.pattern(chest\_pain)



## Age Sex ChestPain RestBP Chol Fbs RestECG MaxHR ExAng Oldpeak Slope AHD  
## 297 1 1 1 1 1 1 1 1 1 1 1 1  
## 4 1 1 1 1 1 1 1 1 1 1 1 1  
## 2 1 1 1 1 1 1 1 1 1 1 1 1  
## 0 0 0 0 0 0 0 0 0 0 0 0  
## Thal1 Ca   
## 297 1 1 0  
## 4 1 0 1  
## 2 0 1 1  
## 2 4 6

##So by observing the below pattern it seems that there are missing values in Thal1 and Ca of 2 and 4 respectively.

chest\_pain %>% group\_by(Thal1) %>% count()

## # A tibble: 4 x 2  
## # Groups: Thal1 [4]  
## Thal1 n  
## <dbl> <int>  
## 1 0 18  
## 2 1 166  
## 3 2 117  
## 4 NA 2

chest\_pain %>% group\_by(Ca) %>% count()

## # A tibble: 5 x 2  
## # Groups: Ca [5]  
## Ca n  
## <dbl> <int>  
## 1 0 176  
## 2 1 65  
## 3 2 38  
## 4 3 20  
## 5 NA 4

imputed\_Data <- mice(chest\_pain, m=5, maxit = 50, method = 'pmm', seed = 500)

##   
## iter imp variable  
## 1 1 Ca Thal1  
## 1 2 Ca Thal1  
## 1 3 Ca Thal1  
## 1 4 Ca Thal1  
## 1 5 Ca Thal1  
## 2 1 Ca Thal1  
## 2 2 Ca Thal1  
## 2 3 Ca Thal1  
## 2 4 Ca Thal1  
## 2 5 Ca Thal1  
## 3 1 Ca Thal1  
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## 8 1 Ca Thal1  
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## 9 1 Ca Thal1  
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## 11 1 Ca Thal1  
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## 50 3 Ca Thal1  
## 50 4 Ca Thal1  
## 50 5 Ca Thal1

## Warning: Number of logged events: 2

summary(imputed\_Data)

## Class: mids  
## Number of multiple imputations: 5   
## Imputation methods:  
## Age Sex ChestPain RestBP Chol Fbs RestECG MaxHR   
## "" "" "" "" "" "" "" ""   
## ExAng Oldpeak Slope Ca AHD Thal1   
## "" "" "" "pmm" "" "pmm"   
## PredictorMatrix:  
## Age Sex ChestPain RestBP Chol Fbs RestECG MaxHR ExAng Oldpeak Slope  
## Age 0 1 0 1 1 1 1 1 1 1 1  
## Sex 1 0 0 1 1 1 1 1 1 1 1  
## ChestPain 1 1 0 1 1 1 1 1 1 1 1  
## RestBP 1 1 0 0 1 1 1 1 1 1 1  
## Chol 1 1 0 1 0 1 1 1 1 1 1  
## Fbs 1 1 0 1 1 0 1 1 1 1 1  
## Ca AHD Thal1  
## Age 1 0 1  
## Sex 1 0 1  
## ChestPain 1 0 1  
## RestBP 1 0 1  
## Chol 1 0 1  
## Fbs 1 0 1  
## Number of logged events: 2   
## it im dep meth out  
## 1 0 0 constant ChestPain  
## 2 0 0 constant AHD

#m – Refers to the imputed data sets  
#maxit – Refers to no. of iterations taken to impute missing values  
#method – Refers to method used in imputation. I used predictive mean matching

imputed\_Data$imp$Ca

## 1 2 3 4 5  
## 167 1 0 0 0 0  
## 193 1 0 0 0 1  
## 288 0 0 0 0 0  
## 303 0 0 1 0 0

imputed\_Data$imp$Thal1

## 1 2 3 4 5  
## 88 1 1 1 1 1  
## 267 2 2 0 1 2

## Here is the the completed dataset without any missing values  
cp\_new <- complete(imputed\_Data,2)  
cp\_new

## Age Sex ChestPain RestBP Chol Fbs RestECG MaxHR ExAng Oldpeak Slope Ca  
## 1 63 1 typical 145 233 1 2 150 0 2.3 3 0  
## 2 67 1 asymptomatic 160 286 0 2 108 1 1.5 2 3  
## 3 67 1 asymptomatic 120 229 0 2 129 1 2.6 2 2  
## 4 37 1 nonanginal 130 250 0 0 187 0 3.5 3 0  
## 5 41 0 nontypical 130 204 0 2 172 0 1.4 1 0  
## 6 56 1 nontypical 120 236 0 0 178 0 0.8 1 0  
## 7 62 0 asymptomatic 140 268 0 2 160 0 3.6 3 2  
## 8 57 0 asymptomatic 120 354 0 0 163 1 0.6 1 0  
## 9 63 1 asymptomatic 130 254 0 2 147 0 1.4 2 1  
## 10 53 1 asymptomatic 140 203 1 2 155 1 3.1 3 0  
## 11 57 1 asymptomatic 140 192 0 0 148 0 0.4 2 0  
## 12 56 0 nontypical 140 294 0 2 153 0 1.3 2 0  
## 13 56 1 nonanginal 130 256 1 2 142 1 0.6 2 1  
## 14 44 1 nontypical 120 263 0 0 173 0 0.0 1 0  
## 15 52 1 nonanginal 172 199 1 0 162 0 0.5 1 0  
## 16 57 1 nonanginal 150 168 0 0 174 0 1.6 1 0  
## 17 48 1 nontypical 110 229 0 0 168 0 1.0 3 0  
## 18 54 1 asymptomatic 140 239 0 0 160 0 1.2 1 0  
## 19 48 0 nonanginal 130 275 0 0 139 0 0.2 1 0  
## 20 49 1 nontypical 130 266 0 0 171 0 0.6 1 0  
## 21 64 1 typical 110 211 0 2 144 1 1.8 2 0  
## 22 58 0 typical 150 283 1 2 162 0 1.0 1 0  
## 23 58 1 nontypical 120 284 0 2 160 0 1.8 2 0  
## 24 58 1 nonanginal 132 224 0 2 173 0 3.2 1 2  
## 25 60 1 asymptomatic 130 206 0 2 132 1 2.4 2 2  
## 26 50 0 nonanginal 120 219 0 0 158 0 1.6 2 0  
## 27 58 0 nonanginal 120 340 0 0 172 0 0.0 1 0  
## 28 66 0 typical 150 226 0 0 114 0 2.6 3 0  
## 29 43 1 asymptomatic 150 247 0 0 171 0 1.5 1 0  
## 30 40 1 asymptomatic 110 167 0 2 114 1 2.0 2 0  
## 31 69 0 typical 140 239 0 0 151 0 1.8 1 2  
## 32 60 1 asymptomatic 117 230 1 0 160 1 1.4 1 2  
## 33 64 1 nonanginal 140 335 0 0 158 0 0.0 1 0  
## 34 59 1 asymptomatic 135 234 0 0 161 0 0.5 2 0  
## 35 44 1 nonanginal 130 233 0 0 179 1 0.4 1 0  
## 36 42 1 asymptomatic 140 226 0 0 178 0 0.0 1 0  
## 37 43 1 asymptomatic 120 177 0 2 120 1 2.5 2 0  
## 38 57 1 asymptomatic 150 276 0 2 112 1 0.6 2 1  
## 39 55 1 asymptomatic 132 353 0 0 132 1 1.2 2 1  
## 40 61 1 nonanginal 150 243 1 0 137 1 1.0 2 0  
## 41 65 0 asymptomatic 150 225 0 2 114 0 1.0 2 3  
## 42 40 1 typical 140 199 0 0 178 1 1.4 1 0  
## 43 71 0 nontypical 160 302 0 0 162 0 0.4 1 2  
## 44 59 1 nonanginal 150 212 1 0 157 0 1.6 1 0  
## 45 61 0 asymptomatic 130 330 0 2 169 0 0.0 1 0  
## 46 58 1 nonanginal 112 230 0 2 165 0 2.5 2 1  
## 47 51 1 nonanginal 110 175 0 0 123 0 0.6 1 0  
## 48 50 1 asymptomatic 150 243 0 2 128 0 2.6 2 0  
## 49 65 0 nonanginal 140 417 1 2 157 0 0.8 1 1  
## 50 53 1 nonanginal 130 197 1 2 152 0 1.2 3 0  
## 51 41 0 nontypical 105 198 0 0 168 0 0.0 1 1  
## 52 65 1 asymptomatic 120 177 0 0 140 0 0.4 1 0  
## 53 44 1 asymptomatic 112 290 0 2 153 0 0.0 1 1  
## 54 44 1 nontypical 130 219 0 2 188 0 0.0 1 0  
## 55 60 1 asymptomatic 130 253 0 0 144 1 1.4 1 1  
## 56 54 1 asymptomatic 124 266 0 2 109 1 2.2 2 1  
## 57 50 1 nonanginal 140 233 0 0 163 0 0.6 2 1  
## 58 41 1 asymptomatic 110 172 0 2 158 0 0.0 1 0  
## 59 54 1 nonanginal 125 273 0 2 152 0 0.5 3 1  
## 60 51 1 typical 125 213 0 2 125 1 1.4 1 1  
## 61 51 0 asymptomatic 130 305 0 0 142 1 1.2 2 0  
## 62 46 0 nonanginal 142 177 0 2 160 1 1.4 3 0  
## 63 58 1 asymptomatic 128 216 0 2 131 1 2.2 2 3  
## 64 54 0 nonanginal 135 304 1 0 170 0 0.0 1 0  
## 65 54 1 asymptomatic 120 188 0 0 113 0 1.4 2 1  
## 66 60 1 asymptomatic 145 282 0 2 142 1 2.8 2 2  
## 67 60 1 nonanginal 140 185 0 2 155 0 3.0 2 0  
## 68 54 1 nonanginal 150 232 0 2 165 0 1.6 1 0  
## 69 59 1 asymptomatic 170 326 0 2 140 1 3.4 3 0  
## 70 46 1 nonanginal 150 231 0 0 147 0 3.6 2 0  
## 71 65 0 nonanginal 155 269 0 0 148 0 0.8 1 0  
## 72 67 1 asymptomatic 125 254 1 0 163 0 0.2 2 2  
## 73 62 1 asymptomatic 120 267 0 0 99 1 1.8 2 2  
## 74 65 1 asymptomatic 110 248 0 2 158 0 0.6 1 2  
## 75 44 1 asymptomatic 110 197 0 2 177 0 0.0 1 1  
## 76 65 0 nonanginal 160 360 0 2 151 0 0.8 1 0  
## 77 60 1 asymptomatic 125 258 0 2 141 1 2.8 2 1  
## 78 51 0 nonanginal 140 308 0 2 142 0 1.5 1 1  
## 79 48 1 nontypical 130 245 0 2 180 0 0.2 2 0  
## 80 58 1 asymptomatic 150 270 0 2 111 1 0.8 1 0  
## 81 45 1 asymptomatic 104 208 0 2 148 1 3.0 2 0  
## 82 53 0 asymptomatic 130 264 0 2 143 0 0.4 2 0  
## 83 39 1 nonanginal 140 321 0 2 182 0 0.0 1 0  
## 84 68 1 nonanginal 180 274 1 2 150 1 1.6 2 0  
## 85 52 1 nontypical 120 325 0 0 172 0 0.2 1 0  
## 86 44 1 nonanginal 140 235 0 2 180 0 0.0 1 0  
## 87 47 1 nonanginal 138 257 0 2 156 0 0.0 1 0  
## 88 53 0 nonanginal 128 216 0 2 115 0 0.0 1 0  
## 89 53 0 asymptomatic 138 234 0 2 160 0 0.0 1 0  
## 90 51 0 nonanginal 130 256 0 2 149 0 0.5 1 0  
## 91 66 1 asymptomatic 120 302 0 2 151 0 0.4 2 0  
## 92 62 0 asymptomatic 160 164 0 2 145 0 6.2 3 3  
## 93 62 1 nonanginal 130 231 0 0 146 0 1.8 2 3  
## 94 44 0 nonanginal 108 141 0 0 175 0 0.6 2 0  
## 95 63 0 nonanginal 135 252 0 2 172 0 0.0 1 0  
## 96 52 1 asymptomatic 128 255 0 0 161 1 0.0 1 1  
## 97 59 1 asymptomatic 110 239 0 2 142 1 1.2 2 1  
## 98 60 0 asymptomatic 150 258 0 2 157 0 2.6 2 2  
## 99 52 1 nontypical 134 201 0 0 158 0 0.8 1 1  
## 100 48 1 asymptomatic 122 222 0 2 186 0 0.0 1 0  
## 101 45 1 asymptomatic 115 260 0 2 185 0 0.0 1 0  
## 102 34 1 typical 118 182 0 2 174 0 0.0 1 0  
## 103 57 0 asymptomatic 128 303 0 2 159 0 0.0 1 1  
## 104 71 0 nonanginal 110 265 1 2 130 0 0.0 1 1  
## 105 49 1 nonanginal 120 188 0 0 139 0 2.0 2 3  
## 106 54 1 nontypical 108 309 0 0 156 0 0.0 1 0  
## 107 59 1 asymptomatic 140 177 0 0 162 1 0.0 1 1  
## 108 57 1 nonanginal 128 229 0 2 150 0 0.4 2 1  
## 109 61 1 asymptomatic 120 260 0 0 140 1 3.6 2 1  
## 110 39 1 asymptomatic 118 219 0 0 140 0 1.2 2 0  
## 111 61 0 asymptomatic 145 307 0 2 146 1 1.0 2 0  
## 112 56 1 asymptomatic 125 249 1 2 144 1 1.2 2 1  
## 113 52 1 typical 118 186 0 2 190 0 0.0 2 0  
## 114 43 0 asymptomatic 132 341 1 2 136 1 3.0 2 0  
## 115 62 0 nonanginal 130 263 0 0 97 0 1.2 2 1  
## 116 41 1 nontypical 135 203 0 0 132 0 0.0 2 0  
## 117 58 1 nonanginal 140 211 1 2 165 0 0.0 1 0  
## 118 35 0 asymptomatic 138 183 0 0 182 0 1.4 1 0  
## 119 63 1 asymptomatic 130 330 1 2 132 1 1.8 1 3  
## 120 65 1 asymptomatic 135 254 0 2 127 0 2.8 2 1  
## 121 48 1 asymptomatic 130 256 1 2 150 1 0.0 1 2  
## 122 63 0 asymptomatic 150 407 0 2 154 0 4.0 2 3  
## 123 51 1 nonanginal 100 222 0 0 143 1 1.2 2 0  
## 124 55 1 asymptomatic 140 217 0 0 111 1 5.6 3 0  
## 125 65 1 typical 138 282 1 2 174 0 1.4 2 1  
## 126 45 0 nontypical 130 234 0 2 175 0 0.6 2 0  
## 127 56 0 asymptomatic 200 288 1 2 133 1 4.0 3 2  
## 128 54 1 asymptomatic 110 239 0 0 126 1 2.8 2 1  
## 129 44 1 nontypical 120 220 0 0 170 0 0.0 1 0  
## 130 62 0 asymptomatic 124 209 0 0 163 0 0.0 1 0  
## 131 54 1 nonanginal 120 258 0 2 147 0 0.4 2 0  
## 132 51 1 nonanginal 94 227 0 0 154 1 0.0 1 1  
## 133 29 1 nontypical 130 204 0 2 202 0 0.0 1 0  
## 134 51 1 asymptomatic 140 261 0 2 186 1 0.0 1 0  
## 135 43 0 nonanginal 122 213 0 0 165 0 0.2 2 0  
## 136 55 0 nontypical 135 250 0 2 161 0 1.4 2 0  
## 137 70 1 asymptomatic 145 174 0 0 125 1 2.6 3 0  
## 138 62 1 nontypical 120 281 0 2 103 0 1.4 2 1  
## 139 35 1 asymptomatic 120 198 0 0 130 1 1.6 2 0  
## 140 51 1 nonanginal 125 245 1 2 166 0 2.4 2 0  
## 141 59 1 nontypical 140 221 0 0 164 1 0.0 1 0  
## 142 59 1 typical 170 288 0 2 159 0 0.2 2 0  
## 143 52 1 nontypical 128 205 1 0 184 0 0.0 1 0  
## 144 64 1 nonanginal 125 309 0 0 131 1 1.8 2 0  
## 145 58 1 nonanginal 105 240 0 2 154 1 0.6 2 0  
## 146 47 1 nonanginal 108 243 0 0 152 0 0.0 1 0  
## 147 57 1 asymptomatic 165 289 1 2 124 0 1.0 2 3  
## 148 41 1 nonanginal 112 250 0 0 179 0 0.0 1 0  
## 149 45 1 nontypical 128 308 0 2 170 0 0.0 1 0  
## 150 60 0 nonanginal 102 318 0 0 160 0 0.0 1 1  
## 151 52 1 typical 152 298 1 0 178 0 1.2 2 0  
## 152 42 0 asymptomatic 102 265 0 2 122 0 0.6 2 0  
## 153 67 0 nonanginal 115 564 0 2 160 0 1.6 2 0  
## 154 55 1 asymptomatic 160 289 0 2 145 1 0.8 2 1  
## 155 64 1 asymptomatic 120 246 0 2 96 1 2.2 3 1  
## 156 70 1 asymptomatic 130 322 0 2 109 0 2.4 2 3  
## 157 51 1 asymptomatic 140 299 0 0 173 1 1.6 1 0  
## 158 58 1 asymptomatic 125 300 0 2 171 0 0.0 1 2  
## 159 60 1 asymptomatic 140 293 0 2 170 0 1.2 2 2  
## 160 68 1 nonanginal 118 277 0 0 151 0 1.0 1 1  
## 161 46 1 nontypical 101 197 1 0 156 0 0.0 1 0  
## 162 77 1 asymptomatic 125 304 0 2 162 1 0.0 1 3  
## 163 54 0 nonanginal 110 214 0 0 158 0 1.6 2 0  
## 164 58 0 asymptomatic 100 248 0 2 122 0 1.0 2 0  
## 165 48 1 nonanginal 124 255 1 0 175 0 0.0 1 2  
## 166 57 1 asymptomatic 132 207 0 0 168 1 0.0 1 0  
## 167 52 1 nonanginal 138 223 0 0 169 0 0.0 1 0  
## 168 54 0 nontypical 132 288 1 2 159 1 0.0 1 1  
## 169 35 1 asymptomatic 126 282 0 2 156 1 0.0 1 0  
## 170 45 0 nontypical 112 160 0 0 138 0 0.0 2 0  
## 171 70 1 nonanginal 160 269 0 0 112 1 2.9 2 1  
## 172 53 1 asymptomatic 142 226 0 2 111 1 0.0 1 0  
## 173 59 0 asymptomatic 174 249 0 0 143 1 0.0 2 0  
## 174 62 0 asymptomatic 140 394 0 2 157 0 1.2 2 0  
## 175 64 1 asymptomatic 145 212 0 2 132 0 2.0 2 2  
## 176 57 1 asymptomatic 152 274 0 0 88 1 1.2 2 1  
## 177 52 1 asymptomatic 108 233 1 0 147 0 0.1 1 3  
## 178 56 1 asymptomatic 132 184 0 2 105 1 2.1 2 1  
## 179 43 1 nonanginal 130 315 0 0 162 0 1.9 1 1  
## 180 53 1 nonanginal 130 246 1 2 173 0 0.0 1 3  
## 181 48 1 asymptomatic 124 274 0 2 166 0 0.5 2 0  
## 182 56 0 asymptomatic 134 409 0 2 150 1 1.9 2 2  
## 183 42 1 typical 148 244 0 2 178 0 0.8 1 2  
## 184 59 1 typical 178 270 0 2 145 0 4.2 3 0  
## 185 60 0 asymptomatic 158 305 0 2 161 0 0.0 1 0  
## 186 63 0 nontypical 140 195 0 0 179 0 0.0 1 2  
## 187 42 1 nonanginal 120 240 1 0 194 0 0.8 3 0  
## 188 66 1 nontypical 160 246 0 0 120 1 0.0 2 3  
## 189 54 1 nontypical 192 283 0 2 195 0 0.0 1 1  
## 190 69 1 nonanginal 140 254 0 2 146 0 2.0 2 3  
## 191 50 1 nonanginal 129 196 0 0 163 0 0.0 1 0  
## 192 51 1 asymptomatic 140 298 0 0 122 1 4.2 2 3  
## 193 43 1 asymptomatic 132 247 1 2 143 1 0.1 2 0  
## 194 62 0 asymptomatic 138 294 1 0 106 0 1.9 2 3  
## 195 68 0 nonanginal 120 211 0 2 115 0 1.5 2 0  
## 196 67 1 asymptomatic 100 299 0 2 125 1 0.9 2 2  
## 197 69 1 typical 160 234 1 2 131 0 0.1 2 1  
## 198 45 0 asymptomatic 138 236 0 2 152 1 0.2 2 0  
## 199 50 0 nontypical 120 244 0 0 162 0 1.1 1 0  
## 200 59 1 typical 160 273 0 2 125 0 0.0 1 0  
## 201 50 0 asymptomatic 110 254 0 2 159 0 0.0 1 0  
## 202 64 0 asymptomatic 180 325 0 0 154 1 0.0 1 0  
## 203 57 1 nonanginal 150 126 1 0 173 0 0.2 1 1  
## 204 64 0 nonanginal 140 313 0 0 133 0 0.2 1 0  
## 205 43 1 asymptomatic 110 211 0 0 161 0 0.0 1 0  
## 206 45 1 asymptomatic 142 309 0 2 147 1 0.0 2 3  
## 207 58 1 asymptomatic 128 259 0 2 130 1 3.0 2 2  
## 208 50 1 asymptomatic 144 200 0 2 126 1 0.9 2 0  
## 209 55 1 nontypical 130 262 0 0 155 0 0.0 1 0  
## 210 62 0 asymptomatic 150 244 0 0 154 1 1.4 2 0  
## 211 37 0 nonanginal 120 215 0 0 170 0 0.0 1 0  
## 212 38 1 typical 120 231 0 0 182 1 3.8 2 0  
## 213 41 1 nonanginal 130 214 0 2 168 0 2.0 2 0  
## 214 66 0 asymptomatic 178 228 1 0 165 1 1.0 2 2  
## 215 52 1 asymptomatic 112 230 0 0 160 0 0.0 1 1  
## 216 56 1 typical 120 193 0 2 162 0 1.9 2 0  
## 217 46 0 nontypical 105 204 0 0 172 0 0.0 1 0  
## 218 46 0 asymptomatic 138 243 0 2 152 1 0.0 2 0  
## 219 64 0 asymptomatic 130 303 0 0 122 0 2.0 2 2  
## 220 59 1 asymptomatic 138 271 0 2 182 0 0.0 1 0  
## 221 41 0 nonanginal 112 268 0 2 172 1 0.0 1 0  
## 222 54 0 nonanginal 108 267 0 2 167 0 0.0 1 0  
## 223 39 0 nonanginal 94 199 0 0 179 0 0.0 1 0  
## 224 53 1 asymptomatic 123 282 0 0 95 1 2.0 2 2  
## 225 63 0 asymptomatic 108 269 0 0 169 1 1.8 2 2  
## 226 34 0 nontypical 118 210 0 0 192 0 0.7 1 0  
## 227 47 1 asymptomatic 112 204 0 0 143 0 0.1 1 0  
## 228 67 0 nonanginal 152 277 0 0 172 0 0.0 1 1  
## 229 54 1 asymptomatic 110 206 0 2 108 1 0.0 2 1  
## 230 66 1 asymptomatic 112 212 0 2 132 1 0.1 1 1  
## 231 52 0 nonanginal 136 196 0 2 169 0 0.1 2 0  
## 232 55 0 asymptomatic 180 327 0 1 117 1 3.4 2 0  
## 233 49 1 nonanginal 118 149 0 2 126 0 0.8 1 3  
## 234 74 0 nontypical 120 269 0 2 121 1 0.2 1 1  
## 235 54 0 nonanginal 160 201 0 0 163 0 0.0 1 1  
## 236 54 1 asymptomatic 122 286 0 2 116 1 3.2 2 2  
## 237 56 1 asymptomatic 130 283 1 2 103 1 1.6 3 0  
## 238 46 1 asymptomatic 120 249 0 2 144 0 0.8 1 0  
## 239 49 0 nontypical 134 271 0 0 162 0 0.0 2 0  
## 240 42 1 nontypical 120 295 0 0 162 0 0.0 1 0  
## 241 41 1 nontypical 110 235 0 0 153 0 0.0 1 0  
## 242 41 0 nontypical 126 306 0 0 163 0 0.0 1 0  
## 243 49 0 asymptomatic 130 269 0 0 163 0 0.0 1 0  
## 244 61 1 typical 134 234 0 0 145 0 2.6 2 2  
## 245 60 0 nonanginal 120 178 1 0 96 0 0.0 1 0  
## 246 67 1 asymptomatic 120 237 0 0 71 0 1.0 2 0  
## 247 58 1 asymptomatic 100 234 0 0 156 0 0.1 1 1  
## 248 47 1 asymptomatic 110 275 0 2 118 1 1.0 2 1  
## 249 52 1 asymptomatic 125 212 0 0 168 0 1.0 1 2  
## 250 62 1 nontypical 128 208 1 2 140 0 0.0 1 0  
## 251 57 1 asymptomatic 110 201 0 0 126 1 1.5 2 0  
## 252 58 1 asymptomatic 146 218 0 0 105 0 2.0 2 1  
## 253 64 1 asymptomatic 128 263 0 0 105 1 0.2 2 1  
## 254 51 0 nonanginal 120 295 0 2 157 0 0.6 1 0  
## 255 43 1 asymptomatic 115 303 0 0 181 0 1.2 2 0  
## 256 42 0 nonanginal 120 209 0 0 173 0 0.0 2 0  
## 257 67 0 asymptomatic 106 223 0 0 142 0 0.3 1 2  
## 258 76 0 nonanginal 140 197 0 1 116 0 1.1 2 0  
## 259 70 1 nontypical 156 245 0 2 143 0 0.0 1 0  
## 260 57 1 nontypical 124 261 0 0 141 0 0.3 1 0  
## 261 44 0 nonanginal 118 242 0 0 149 0 0.3 2 1  
## 262 58 0 nontypical 136 319 1 2 152 0 0.0 1 2  
## 263 60 0 typical 150 240 0 0 171 0 0.9 1 0  
## 264 44 1 nonanginal 120 226 0 0 169 0 0.0 1 0  
## 265 61 1 asymptomatic 138 166 0 2 125 1 3.6 2 1  
## 266 42 1 asymptomatic 136 315 0 0 125 1 1.8 2 0  
## 267 52 1 asymptomatic 128 204 1 0 156 1 1.0 2 0  
## 268 59 1 nonanginal 126 218 1 0 134 0 2.2 2 1  
## 269 40 1 asymptomatic 152 223 0 0 181 0 0.0 1 0  
## 270 42 1 nonanginal 130 180 0 0 150 0 0.0 1 0  
## 271 61 1 asymptomatic 140 207 0 2 138 1 1.9 1 1  
## 272 66 1 asymptomatic 160 228 0 2 138 0 2.3 1 0  
## 273 46 1 asymptomatic 140 311 0 0 120 1 1.8 2 2  
## 274 71 0 asymptomatic 112 149 0 0 125 0 1.6 2 0  
## 275 59 1 typical 134 204 0 0 162 0 0.8 1 2  
## 276 64 1 typical 170 227 0 2 155 0 0.6 2 0  
## 277 66 0 nonanginal 146 278 0 2 152 0 0.0 2 1  
## 278 39 0 nonanginal 138 220 0 0 152 0 0.0 2 0  
## 279 57 1 nontypical 154 232 0 2 164 0 0.0 1 1  
## 280 58 0 asymptomatic 130 197 0 0 131 0 0.6 2 0  
## 281 57 1 asymptomatic 110 335 0 0 143 1 3.0 2 1  
## 282 47 1 nonanginal 130 253 0 0 179 0 0.0 1 0  
## 283 55 0 asymptomatic 128 205 0 1 130 1 2.0 2 1  
## 284 35 1 nontypical 122 192 0 0 174 0 0.0 1 0  
## 285 61 1 asymptomatic 148 203 0 0 161 0 0.0 1 1  
## 286 58 1 asymptomatic 114 318 0 1 140 0 4.4 3 3  
## 287 58 0 asymptomatic 170 225 1 2 146 1 2.8 2 2  
## 288 58 1 nontypical 125 220 0 0 144 0 0.4 2 0  
## 289 56 1 nontypical 130 221 0 2 163 0 0.0 1 0  
## 290 56 1 nontypical 120 240 0 0 169 0 0.0 3 0  
## 291 67 1 nonanginal 152 212 0 2 150 0 0.8 2 0  
## 292 55 0 nontypical 132 342 0 0 166 0 1.2 1 0  
## 293 44 1 asymptomatic 120 169 0 0 144 1 2.8 3 0  
## 294 63 1 asymptomatic 140 187 0 2 144 1 4.0 1 2  
## 295 63 0 asymptomatic 124 197 0 0 136 1 0.0 2 0  
## 296 41 1 nontypical 120 157 0 0 182 0 0.0 1 0  
## 297 59 1 asymptomatic 164 176 1 2 90 0 1.0 2 2  
## 298 57 0 asymptomatic 140 241 0 0 123 1 0.2 2 0  
## 299 45 1 typical 110 264 0 0 132 0 1.2 2 0  
## 300 68 1 asymptomatic 144 193 1 0 141 0 3.4 2 2  
## 301 57 1 asymptomatic 130 131 0 0 115 1 1.2 2 1  
## 302 57 0 nontypical 130 236 0 2 174 0 0.0 2 1  
## 303 38 1 nonanginal 138 175 0 0 173 0 0.0 1 0  
## AHD Thal1  
## 1 No 0  
## 2 Yes 1  
## 3 Yes 2  
## 4 No 1  
## 5 No 1  
## 6 No 1  
## 7 Yes 1  
## 8 No 1  
## 9 Yes 2  
## 10 Yes 2  
## 11 No 0  
## 12 No 1  
## 13 Yes 0  
## 14 No 2  
## 15 No 2  
## 16 No 1  
## 17 Yes 2  
## 18 No 1  
## 19 No 1  
## 20 No 1  
## 21 No 1  
## 22 No 1  
## 23 Yes 1  
## 24 Yes 2  
## 25 Yes 2  
## 26 No 1  
## 27 No 1  
## 28 No 1  
## 29 No 1  
## 30 Yes 2  
## 31 No 1  
## 32 Yes 2  
## 33 Yes 1  
## 34 No 2  
## 35 No 1  
## 36 No 1  
## 37 Yes 2  
## 38 Yes 0  
## 39 Yes 2  
## 40 No 1  
## 41 Yes 2  
## 42 No 2  
## 43 No 1  
## 44 No 1  
## 45 Yes 1  
## 46 Yes 2  
## 47 No 1  
## 48 Yes 2  
## 49 No 1  
## 50 No 1  
## 51 No 1  
## 52 No 2  
## 53 Yes 1  
## 54 No 1  
## 55 Yes 2  
## 56 Yes 2  
## 57 Yes 2  
## 58 Yes 2  
## 59 No 1  
## 60 No 1  
## 61 Yes 2  
## 62 No 1  
## 63 Yes 2  
## 64 No 1  
## 65 Yes 2  
## 66 Yes 2  
## 67 Yes 1  
## 68 No 2  
## 69 Yes 2  
## 70 Yes 1  
## 71 No 1  
## 72 Yes 2  
## 73 Yes 2  
## 74 Yes 0  
## 75 Yes 1  
## 76 No 1  
## 77 Yes 2  
## 78 No 1  
## 79 No 1  
## 80 Yes 2  
## 81 No 1  
## 82 No 1  
## 83 No 1  
## 84 Yes 2  
## 85 No 1  
## 86 No 1  
## 87 No 1  
## 88 No 1  
## 89 No 1  
## 90 No 1  
## 91 No 1  
## 92 Yes 2  
## 93 No 2  
## 94 No 1  
## 95 No 1  
## 96 Yes 2  
## 97 Yes 2  
## 98 Yes 2  
## 99 No 1  
## 100 No 1  
## 101 No 1  
## 102 No 1  
## 103 No 1  
## 104 No 1  
## 105 Yes 2  
## 106 No 2  
## 107 Yes 2  
## 108 Yes 2  
## 109 Yes 2  
## 110 Yes 2  
## 111 Yes 2  
## 112 Yes 1  
## 113 No 0  
## 114 Yes 2  
## 115 Yes 2  
## 116 No 0  
## 117 No 1  
## 118 No 1  
## 119 Yes 2  
## 120 Yes 2  
## 121 Yes 2  
## 122 Yes 2  
## 123 No 1  
## 124 Yes 2  
## 125 Yes 1  
## 126 No 1  
## 127 Yes 2  
## 128 Yes 2  
## 129 No 1  
## 130 No 1  
## 131 No 2  
## 132 No 2  
## 133 No 1  
## 134 No 1  
## 135 No 1  
## 136 No 1  
## 137 Yes 2  
## 138 Yes 2  
## 139 Yes 2  
## 140 No 1  
## 141 No 1  
## 142 Yes 2  
## 143 No 1  
## 144 Yes 2  
## 145 No 2  
## 146 Yes 1  
## 147 Yes 2  
## 148 No 1  
## 149 No 1  
## 150 No 1  
## 151 No 2  
## 152 No 1  
## 153 No 2  
## 154 Yes 2  
## 155 Yes 1  
## 156 Yes 1  
## 157 Yes 2  
## 158 Yes 2  
## 159 Yes 2  
## 160 No 2  
## 161 No 2  
## 162 Yes 1  
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## 164 No 1  
## 165 No 1  
## 166 No 2  
## 167 No 1  
## 168 No 1  
## 169 Yes 2  
## 170 No 1  
## 171 Yes 2  
## 172 No 2  
## 173 Yes 1  
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## 175 Yes 0  
## 176 Yes 2  
## 177 No 2  
## 178 Yes 0  
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## 181 Yes 2  
## 182 Yes 2  
## 183 No 1  
## 184 No 2  
## 185 Yes 1  
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## 187 No 2  
## 188 Yes 0  
## 189 Yes 2  
## 190 Yes 2  
## 191 No 1  
## 192 Yes 2  
## 193 Yes 2  
## 194 Yes 1  
## 195 No 1  
## 196 Yes 1  
## 197 No 1  
## 198 No 1  
## 199 No 1  
## 200 Yes 1  
## 201 No 1  
## 202 No 1  
## 203 No 2  
## 204 No 2  
## 205 No 2  
## 206 Yes 2  
## 207 Yes 2  
## 208 Yes 2  
## 209 No 1  
## 210 Yes 1  
## 211 No 1  
## 212 Yes 2  
## 213 No 1  
## 214 Yes 2  
## 215 Yes 1  
## 216 No 2  
## 217 No 1  
## 218 No 1  
## 219 No 1  
## 220 No 1  
## 221 No 1  
## 222 No 1  
## 223 No 1  
## 224 Yes 2  
## 225 Yes 1  
## 226 No 1  
## 227 No 1  
## 228 No 1  
## 229 Yes 1  
## 230 Yes 1  
## 231 No 1  
## 232 Yes 1  
## 233 Yes 1  
## 234 No 1  
## 235 No 1  
## 236 Yes 1  
## 237 Yes 2  
## 238 Yes 2  
## 239 No 1  
## 240 No 1  
## 241 No 1  
## 242 No 1  
## 243 No 1  
## 244 Yes 1  
## 245 No 1  
## 246 Yes 1  
## 247 Yes 2  
## 248 Yes 1  
## 249 Yes 2  
## 250 No 1  
## 251 No 0  
## 252 Yes 2  
## 253 No 2  
## 254 No 1  
## 255 No 1  
## 256 No 1  
## 257 No 1  
## 258 No 1  
## 259 No 1  
## 260 Yes 2  
## 261 No 1  
## 262 Yes 1  
## 263 No 1  
## 264 No 1  
## 265 Yes 1  
## 266 Yes 0  
## 267 Yes 2  
## 268 Yes 0  
## 269 Yes 2  
## 270 No 1  
## 271 Yes 2  
## 272 No 0  
## 273 Yes 2  
## 274 No 1  
## 275 Yes 1  
## 276 No 2  
## 277 No 1  
## 278 No 1  
## 279 Yes 1  
## 280 No 1  
## 281 Yes 2  
## 282 No 1  
## 283 Yes 2  
## 284 No 1  
## 285 Yes 2  
## 286 Yes 0  
## 287 Yes 0  
## 288 No 2  
## 289 No 2  
## 290 No 1  
## 291 Yes 2  
## 292 No 1  
## 293 Yes 0  
## 294 Yes 2  
## 295 Yes 1  
## 296 No 1  
## 297 Yes 0  
## 298 Yes 2  
## 299 Yes 2  
## 300 Yes 2  
## 301 Yes 2  
## 302 Yes 1  
## 303 No 1

cp\_new %>% group\_by(Ca) %>% count()

## # A tibble: 4 x 2  
## # Groups: Ca [4]  
## Ca n  
## <dbl> <int>  
## 1 0 180  
## 2 1 65  
## 3 2 38  
## 4 3 20

cp\_new %>% group\_by(Thal1) %>% count()

## # A tibble: 3 x 2  
## # Groups: Thal1 [3]  
## Thal1 n  
## <dbl> <int>  
## 1 0 18  
## 2 1 167  
## 3 2 118

#view(chest\_pain)

## Normalize numeric variables

## There are some numeric variable but they wont be normalized since they represent a specific caregorical value. Eg : for sex 1 represents male and 0 represents female. So that cannot be normailzed.  
  
cp\_new1 = cp\_new %>% select(Age,RestBP,Chol,MaxHR,Oldpeak)  
cp\_new2=cp\_new1%>% mutate\_if(is.numeric,scale)  
cp\_new2 = cp\_new2 %>% mutate(id = row\_number())  
cp\_new3 = cp\_new %>% select(ChestPain,Sex, Fbs,RestECG,ExAng,Slope,Ca,Thal1,AHD)  
  
cp\_new3 = cp\_new3 %>% mutate(id = row\_number())  
cp\_new4=cp\_new2 %>% left\_join(cp\_new3, by = c('id'= 'id'))  
   
cp\_new4

## Age RestBP Chol MaxHR Oldpeak id  
## 1 0.94715962 0.75627397 -0.264462814 0.01716893 1.08554229 1  
## 2 1.38970298 1.60855891 0.759159343 -1.81889638 0.39652566 2  
## 3 1.38970298 -0.66420094 -0.341717316 -0.90086373 1.34392353 3  
## 4 -1.92937218 -0.09601098 0.063868821 1.63465503 2.11906724 4  
## 5 -1.48682883 -0.09601098 -0.824557956 0.97891742 0.31039858 5  
## 6 0.17270875 -0.66420094 -0.206521937 1.24121247 -0.20636389 6  
## 7 0.83652378 0.47217899 0.411514082 0.45432733 2.20519432 7  
## 8 0.28334459 -0.66420094 2.072485883 0.58547486 -0.37861805 8  
## 9 0.94715962 -0.09601098 0.141123324 -0.11397859 0.31039858 9  
## 10 -0.15919876 0.47217899 -0.843871582 0.23574813 1.77455892 10  
## 11 0.28334459 0.47217899 -1.056321463 -0.07026275 -0.55087221 11  
## 12 0.17270875 0.47217899 0.913668348 0.14831645 0.22427150 12  
## 13 0.17270875 -0.09601098 0.179750575 -0.33255780 -0.37861805 13  
## 14 -1.15492131 -0.66420094 0.314945954 1.02263326 -0.89538052 14  
## 15 -0.26983460 2.29038686 -0.921126084 0.54175902 -0.46474513 15  
## 16 0.28334459 1.04036895 -1.519848478 1.06634911 0.48265274 16  
## 17 -0.71237796 -1.23239090 -0.341717316 0.80405406 -0.03410973 17  
## 18 -0.04856293 0.47217899 -0.148581060 0.45432733 0.13814442 18  
## 19 -0.71237796 -0.09601098 0.546709461 -0.46370532 -0.72312637 19  
## 20 -0.60174212 -0.09601098 0.372886831 0.93520158 -0.37861805 20  
## 21 1.05779546 -1.23239090 -0.689362577 -0.24512612 0.65490690 21  
## 22 0.39398043 1.04036895 0.701218466 0.54175902 -0.03410973 22  
## 23 0.39398043 -0.66420094 0.720532092 0.45432733 0.65490690 23  
## 24 0.39398043 0.01762702 -0.438285444 1.02263326 1.86068600 24  
## 25 0.61525211 -0.09601098 -0.785930705 -0.76971621 1.17166937 25  
## 26 -0.49110628 -0.66420094 -0.534853572 0.36689565 0.48265274 26  
## 27 0.39398043 -0.66420094 1.802095125 0.97891742 -0.89538052 27  
## 28 1.27906714 1.04036895 -0.399658193 -1.55660134 1.34392353 28  
## 29 -1.26555715 1.04036895 0.005927944 0.93520158 0.39652566 29  
## 30 -1.59746467 -1.23239090 -1.539162103 -1.55660134 0.82716105 30  
## 31 1.61097465 0.47217899 -0.148581060 0.06088477 0.65490690 31  
## 32 0.61525211 -0.83465793 -0.322403691 0.45432733 0.31039858 32  
## 33 1.05779546 0.47217899 1.705526997 0.36689565 -0.89538052 33  
## 34 0.50461627 0.18808400 -0.245149188 0.49804318 -0.46474513 34  
## 35 -1.15492131 -0.09601098 -0.264462814 1.28492831 -0.55087221 35  
## 36 -1.37619299 0.47217899 -0.399658193 1.24121247 -0.89538052 36  
## 37 -1.26555715 -0.66420094 -1.346025847 -1.29430629 1.25779645 37  
## 38 0.28334459 1.04036895 0.566023087 -1.64403302 -0.37861805 38  
## 39 0.06207291 0.01762702 2.053172258 -0.76971621 0.13814442 39  
## 40 0.72588794 1.04036895 -0.071326558 -0.55113700 -0.03410973 40  
## 41 1.16843130 1.04036895 -0.418971819 -1.55660134 -0.03410973 41  
## 42 -1.59746467 0.47217899 -0.921126084 1.24121247 0.31039858 42  
## 43 1.83224633 1.60855891 1.068177352 0.54175902 -0.55087221 43  
## 44 0.50461627 1.04036895 -0.670048951 0.32317981 0.48265274 44  
## 45 0.72588794 -0.09601098 1.608958869 0.84776990 -0.89538052 45  
## 46 0.39398043 -1.11875291 -0.322403691 0.67290654 1.25779645 46  
## 47 -0.38047044 -1.23239090 -1.384653099 -1.16315877 -0.37861805 47  
## 48 -0.49110628 1.04036895 -0.071326558 -0.94457957 1.34392353 48  
## 49 1.16843130 0.47217899 3.289244296 0.32317981 -0.20636389 49  
## 50 -0.15919876 -0.09601098 -0.959753335 0.10460061 0.13814442 50  
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## 273 -0.93364964 0.47217899 1.241999983 -1.29430629 0.65490690 273  
## 274 1.83224633 -1.11875291 -1.886807364 -1.07572709 0.48265274 274  
## 275 0.50461627 0.13126501 -0.824557956 0.54175902 -0.20636389 275  
## 276 1.05779546 2.17674887 -0.380344567 0.23574813 -0.37861805 276  
## 277 1.27906714 0.81309296 0.604650338 0.10460061 -0.89538052 277  
## 278 -1.70810051 0.35854099 -0.515539947 0.10460061 -0.89538052 278  
## 279 0.28334459 1.26764493 -0.283776439 0.62919070 -0.89538052 279  
## 280 0.39398043 -0.09601098 -0.959753335 -0.81343205 -0.37861805 280  
## 281 0.28334459 -1.23239090 1.705526997 -0.28884196 1.68843184 281  
## 282 -0.82301380 -0.09601098 0.121809698 1.28492831 -0.89538052 282  
## 283 0.06207291 -0.20964897 -0.805244331 -0.85714789 0.82716105 283  
## 284 -2.15064386 -0.55056295 -1.056321463 1.06634911 -0.89538052 284  
## 285 0.72588794 0.92673096 -0.843871582 0.49804318 -0.89538052 285  
## 286 0.39398043 -1.00511492 1.377195362 -0.41998948 2.89421095 286  
## 287 0.39398043 2.17674887 -0.418971819 -0.15769444 1.51617769 287  
## 288 0.39398043 -0.38010596 -0.515539947 -0.24512612 -0.55087221 288  
## 289 0.17270875 -0.09601098 -0.496226321 0.58547486 -0.89538052 289  
## 290 0.17270875 -0.66420094 -0.129267435 0.84776990 -0.89538052 290  
## 291 1.38970298 1.15400694 -0.670048951 0.01716893 -0.20636389 291  
## 292 0.06207291 0.01762702 1.840722376 0.71662238 0.13814442 292  
## 293 -1.15492131 -0.66420094 -1.500534852 -0.24512612 1.51617769 293  
## 294 0.94715962 0.47217899 -1.152889591 -0.24512612 2.54970263 294  
## 295 0.94715962 -0.43692495 -0.959753335 -0.59485284 -0.89538052 295  
## 296 -1.48682883 -0.66420094 -1.732298359 1.41607583 -0.89538052 296  
## 297 0.50461627 1.83583489 -1.365339473 -2.60578152 -0.03410973 297  
## 298 0.28334459 0.47217899 -0.109953809 -1.16315877 -0.72312637 298  
## 299 -1.04428547 -1.23239090 0.334259580 -0.76971621 0.13814442 299  
## 300 1.50033882 0.69945497 -1.037007838 -0.37627364 2.03294016 300  
## 301 0.28334459 -0.09601098 -2.234452625 -1.51288550 0.13814442 301  
## 302 0.28334459 -0.09601098 -0.206521937 1.06634911 -0.89538052 302  
## 303 -1.81873635 0.35854099 -1.384653099 1.02263326 -0.89538052 303  
## ChestPain Sex Fbs RestECG ExAng Slope Ca Thal1 AHD  
## 1 typical 1 1 2 0 3 0 0 No  
## 2 asymptomatic 1 0 2 1 2 3 1 Yes  
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## 6 nontypical 1 0 0 0 1 0 1 No  
## 7 asymptomatic 0 0 2 0 3 2 1 Yes  
## 8 asymptomatic 0 0 0 1 1 0 1 No  
## 9 asymptomatic 1 0 2 0 2 1 2 Yes  
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## 14 nontypical 1 0 0 0 1 0 2 No  
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## 26 nonanginal 0 0 0 0 2 0 1 No  
## 27 nonanginal 0 0 0 0 1 0 1 No  
## 28 typical 0 0 0 0 3 0 1 No  
## 29 asymptomatic 1 0 0 0 1 0 1 No  
## 30 asymptomatic 1 0 2 1 2 0 2 Yes  
## 31 typical 0 0 0 0 1 2 1 No  
## 32 asymptomatic 1 1 0 1 1 2 2 Yes  
## 33 nonanginal 1 0 0 0 1 0 1 Yes  
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## 303 nonanginal 1 0 0 0 1 0 1 No

cp\_new4

## Age RestBP Chol MaxHR Oldpeak id  
## 1 0.94715962 0.75627397 -0.264462814 0.01716893 1.08554229 1  
## 2 1.38970298 1.60855891 0.759159343 -1.81889638 0.39652566 2  
## 3 1.38970298 -0.66420094 -0.341717316 -0.90086373 1.34392353 3  
## 4 -1.92937218 -0.09601098 0.063868821 1.63465503 2.11906724 4  
## 5 -1.48682883 -0.09601098 -0.824557956 0.97891742 0.31039858 5  
## 6 0.17270875 -0.66420094 -0.206521937 1.24121247 -0.20636389 6  
## 7 0.83652378 0.47217899 0.411514082 0.45432733 2.20519432 7  
## 8 0.28334459 -0.66420094 2.072485883 0.58547486 -0.37861805 8  
## 9 0.94715962 -0.09601098 0.141123324 -0.11397859 0.31039858 9  
## 10 -0.15919876 0.47217899 -0.843871582 0.23574813 1.77455892 10  
## 11 0.28334459 0.47217899 -1.056321463 -0.07026275 -0.55087221 11  
## 12 0.17270875 0.47217899 0.913668348 0.14831645 0.22427150 12  
## 13 0.17270875 -0.09601098 0.179750575 -0.33255780 -0.37861805 13  
## 14 -1.15492131 -0.66420094 0.314945954 1.02263326 -0.89538052 14  
## 15 -0.26983460 2.29038686 -0.921126084 0.54175902 -0.46474513 15  
## 16 0.28334459 1.04036895 -1.519848478 1.06634911 0.48265274 16  
## 17 -0.71237796 -1.23239090 -0.341717316 0.80405406 -0.03410973 17  
## 18 -0.04856293 0.47217899 -0.148581060 0.45432733 0.13814442 18  
## 19 -0.71237796 -0.09601098 0.546709461 -0.46370532 -0.72312637 19  
## 20 -0.60174212 -0.09601098 0.372886831 0.93520158 -0.37861805 20  
## 21 1.05779546 -1.23239090 -0.689362577 -0.24512612 0.65490690 21  
## 22 0.39398043 1.04036895 0.701218466 0.54175902 -0.03410973 22  
## 23 0.39398043 -0.66420094 0.720532092 0.45432733 0.65490690 23  
## 24 0.39398043 0.01762702 -0.438285444 1.02263326 1.86068600 24  
## 25 0.61525211 -0.09601098 -0.785930705 -0.76971621 1.17166937 25  
## 26 -0.49110628 -0.66420094 -0.534853572 0.36689565 0.48265274 26  
## 27 0.39398043 -0.66420094 1.802095125 0.97891742 -0.89538052 27  
## 28 1.27906714 1.04036895 -0.399658193 -1.55660134 1.34392353 28  
## 29 -1.26555715 1.04036895 0.005927944 0.93520158 0.39652566 29  
## 30 -1.59746467 -1.23239090 -1.539162103 -1.55660134 0.82716105 30  
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## 34 0.50461627 0.18808400 -0.245149188 0.49804318 -0.46474513 34  
## 35 -1.15492131 -0.09601098 -0.264462814 1.28492831 -0.55087221 35  
## 36 -1.37619299 0.47217899 -0.399658193 1.24121247 -0.89538052 36  
## 37 -1.26555715 -0.66420094 -1.346025847 -1.29430629 1.25779645 37  
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## 41 1.16843130 1.04036895 -0.418971819 -1.55660134 -0.03410973 41  
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## 43 1.83224633 1.60855891 1.068177352 0.54175902 -0.55087221 43  
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## 51 -1.48682883 -1.51648588 -0.940439710 0.80405406 -0.89538052 51  
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## 290 0.17270875 -0.66420094 -0.129267435 0.84776990 -0.89538052 290  
## 291 1.38970298 1.15400694 -0.670048951 0.01716893 -0.20636389 291  
## 292 0.06207291 0.01762702 1.840722376 0.71662238 0.13814442 292  
## 293 -1.15492131 -0.66420094 -1.500534852 -0.24512612 1.51617769 293  
## 294 0.94715962 0.47217899 -1.152889591 -0.24512612 2.54970263 294  
## 295 0.94715962 -0.43692495 -0.959753335 -0.59485284 -0.89538052 295  
## 296 -1.48682883 -0.66420094 -1.732298359 1.41607583 -0.89538052 296  
## 297 0.50461627 1.83583489 -1.365339473 -2.60578152 -0.03410973 297  
## 298 0.28334459 0.47217899 -0.109953809 -1.16315877 -0.72312637 298  
## 299 -1.04428547 -1.23239090 0.334259580 -0.76971621 0.13814442 299  
## 300 1.50033882 0.69945497 -1.037007838 -0.37627364 2.03294016 300  
## 301 0.28334459 -0.09601098 -2.234452625 -1.51288550 0.13814442 301  
## 302 0.28334459 -0.09601098 -0.206521937 1.06634911 -0.89538052 302  
## 303 -1.81873635 0.35854099 -1.384653099 1.02263326 -0.89538052 303  
## ChestPain Sex Fbs RestECG ExAng Slope Ca Thal1 AHD  
## 1 typical 1 1 2 0 3 0 0 No  
## 2 asymptomatic 1 0 2 1 2 3 1 Yes  
## 3 asymptomatic 1 0 2 1 2 2 2 Yes  
## 4 nonanginal 1 0 0 0 3 0 1 No  
## 5 nontypical 0 0 2 0 1 0 1 No  
## 6 nontypical 1 0 0 0 1 0 1 No  
## 7 asymptomatic 0 0 2 0 3 2 1 Yes  
## 8 asymptomatic 0 0 0 1 1 0 1 No  
## 9 asymptomatic 1 0 2 0 2 1 2 Yes  
## 10 asymptomatic 1 1 2 1 3 0 2 Yes  
## 11 asymptomatic 1 0 0 0 2 0 0 No  
## 12 nontypical 0 0 2 0 2 0 1 No  
## 13 nonanginal 1 1 2 1 2 1 0 Yes  
## 14 nontypical 1 0 0 0 1 0 2 No  
## 15 nonanginal 1 1 0 0 1 0 2 No  
## 16 nonanginal 1 0 0 0 1 0 1 No  
## 17 nontypical 1 0 0 0 3 0 2 Yes  
## 18 asymptomatic 1 0 0 0 1 0 1 No  
## 19 nonanginal 0 0 0 0 1 0 1 No  
## 20 nontypical 1 0 0 0 1 0 1 No  
## 21 typical 1 0 2 1 2 0 1 No  
## 22 typical 0 1 2 0 1 0 1 No  
## 23 nontypical 1 0 2 0 2 0 1 Yes  
## 24 nonanginal 1 0 2 0 1 2 2 Yes  
## 25 asymptomatic 1 0 2 1 2 2 2 Yes  
## 26 nonanginal 0 0 0 0 2 0 1 No  
## 27 nonanginal 0 0 0 0 1 0 1 No  
## 28 typical 0 0 0 0 3 0 1 No  
## 29 asymptomatic 1 0 0 0 1 0 1 No  
## 30 asymptomatic 1 0 2 1 2 0 2 Yes  
## 31 typical 0 0 0 0 1 2 1 No  
## 32 asymptomatic 1 1 0 1 1 2 2 Yes  
## 33 nonanginal 1 0 0 0 1 0 1 Yes  
## 34 asymptomatic 1 0 0 0 2 0 2 No  
## 35 nonanginal 1 0 0 1 1 0 1 No  
## 36 asymptomatic 1 0 0 0 1 0 1 No  
## 37 asymptomatic 1 0 2 1 2 0 2 Yes  
## 38 asymptomatic 1 0 2 1 2 1 0 Yes  
## 39 asymptomatic 1 0 0 1 2 1 2 Yes  
## 40 nonanginal 1 1 0 1 2 0 1 No  
## 41 asymptomatic 0 0 2 0 2 3 2 Yes  
## 42 typical 1 0 0 1 1 0 2 No  
## 43 nontypical 0 0 0 0 1 2 1 No  
## 44 nonanginal 1 1 0 0 1 0 1 No  
## 45 asymptomatic 0 0 2 0 1 0 1 Yes  
## 46 nonanginal 1 0 2 0 2 1 2 Yes  
## 47 nonanginal 1 0 0 0 1 0 1 No  
## 48 asymptomatic 1 0 2 0 2 0 2 Yes  
## 49 nonanginal 0 1 2 0 1 1 1 No  
## 50 nonanginal 1 1 2 0 3 0 1 No  
## 51 nontypical 0 0 0 0 1 1 1 No  
## 52 asymptomatic 1 0 0 0 1 0 2 No  
## 53 asymptomatic 1 0 2 0 1 1 1 Yes  
## 54 nontypical 1 0 2 0 1 0 1 No  
## 55 asymptomatic 1 0 0 1 1 1 2 Yes  
## 56 asymptomatic 1 0 2 1 2 1 2 Yes  
## 57 nonanginal 1 0 0 0 2 1 2 Yes  
## 58 asymptomatic 1 0 2 0 1 0 2 Yes  
## 59 nonanginal 1 0 2 0 3 1 1 No  
## 60 typical 1 0 2 1 1 1 1 No  
## 61 asymptomatic 0 0 0 1 2 0 2 Yes  
## 62 nonanginal 0 0 2 1 3 0 1 No  
## 63 asymptomatic 1 0 2 1 2 3 2 Yes  
## 64 nonanginal 0 1 0 0 1 0 1 No  
## 65 asymptomatic 1 0 0 0 2 1 2 Yes  
## 66 asymptomatic 1 0 2 1 2 2 2 Yes  
## 67 nonanginal 1 0 2 0 2 0 1 Yes  
## 68 nonanginal 1 0 2 0 1 0 2 No  
## 69 asymptomatic 1 0 2 1 3 0 2 Yes  
## 70 nonanginal 1 0 0 0 2 0 1 Yes  
## 71 nonanginal 0 0 0 0 1 0 1 No  
## 72 asymptomatic 1 1 0 0 2 2 2 Yes  
## 73 asymptomatic 1 0 0 1 2 2 2 Yes  
## 74 asymptomatic 1 0 2 0 1 2 0 Yes  
## 75 asymptomatic 1 0 2 0 1 1 1 Yes  
## 76 nonanginal 0 0 2 0 1 0 1 No  
## 77 asymptomatic 1 0 2 1 2 1 2 Yes  
## 78 nonanginal 0 0 2 0 1 1 1 No  
## 79 nontypical 1 0 2 0 2 0 1 No  
## 80 asymptomatic 1 0 2 1 1 0 2 Yes  
## 81 asymptomatic 1 0 2 1 2 0 1 No  
## 82 asymptomatic 0 0 2 0 2 0 1 No  
## 83 nonanginal 1 0 2 0 1 0 1 No  
## 84 nonanginal 1 1 2 1 2 0 2 Yes  
## 85 nontypical 1 0 0 0 1 0 1 No  
## 86 nonanginal 1 0 2 0 1 0 1 No  
## 87 nonanginal 1 0 2 0 1 0 1 No  
## 88 nonanginal 0 0 2 0 1 0 1 No  
## 89 asymptomatic 0 0 2 0 1 0 1 No  
## 90 nonanginal 0 0 2 0 1 0 1 No  
## 91 asymptomatic 1 0 2 0 2 0 1 No  
## 92 asymptomatic 0 0 2 0 3 3 2 Yes  
## 93 nonanginal 1 0 0 0 2 3 2 No  
## 94 nonanginal 0 0 0 0 2 0 1 No  
## 95 nonanginal 0 0 2 0 1 0 1 No  
## 96 asymptomatic 1 0 0 1 1 1 2 Yes  
## 97 asymptomatic 1 0 2 1 2 1 2 Yes  
## 98 asymptomatic 0 0 2 0 2 2 2 Yes  
## 99 nontypical 1 0 0 0 1 1 1 No  
## 100 asymptomatic 1 0 2 0 1 0 1 No  
## 101 asymptomatic 1 0 2 0 1 0 1 No  
## 102 typical 1 0 2 0 1 0 1 No  
## 103 asymptomatic 0 0 2 0 1 1 1 No  
## 104 nonanginal 0 1 2 0 1 1 1 No  
## 105 nonanginal 1 0 0 0 2 3 2 Yes  
## 106 nontypical 1 0 0 0 1 0 2 No  
## 107 asymptomatic 1 0 0 1 1 1 2 Yes  
## 108 nonanginal 1 0 2 0 2 1 2 Yes  
## 109 asymptomatic 1 0 0 1 2 1 2 Yes  
## 110 asymptomatic 1 0 0 0 2 0 2 Yes  
## 111 asymptomatic 0 0 2 1 2 0 2 Yes  
## 112 asymptomatic 1 1 2 1 2 1 1 Yes  
## 113 typical 1 0 2 0 2 0 0 No  
## 114 asymptomatic 0 1 2 1 2 0 2 Yes  
## 115 nonanginal 0 0 0 0 2 1 2 Yes  
## 116 nontypical 1 0 0 0 2 0 0 No  
## 117 nonanginal 1 1 2 0 1 0 1 No  
## 118 asymptomatic 0 0 0 0 1 0 1 No  
## 119 asymptomatic 1 1 2 1 1 3 2 Yes  
## 120 asymptomatic 1 0 2 0 2 1 2 Yes  
## 121 asymptomatic 1 1 2 1 1 2 2 Yes  
## 122 asymptomatic 0 0 2 0 2 3 2 Yes  
## 123 nonanginal 1 0 0 1 2 0 1 No  
## 124 asymptomatic 1 0 0 1 3 0 2 Yes  
## 125 typical 1 1 2 0 2 1 1 Yes  
## 126 nontypical 0 0 2 0 2 0 1 No  
## 127 asymptomatic 0 1 2 1 3 2 2 Yes  
## 128 asymptomatic 1 0 0 1 2 1 2 Yes  
## 129 nontypical 1 0 0 0 1 0 1 No  
## 130 asymptomatic 0 0 0 0 1 0 1 No  
## 131 nonanginal 1 0 2 0 2 0 2 No  
## 132 nonanginal 1 0 0 1 1 1 2 No  
## 133 nontypical 1 0 2 0 1 0 1 No  
## 134 asymptomatic 1 0 2 1 1 0 1 No  
## 135 nonanginal 0 0 0 0 2 0 1 No  
## 136 nontypical 0 0 2 0 2 0 1 No  
## 137 asymptomatic 1 0 0 1 3 0 2 Yes  
## 138 nontypical 1 0 2 0 2 1 2 Yes  
## 139 asymptomatic 1 0 0 1 2 0 2 Yes  
## 140 nonanginal 1 1 2 0 2 0 1 No  
## 141 nontypical 1 0 0 1 1 0 1 No  
## 142 typical 1 0 2 0 2 0 2 Yes  
## 143 nontypical 1 1 0 0 1 0 1 No  
## 144 nonanginal 1 0 0 1 2 0 2 Yes  
## 145 nonanginal 1 0 2 1 2 0 2 No  
## 146 nonanginal 1 0 0 0 1 0 1 Yes  
## 147 asymptomatic 1 1 2 0 2 3 2 Yes  
## 148 nonanginal 1 0 0 0 1 0 1 No  
## 149 nontypical 1 0 2 0 1 0 1 No  
## 150 nonanginal 0 0 0 0 1 1 1 No  
## 151 typical 1 1 0 0 2 0 2 No  
## 152 asymptomatic 0 0 2 0 2 0 1 No  
## 153 nonanginal 0 0 2 0 2 0 2 No  
## 154 asymptomatic 1 0 2 1 2 1 2 Yes  
## 155 asymptomatic 1 0 2 1 3 1 1 Yes  
## 156 asymptomatic 1 0 2 0 2 3 1 Yes  
## 157 asymptomatic 1 0 0 1 1 0 2 Yes  
## 158 asymptomatic 1 0 2 0 1 2 2 Yes  
## 159 asymptomatic 1 0 2 0 2 2 2 Yes  
## 160 nonanginal 1 0 0 0 1 1 2 No  
## 161 nontypical 1 1 0 0 1 0 2 No  
## 162 asymptomatic 1 0 2 1 1 3 1 Yes  
## 163 nonanginal 0 0 0 0 2 0 1 No  
## 164 asymptomatic 0 0 2 0 2 0 1 No  
## 165 nonanginal 1 1 0 0 1 2 1 No  
## 166 asymptomatic 1 0 0 1 1 0 2 No  
## 167 nonanginal 1 0 0 0 1 0 1 No  
## 168 nontypical 0 1 2 1 1 1 1 No  
## 169 asymptomatic 1 0 2 1 1 0 2 Yes  
## 170 nontypical 0 0 0 0 2 0 1 No  
## 171 nonanginal 1 0 0 1 2 1 2 Yes  
## 172 asymptomatic 1 0 2 1 1 0 2 No  
## 173 asymptomatic 0 0 0 1 2 0 1 Yes  
## 174 asymptomatic 0 0 2 0 2 0 1 No  
## 175 asymptomatic 1 0 2 0 2 2 0 Yes  
## 176 asymptomatic 1 0 0 1 2 1 2 Yes  
## 177 asymptomatic 1 1 0 0 1 3 2 No  
## 178 asymptomatic 1 0 2 1 2 1 0 Yes  
## 179 nonanginal 1 0 0 0 1 1 1 No  
## 180 nonanginal 1 1 2 0 1 3 1 No  
## 181 asymptomatic 1 0 2 0 2 0 2 Yes  
## 182 asymptomatic 0 0 2 1 2 2 2 Yes  
## 183 typical 1 0 2 0 1 2 1 No  
## 184 typical 1 0 2 0 3 0 2 No  
## 185 asymptomatic 0 0 2 0 1 0 1 Yes  
## 186 nontypical 0 0 0 0 1 2 1 No  
## 187 nonanginal 1 1 0 0 3 0 2 No  
## 188 nontypical 1 0 0 1 2 3 0 Yes  
## 189 nontypical 1 0 2 0 1 1 2 Yes  
## 190 nonanginal 1 0 2 0 2 3 2 Yes  
## 191 nonanginal 1 0 0 0 1 0 1 No  
## 192 asymptomatic 1 0 0 1 2 3 2 Yes  
## 193 asymptomatic 1 1 2 1 2 0 2 Yes  
## 194 asymptomatic 0 1 0 0 2 3 1 Yes  
## 195 nonanginal 0 0 2 0 2 0 1 No  
## 196 asymptomatic 1 0 2 1 2 2 1 Yes  
## 197 typical 1 1 2 0 2 1 1 No  
## 198 asymptomatic 0 0 2 1 2 0 1 No  
## 199 nontypical 0 0 0 0 1 0 1 No  
## 200 typical 1 0 2 0 1 0 1 Yes  
## 201 asymptomatic 0 0 2 0 1 0 1 No  
## 202 asymptomatic 0 0 0 1 1 0 1 No  
## 203 nonanginal 1 1 0 0 1 1 2 No  
## 204 nonanginal 0 0 0 0 1 0 2 No  
## 205 asymptomatic 1 0 0 0 1 0 2 No  
## 206 asymptomatic 1 0 2 1 2 3 2 Yes  
## 207 asymptomatic 1 0 2 1 2 2 2 Yes  
## 208 asymptomatic 1 0 2 1 2 0 2 Yes  
## 209 nontypical 1 0 0 0 1 0 1 No  
## 210 asymptomatic 0 0 0 1 2 0 1 Yes  
## 211 nonanginal 0 0 0 0 1 0 1 No  
## 212 typical 1 0 0 1 2 0 2 Yes  
## 213 nonanginal 1 0 2 0 2 0 1 No  
## 214 asymptomatic 0 1 0 1 2 2 2 Yes  
## 215 asymptomatic 1 0 0 0 1 1 1 Yes  
## 216 typical 1 0 2 0 2 0 2 No  
## 217 nontypical 0 0 0 0 1 0 1 No  
## 218 asymptomatic 0 0 2 1 2 0 1 No  
## 219 asymptomatic 0 0 0 0 2 2 1 No  
## 220 asymptomatic 1 0 2 0 1 0 1 No  
## 221 nonanginal 0 0 2 1 1 0 1 No  
## 222 nonanginal 0 0 2 0 1 0 1 No  
## 223 nonanginal 0 0 0 0 1 0 1 No  
## 224 asymptomatic 1 0 0 1 2 2 2 Yes  
## 225 asymptomatic 0 0 0 1 2 2 1 Yes  
## 226 nontypical 0 0 0 0 1 0 1 No  
## 227 asymptomatic 1 0 0 0 1 0 1 No  
## 228 nonanginal 0 0 0 0 1 1 1 No  
## 229 asymptomatic 1 0 2 1 2 1 1 Yes  
## 230 asymptomatic 1 0 2 1 1 1 1 Yes  
## 231 nonanginal 0 0 2 0 2 0 1 No  
## 232 asymptomatic 0 0 1 1 2 0 1 Yes  
## 233 nonanginal 1 0 2 0 1 3 1 Yes  
## 234 nontypical 0 0 2 1 1 1 1 No  
## 235 nonanginal 0 0 0 0 1 1 1 No  
## 236 asymptomatic 1 0 2 1 2 2 1 Yes  
## 237 asymptomatic 1 1 2 1 3 0 2 Yes  
## 238 asymptomatic 1 0 2 0 1 0 2 Yes  
## 239 nontypical 0 0 0 0 2 0 1 No  
## 240 nontypical 1 0 0 0 1 0 1 No  
## 241 nontypical 1 0 0 0 1 0 1 No  
## 242 nontypical 0 0 0 0 1 0 1 No  
## 243 asymptomatic 0 0 0 0 1 0 1 No  
## 244 typical 1 0 0 0 2 2 1 Yes  
## 245 nonanginal 0 1 0 0 1 0 1 No  
## 246 asymptomatic 1 0 0 0 2 0 1 Yes  
## 247 asymptomatic 1 0 0 0 1 1 2 Yes  
## 248 asymptomatic 1 0 2 1 2 1 1 Yes  
## 249 asymptomatic 1 0 0 0 1 2 2 Yes  
## 250 nontypical 1 1 2 0 1 0 1 No  
## 251 asymptomatic 1 0 0 1 2 0 0 No  
## 252 asymptomatic 1 0 0 0 2 1 2 Yes  
## 253 asymptomatic 1 0 0 1 2 1 2 No  
## 254 nonanginal 0 0 2 0 1 0 1 No  
## 255 asymptomatic 1 0 0 0 2 0 1 No  
## 256 nonanginal 0 0 0 0 2 0 1 No  
## 257 asymptomatic 0 0 0 0 1 2 1 No  
## 258 nonanginal 0 0 1 0 2 0 1 No  
## 259 nontypical 1 0 2 0 1 0 1 No  
## 260 nontypical 1 0 0 0 1 0 2 Yes  
## 261 nonanginal 0 0 0 0 2 1 1 No  
## 262 nontypical 0 1 2 0 1 2 1 Yes  
## 263 typical 0 0 0 0 1 0 1 No  
## 264 nonanginal 1 0 0 0 1 0 1 No  
## 265 asymptomatic 1 0 2 1 2 1 1 Yes  
## 266 asymptomatic 1 0 0 1 2 0 0 Yes  
## 267 asymptomatic 1 1 0 1 2 0 2 Yes  
## 268 nonanginal 1 1 0 0 2 1 0 Yes  
## 269 asymptomatic 1 0 0 0 1 0 2 Yes  
## 270 nonanginal 1 0 0 0 1 0 1 No  
## 271 asymptomatic 1 0 2 1 1 1 2 Yes  
## 272 asymptomatic 1 0 2 0 1 0 0 No  
## 273 asymptomatic 1 0 0 1 2 2 2 Yes  
## 274 asymptomatic 0 0 0 0 2 0 1 No  
## 275 typical 1 0 0 0 1 2 1 Yes  
## 276 typical 1 0 2 0 2 0 2 No  
## 277 nonanginal 0 0 2 0 2 1 1 No  
## 278 nonanginal 0 0 0 0 2 0 1 No  
## 279 nontypical 1 0 2 0 1 1 1 Yes  
## 280 asymptomatic 0 0 0 0 2 0 1 No  
## 281 asymptomatic 1 0 0 1 2 1 2 Yes  
## 282 nonanginal 1 0 0 0 1 0 1 No  
## 283 asymptomatic 0 0 1 1 2 1 2 Yes  
## 284 nontypical 1 0 0 0 1 0 1 No  
## 285 asymptomatic 1 0 0 0 1 1 2 Yes  
## 286 asymptomatic 1 0 1 0 3 3 0 Yes  
## 287 asymptomatic 0 1 2 1 2 2 0 Yes  
## 288 nontypical 1 0 0 0 2 0 2 No  
## 289 nontypical 1 0 2 0 1 0 2 No  
## 290 nontypical 1 0 0 0 3 0 1 No  
## 291 nonanginal 1 0 2 0 2 0 2 Yes  
## 292 nontypical 0 0 0 0 1 0 1 No  
## 293 asymptomatic 1 0 0 1 3 0 0 Yes  
## 294 asymptomatic 1 0 2 1 1 2 2 Yes  
## 295 asymptomatic 0 0 0 1 2 0 1 Yes  
## 296 nontypical 1 0 0 0 1 0 1 No  
## 297 asymptomatic 1 1 2 0 2 2 0 Yes  
## 298 asymptomatic 0 0 0 1 2 0 2 Yes  
## 299 typical 1 0 0 0 2 0 2 Yes  
## 300 asymptomatic 1 1 0 0 2 2 2 Yes  
## 301 asymptomatic 1 0 0 1 2 1 2 Yes  
## 302 nontypical 0 0 2 0 2 1 1 Yes  
## 303 nonanginal 1 0 0 0 1 0 1 No

cp\_new4 = cp\_new4 %>% select(Age,RestBP,Chol,MaxHR,Oldpeak,ChestPain,Sex,Fbs,RestECG,ExAng,Slope,Ca,Thal1,AHD,id)  
cp\_new4

## Age RestBP Chol MaxHR Oldpeak ChestPain  
## 1 0.94715962 0.75627397 -0.264462814 0.01716893 1.08554229 typical  
## 2 1.38970298 1.60855891 0.759159343 -1.81889638 0.39652566 asymptomatic  
## 3 1.38970298 -0.66420094 -0.341717316 -0.90086373 1.34392353 asymptomatic  
## 4 -1.92937218 -0.09601098 0.063868821 1.63465503 2.11906724 nonanginal  
## 5 -1.48682883 -0.09601098 -0.824557956 0.97891742 0.31039858 nontypical  
## 6 0.17270875 -0.66420094 -0.206521937 1.24121247 -0.20636389 nontypical  
## 7 0.83652378 0.47217899 0.411514082 0.45432733 2.20519432 asymptomatic  
## 8 0.28334459 -0.66420094 2.072485883 0.58547486 -0.37861805 asymptomatic  
## 9 0.94715962 -0.09601098 0.141123324 -0.11397859 0.31039858 asymptomatic  
## 10 -0.15919876 0.47217899 -0.843871582 0.23574813 1.77455892 asymptomatic  
## 11 0.28334459 0.47217899 -1.056321463 -0.07026275 -0.55087221 asymptomatic  
## 12 0.17270875 0.47217899 0.913668348 0.14831645 0.22427150 nontypical  
## 13 0.17270875 -0.09601098 0.179750575 -0.33255780 -0.37861805 nonanginal  
## 14 -1.15492131 -0.66420094 0.314945954 1.02263326 -0.89538052 nontypical  
## 15 -0.26983460 2.29038686 -0.921126084 0.54175902 -0.46474513 nonanginal  
## 16 0.28334459 1.04036895 -1.519848478 1.06634911 0.48265274 nonanginal  
## 17 -0.71237796 -1.23239090 -0.341717316 0.80405406 -0.03410973 nontypical  
## 18 -0.04856293 0.47217899 -0.148581060 0.45432733 0.13814442 asymptomatic  
## 19 -0.71237796 -0.09601098 0.546709461 -0.46370532 -0.72312637 nonanginal  
## 20 -0.60174212 -0.09601098 0.372886831 0.93520158 -0.37861805 nontypical  
## 21 1.05779546 -1.23239090 -0.689362577 -0.24512612 0.65490690 typical  
## 22 0.39398043 1.04036895 0.701218466 0.54175902 -0.03410973 typical  
## 23 0.39398043 -0.66420094 0.720532092 0.45432733 0.65490690 nontypical  
## 24 0.39398043 0.01762702 -0.438285444 1.02263326 1.86068600 nonanginal  
## 25 0.61525211 -0.09601098 -0.785930705 -0.76971621 1.17166937 asymptomatic  
## 26 -0.49110628 -0.66420094 -0.534853572 0.36689565 0.48265274 nonanginal  
## 27 0.39398043 -0.66420094 1.802095125 0.97891742 -0.89538052 nonanginal  
## 28 1.27906714 1.04036895 -0.399658193 -1.55660134 1.34392353 typical  
## 29 -1.26555715 1.04036895 0.005927944 0.93520158 0.39652566 asymptomatic  
## 30 -1.59746467 -1.23239090 -1.539162103 -1.55660134 0.82716105 asymptomatic  
## 31 1.61097465 0.47217899 -0.148581060 0.06088477 0.65490690 typical  
## 32 0.61525211 -0.83465793 -0.322403691 0.45432733 0.31039858 asymptomatic  
## 33 1.05779546 0.47217899 1.705526997 0.36689565 -0.89538052 nonanginal  
## 34 0.50461627 0.18808400 -0.245149188 0.49804318 -0.46474513 asymptomatic  
## 35 -1.15492131 -0.09601098 -0.264462814 1.28492831 -0.55087221 nonanginal  
## 36 -1.37619299 0.47217899 -0.399658193 1.24121247 -0.89538052 asymptomatic  
## 37 -1.26555715 -0.66420094 -1.346025847 -1.29430629 1.25779645 asymptomatic  
## 38 0.28334459 1.04036895 0.566023087 -1.64403302 -0.37861805 asymptomatic  
## 39 0.06207291 0.01762702 2.053172258 -0.76971621 0.13814442 asymptomatic  
## 40 0.72588794 1.04036895 -0.071326558 -0.55113700 -0.03410973 nonanginal  
## 41 1.16843130 1.04036895 -0.418971819 -1.55660134 -0.03410973 asymptomatic  
## 42 -1.59746467 0.47217899 -0.921126084 1.24121247 0.31039858 typical  
## 43 1.83224633 1.60855891 1.068177352 0.54175902 -0.55087221 nontypical  
## 44 0.50461627 1.04036895 -0.670048951 0.32317981 0.48265274 nonanginal  
## 45 0.72588794 -0.09601098 1.608958869 0.84776990 -0.89538052 asymptomatic  
## 46 0.39398043 -1.11875291 -0.322403691 0.67290654 1.25779645 nonanginal  
## 47 -0.38047044 -1.23239090 -1.384653099 -1.16315877 -0.37861805 nonanginal  
## 48 -0.49110628 1.04036895 -0.071326558 -0.94457957 1.34392353 asymptomatic  
## 49 1.16843130 0.47217899 3.289244296 0.32317981 -0.20636389 nonanginal  
## 50 -0.15919876 -0.09601098 -0.959753335 0.10460061 0.13814442 nonanginal  
## 51 -1.48682883 -1.51648588 -0.940439710 0.80405406 -0.89538052 nontypical  
## 52 1.16843130 -0.66420094 -1.346025847 -0.41998948 -0.55087221 asymptomatic  
## 53 -1.15492131 -1.11875291 0.836413845 0.14831645 -0.89538052 asymptomatic  
## 54 -1.15492131 -0.09601098 -0.534853572 1.67837088 -0.89538052 nontypical  
## 55 0.61525211 -0.09601098 0.121809698 -0.24512612 0.31039858 asymptomatic  
## 56 -0.04856293 -0.43692495 0.372886831 -1.77518054 0.99941521 asymptomatic  
## 57 -0.49110628 0.47217899 -0.264462814 0.58547486 -0.37861805 nonanginal  
## 58 -1.48682883 -1.23239090 -1.442593975 0.36689565 -0.89538052 asymptomatic  
## 59 -0.04856293 -0.38010596 0.508082210 0.10460061 -0.46474513 nonanginal  
## 60 -0.38047044 -0.38010596 -0.650735326 -1.07572709 0.31039858 typical  
## 61 -0.38047044 -0.09601098 1.126118229 -0.33255780 0.13814442 asymptomatic  
## 62 -0.93364964 0.58581698 -1.346025847 0.45432733 0.31039858 nonanginal  
## 63 0.39398043 -0.20964897 -0.592794449 -0.81343205 0.99941521 asymptomatic  
## 64 -0.04856293 0.18808400 1.106804604 0.89148574 -0.89538052 nonanginal  
## 65 -0.04856293 -0.66420094 -1.133575966 -1.60031718 0.31039858 asymptomatic  
## 66 0.61525211 0.75627397 0.681904840 -0.33255780 1.51617769 asymptomatic  
## 67 0.61525211 0.47217899 -1.191516843 0.23574813 1.68843184 nonanginal  
## 68 -0.04856293 1.04036895 -0.283776439 0.67290654 0.48265274 nonanginal  
## 69 0.50461627 2.17674887 1.531704367 -0.41998948 2.03294016 asymptomatic  
## 70 -0.93364964 1.04036895 -0.303090065 -0.11397859 2.20519432 nonanginal  
## 71 1.16843130 1.32446393 0.430827708 -0.07026275 -0.20636389 nonanginal  
## 72 1.38970298 -0.38010596 0.141123324 0.58547486 -0.72312637 asymptomatic  
## 73 0.83652378 -0.66420094 0.392200456 -2.21233895 0.65490690 asymptomatic  
## 74 1.16843130 -1.23239090 0.025241570 0.36689565 -0.37861805 asymptomatic  
## 75 -1.15492131 -1.23239090 -0.959753335 1.19749663 -0.89538052 asymptomatic  
## 76 1.16843130 1.60855891 2.188367637 0.06088477 -0.20636389 nonanginal  
## 77 0.61525211 -0.38010596 0.218377826 -0.37627364 1.51617769 asymptomatic  
## 78 -0.38047044 0.47217899 1.184059106 -0.33255780 0.39652566 nonanginal  
## 79 -0.71237796 -0.09601098 -0.032699307 1.32864415 -0.72312637 nontypical  
## 80 0.39398043 1.04036895 0.450141333 -1.68774886 -0.20636389 asymptomatic  
## 81 -1.04428547 -1.57330488 -0.747303454 -0.07026275 1.68843184 asymptomatic  
## 82 -0.15919876 -0.09601098 0.334259580 -0.28884196 -0.55087221 asymptomatic  
## 83 -1.70810051 0.47217899 1.435136239 1.41607583 -0.89538052 nonanginal  
## 84 1.50033882 2.74493883 0.527395836 0.01716893 0.48265274 nonanginal  
## 85 -0.26983460 -0.66420094 1.512390741 0.97891742 -0.72312637 nontypical  
## 86 -1.15492131 0.47217899 -0.225835563 1.32864415 -0.89538052 nonanginal  
## 87 -0.82301380 0.35854099 0.199064200 0.27946397 -0.89538052 nonanginal  
## 88 -0.15919876 -0.20964897 -0.592794449 -1.51288550 -0.89538052 nonanginal  
## 89 -0.15919876 0.35854099 -0.245149188 0.45432733 -0.89538052 asymptomatic  
## 90 -0.38047044 -0.09601098 0.179750575 -0.02654691 -0.46474513 nonanginal  
## 91 1.27906714 -0.66420094 1.068177352 0.06088477 -0.55087221 asymptomatic  
## 92 0.83652378 1.60855891 -1.597102980 -0.20141028 4.44449837 asymptomatic  
## 93 0.83652378 -0.09601098 -0.303090065 -0.15769444 0.65490690 nonanginal  
## 94 -1.15492131 -1.34602889 -2.041316369 1.11006495 -0.37861805 nonanginal  
## 95 0.94715962 0.18808400 0.102496072 0.97891742 -0.89538052 nonanginal  
## 96 -0.26983460 -0.20964897 0.160436949 0.49804318 -0.89538052 asymptomatic  
## 97 0.50461627 -1.23239090 -0.148581060 -0.33255780 0.13814442 asymptomatic  
## 98 0.61525211 1.04036895 0.218377826 0.32317981 1.34392353 asymptomatic  
## 99 -0.26983460 0.13126501 -0.882498833 0.36689565 -0.20636389 nontypical  
## 100 -0.71237796 -0.55056295 -0.476912695 1.59093919 -0.89538052 asymptomatic  
## 101 -1.04428547 -0.94829592 0.257005077 1.54722335 -0.89538052 asymptomatic  
## 102 -2.26127970 -0.77783893 -1.249457719 1.06634911 -0.89538052 typical  
## 103 0.28334459 -0.20964897 1.087490978 0.41061149 -0.89538052 asymptomatic  
## 104 1.83224633 -1.23239090 0.353573205 -0.85714789 -0.89538052 nonanginal  
## 105 -0.60174212 -0.66420094 -1.133575966 -0.46370532 0.82716105 nonanginal  
## 106 -0.04856293 -1.34602889 1.203372732 0.27946397 -0.89538052 nontypical  
## 107 0.50461627 0.47217899 -1.346025847 0.54175902 -0.89538052 asymptomatic  
## 108 0.28334459 -0.20964897 -0.341717316 0.01716893 -0.55087221 nonanginal  
## 109 0.72588794 -0.66420094 0.257005077 -0.41998948 2.20519432 asymptomatic  
## 110 -1.70810051 -0.77783893 -0.534853572 -0.41998948 0.13814442 asymptomatic  
## 111 0.72588794 0.75627397 1.164745480 -0.15769444 -0.03410973 asymptomatic  
## 112 0.17270875 -0.38010596 0.044555196 -0.24512612 0.13814442 asymptomatic  
## 113 -0.26983460 -0.77783893 -1.172203217 1.76580256 -0.89538052 typical  
## 114 -1.26555715 0.01762702 1.821408751 -0.59485284 1.68843184 asymptomatic  
## 115 0.83652378 -0.09601098 0.314945954 -2.29977063 0.13814442 nonanginal  
## 116 -1.48682883 0.18808400 -0.843871582 -0.76971621 -0.89538052 nontypical  
## 117 0.39398043 0.47217899 -0.689362577 0.67290654 -0.89538052 nonanginal  
## 118 -2.15064386 0.35854099 -1.230144094 1.41607583 0.31039858 asymptomatic  
## 119 0.94715962 -0.09601098 1.608958869 -0.76971621 0.65490690 asymptomatic  
## 120 1.16843130 0.18808400 0.141123324 -0.98829541 1.51617769 asymptomatic  
## 121 -0.71237796 -0.09601098 0.179750575 0.01716893 -0.89538052 asymptomatic  
## 122 0.94715962 1.04036895 3.096108040 0.19203229 2.54970263 asymptomatic  
## 123 -0.38047044 -1.80058086 -0.476912695 -0.28884196 0.13814442 nonanginal  
## 124 0.06207291 0.47217899 -0.573480823 -1.68774886 3.92773589 asymptomatic  
## 125 1.16843130 0.35854099 0.681904840 1.06634911 0.31039858 typical  
## 126 -1.04428547 -0.09601098 -0.245149188 1.11006495 -0.37861805 nontypical  
## 127 0.17270875 3.88131876 0.797786594 -0.72600036 2.54970263 asymptomatic  
## 128 -0.04856293 -1.23239090 -0.148581060 -1.03201125 1.51617769 asymptomatic  
## 129 -1.15492131 -0.66420094 -0.515539947 0.89148574 -0.89538052 nontypical  
## 130 0.83652378 -0.43692495 -0.727989828 0.58547486 -0.89538052 asymptomatic  
## 131 -0.04856293 -0.66420094 0.218377826 -0.11397859 -0.55087221 nonanginal  
## 132 -0.38047044 -2.14149484 -0.380344567 0.19203229 -0.89538052 nonanginal  
## 133 -2.81445889 -0.09601098 -0.824557956 2.29039265 -0.89538052 nontypical  
## 134 -0.38047044 0.47217899 0.276318703 1.59093919 -0.89538052 asymptomatic  
## 135 -1.26555715 -0.55056295 -0.650735326 0.67290654 -0.72312637 nonanginal  
## 136 0.06207291 0.18808400 0.063868821 0.49804318 0.31039858 nontypical  
## 137 1.72161049 0.75627397 -1.403966724 -1.07572709 1.34392353 asymptomatic  
## 138 0.83652378 -0.66420094 0.662591215 -2.03747559 0.31039858 nontypical  
## 139 -2.15064386 -0.66420094 -0.940439710 -0.85714789 0.48265274 asymptomatic  
## 140 -0.38047044 -0.38010596 -0.032699307 0.71662238 1.17166937 nonanginal  
## 141 0.50461627 0.47217899 -0.496226321 0.62919070 -0.89538052 nontypical  
## 142 0.50461627 2.17674887 0.797786594 0.41061149 -0.72312637 typical  
## 143 -0.26983460 -0.20964897 -0.805244331 1.50350751 -0.89538052 nontypical  
## 144 1.05779546 -0.38010596 1.203372732 -0.81343205 0.65490690 nonanginal  
## 145 0.39398043 -1.51648588 -0.129267435 0.19203229 -0.37861805 nonanginal  
## 146 -0.82301380 -1.34602889 -0.071326558 0.10460061 -0.89538052 nonanginal  
## 147 0.28334459 1.89265389 0.817100220 -1.11944293 -0.03410973 asymptomatic  
## 148 -1.48682883 -1.11875291 0.063868821 1.28492831 -0.89538052 nonanginal  
## 149 -1.04428547 -0.20964897 1.184059106 0.89148574 -0.89538052 nontypical  
## 150 0.61525211 -1.68694287 1.377195362 0.45432733 -0.89538052 nonanginal  
## 151 -0.26983460 1.15400694 0.990922850 1.24121247 0.13814442 typical  
## 152 -1.37619299 -1.68694287 0.353573205 -1.20687461 -0.37861805 asymptomatic  
## 153 1.38970298 -0.94829592 6.128347259 0.45432733 0.48265274 nonanginal  
## 154 0.06207291 1.60855891 0.817100220 -0.20141028 -0.20636389 asymptomatic  
## 155 1.05779546 -0.66420094 -0.013385681 -2.34348647 0.99941521 asymptomatic  
## 156 1.72161049 -0.09601098 1.454449864 -1.77518054 1.17166937 asymptomatic  
## 157 -0.38047044 0.47217899 1.010236476 1.02263326 0.48265274 asymptomatic  
## 158 0.39398043 -0.38010596 1.029550101 0.93520158 -0.89538052 asymptomatic  
## 159 0.61525211 0.47217899 0.894354722 0.89148574 0.13814442 asymptomatic  
## 160 1.50033882 -0.77783893 0.585336712 0.06088477 -0.03410973 nonanginal  
## 161 -0.93364964 -1.74376187 -0.959753335 0.27946397 -0.89538052 nontypical  
## 162 2.49606136 -0.38010596 1.106804604 0.54175902 -0.89538052 asymptomatic  
## 163 -0.04856293 -1.23239090 -0.631421700 0.36689565 0.48265274 nonanginal  
## 164 0.39398043 -1.80058086 0.025241570 -1.20687461 -0.03410973 asymptomatic  
## 165 -0.71237796 -0.43692495 0.160436949 1.11006495 -0.89538052 nonanginal  
## 166 0.28334459 0.01762702 -0.766617079 0.80405406 -0.89538052 asymptomatic  
## 167 -0.26983460 0.35854099 -0.457599070 0.84776990 -0.89538052 nonanginal  
## 168 -0.04856293 0.01762702 0.797786594 0.41061149 -0.89538052 nontypical  
## 169 -2.15064386 -0.32328696 0.681904840 0.27946397 -0.89538052 asymptomatic  
## 170 -1.04428547 -1.11875291 -1.674357482 -0.50742116 -0.89538052 nontypical  
## 171 1.72161049 1.60855891 0.430827708 -1.64403302 1.60230476 nonanginal  
## 172 -0.15919876 0.58581698 -0.399658193 -1.68774886 -0.89538052 asymptomatic  
## 173 0.50461627 2.40402486 0.044555196 -0.28884196 -0.89538052 asymptomatic  
## 174 0.83652378 0.47217899 2.845030907 0.32317981 0.13814442 asymptomatic  
## 175 1.05779546 0.75627397 -0.670048951 -0.76971621 0.82716105 asymptomatic  
## 176 0.28334459 1.15400694 0.527395836 -2.69321320 0.13814442 asymptomatic  
## 177 -0.26983460 -1.34602889 -0.264462814 -0.11397859 -0.80925344 asymptomatic  
## 178 0.17270875 0.01762702 -1.210830468 -1.95004391 0.91328813 asymptomatic  
## 179 -1.26555715 -0.09601098 1.319254485 0.54175902 0.74103398 nonanginal  
## 180 -0.15919876 -0.09601098 -0.013385681 1.02263326 -0.89538052 nonanginal  
## 181 -0.71237796 -0.43692495 0.527395836 0.71662238 -0.46474513 asymptomatic  
## 182 0.17270875 0.13126501 3.134735291 0.01716893 0.74103398 asymptomatic  
## 183 -1.37619299 0.92673096 -0.052012932 1.24121247 -0.20636389 typical  
## 184 0.50461627 2.63130084 0.450141333 -0.20141028 2.72195679 typical  
## 185 0.61525211 1.49492092 1.126118229 0.49804318 -0.89538052 asymptomatic  
## 186 0.94715962 0.47217899 -0.998380587 1.28492831 -0.89538052 nontypical  
## 187 -1.37619299 -0.66420094 -0.129267435 1.94066592 -0.20636389 nonanginal  
## 188 1.27906714 1.60855891 -0.013385681 -1.29430629 -0.89538052 nontypical  
## 189 -0.04856293 3.42676679 0.701218466 1.98438176 -0.89538052 nontypical  
## 190 1.61097465 0.47217899 0.141123324 -0.15769444 0.82716105 nonanginal  
## 191 -0.49110628 -0.15282997 -0.979066961 0.58547486 -0.89538052 nonanginal  
## 192 -0.38047044 0.47217899 0.990922850 -1.20687461 2.72195679 asymptomatic  
## 193 -1.26555715 0.01762702 0.005927944 -0.28884196 -0.80925344 asymptomatic  
## 194 0.83652378 0.35854099 0.913668348 -1.90632806 0.74103398 asymptomatic  
## 195 1.50033882 -0.66420094 -0.689362577 -1.51288550 0.39652566 nonanginal  
## 196 1.38970298 -1.80058086 1.010236476 -1.07572709 -0.12023681 asymptomatic  
## 197 1.61097465 1.60855891 -0.245149188 -0.81343205 -0.80925344 typical  
## 198 -1.04428547 0.35854099 -0.206521937 0.10460061 -0.72312637 asymptomatic  
## 199 -0.49110628 -0.66420094 -0.052012932 0.54175902 0.05201734 nontypical  
## 200 0.50461627 1.60855891 0.508082210 -1.07572709 -0.89538052 typical  
## 201 -0.49110628 -1.23239090 0.141123324 0.41061149 -0.89538052 asymptomatic  
## 202 1.05779546 2.74493883 1.512390741 0.19203229 -0.89538052 asymptomatic  
## 203 0.28334459 1.04036895 -2.331020753 1.02263326 -0.72312637 nonanginal  
## 204 1.05779546 0.47217899 1.280627234 -0.72600036 -0.72312637 nonanginal  
## 205 -1.26555715 -1.23239090 -0.689362577 0.49804318 -0.89538052 asymptomatic  
## 206 -1.04428547 0.58581698 1.203372732 -0.11397859 -0.89538052 asymptomatic  
## 207 0.39398043 -0.20964897 0.237691452 -0.85714789 1.68843184 asymptomatic  
## 208 -0.49110628 0.69945497 -0.901812459 -1.03201125 -0.12023681 asymptomatic  
## 209 0.06207291 -0.09601098 0.295632328 0.23574813 -0.89538052 nontypical  
## 210 0.83652378 1.04036895 -0.052012932 0.19203229 0.31039858 asymptomatic  
## 211 -1.92937218 -0.66420094 -0.612108075 0.89148574 -0.89538052 nonanginal  
## 212 -1.81873635 -0.66420094 -0.303090065 1.41607583 2.37744847 typical  
## 213 -1.48682883 -0.09601098 -0.631421700 0.80405406 0.82716105 nonanginal  
## 214 1.27906714 2.63130084 -0.361030942 0.67290654 -0.03410973 asymptomatic  
## 215 -0.26983460 -1.11875291 -0.322403691 0.45432733 -0.89538052 asymptomatic  
## 216 0.17270875 -0.66420094 -1.037007838 0.54175902 0.74103398 typical  
## 217 -0.93364964 -1.51648588 -0.824557956 0.97891742 -0.89538052 nontypical  
## 218 -0.93364964 0.35854099 -0.071326558 0.10460061 -0.89538052 asymptomatic  
## 219 1.05779546 -0.09601098 1.087490978 -1.20687461 0.82716105 asymptomatic  
## 220 0.50461627 0.35854099 0.469454959 1.41607583 -0.89538052 asymptomatic  
## 221 -1.48682883 -1.11875291 0.411514082 0.97891742 -0.89538052 nonanginal  
## 222 -0.04856293 -1.34602889 0.392200456 0.76033822 -0.89538052 nonanginal  
## 223 -1.70810051 -2.14149484 -0.921126084 1.28492831 -0.89538052 nonanginal  
## 224 -0.15919876 -0.49374395 0.681904840 -2.38720231 0.82716105 asymptomatic  
## 225 0.94715962 -1.34602889 0.430827708 0.84776990 0.65490690 asymptomatic  
## 226 -2.26127970 -0.77783893 -0.708676203 1.85323424 -0.29249097 nontypical  
## 227 -0.82301380 -1.11875291 -0.824557956 -0.28884196 -0.80925344 asymptomatic  
## 228 1.38970298 1.15400694 0.585336712 0.97891742 -0.89538052 nonanginal  
## 229 -0.04856293 -1.23239090 -0.785930705 -1.81889638 -0.89538052 asymptomatic  
## 230 1.27906714 -1.11875291 -0.670048951 -0.76971621 -0.80925344 asymptomatic  
## 231 -0.26983460 0.24490300 -0.979066961 0.84776990 -0.80925344 nonanginal  
## 232 0.06207291 2.74493883 1.551017992 -1.42545382 2.03294016 asymptomatic  
## 233 -0.60174212 -0.77783893 -1.886807364 -1.03201125 -0.20636389 nonanginal  
## 234 2.16415385 -0.66420094 0.430827708 -1.25059045 -0.72312637 nontypical  
## 235 -0.04856293 1.60855891 -0.882498833 0.58547486 -0.89538052 nonanginal  
## 236 -0.04856293 -0.55056295 0.759159343 -1.46916966 1.86068600 asymptomatic  
## 237 0.17270875 -0.09601098 0.701218466 -2.03747559 0.48265274 asymptomatic  
## 238 -0.93364964 -0.66420094 0.044555196 -0.24512612 -0.20636389 asymptomatic  
## 239 -0.60174212 0.13126501 0.469454959 0.54175902 -0.89538052 nontypical  
## 240 -1.37619299 -0.66420094 0.932981973 0.54175902 -0.89538052 nontypical  
## 241 -1.48682883 -1.23239090 -0.225835563 0.14831645 -0.89538052 nontypical  
## 242 -1.48682883 -0.32328696 1.145431855 0.58547486 -0.89538052 nontypical  
## 243 -0.60174212 -0.09601098 0.430827708 0.58547486 -0.89538052 asymptomatic  
## 244 0.72588794 0.13126501 -0.245149188 -0.20141028 1.34392353 typical  
## 245 0.61525211 -0.66420094 -1.326712222 -2.34348647 -0.89538052 nonanginal  
## 246 1.38970298 -0.66420094 -0.187208311 -3.43638249 -0.03410973 asymptomatic  
## 247 0.39398043 -1.80058086 -0.245149188 0.27946397 -0.80925344 asymptomatic  
## 248 -0.82301380 -1.23239090 0.546709461 -1.38173798 -0.03410973 asymptomatic  
## 249 -0.26983460 -0.38010596 -0.670048951 0.80405406 -0.03410973 asymptomatic  
## 250 0.83652378 -0.20964897 -0.747303454 -0.41998948 -0.89538052 nontypical  
## 251 0.28334459 -1.23239090 -0.882498833 -1.03201125 0.39652566 asymptomatic  
## 252 0.39398043 0.81309296 -0.554167198 -1.95004391 0.82716105 asymptomatic  
## 253 1.05779546 -0.20964897 0.314945954 -1.95004391 -0.72312637 asymptomatic  
## 254 -0.38047044 -0.66420094 0.932981973 0.32317981 -0.37861805 nonanginal  
## 255 -1.26555715 -0.94829592 1.087490978 1.37235999 0.13814442 asymptomatic  
## 256 -1.37619299 -0.66420094 -0.727989828 1.02263326 -0.89538052 nonanginal  
## 257 1.38970298 -1.45966689 -0.457599070 -0.33255780 -0.63699929 asymptomatic  
## 258 2.38542553 0.47217899 -0.959753335 -1.46916966 0.05201734 nonanginal  
## 259 1.72161049 1.38128292 -0.032699307 -0.28884196 -0.89538052 nontypical  
## 260 0.28334459 -0.43692495 0.276318703 -0.37627364 -0.63699929 nontypical  
## 261 -1.15492131 -0.77783893 -0.090640183 -0.02654691 -0.63699929 nonanginal  
## 262 0.39398043 0.24490300 1.396508987 0.10460061 -0.89538052 nontypical  
## 263 0.61525211 1.04036895 -0.129267435 0.93520158 -0.12023681 typical  
## 264 -1.15492131 -0.66420094 -0.399658193 0.84776990 -0.89538052 nonanginal  
## 265 0.72588794 0.35854099 -1.558475729 -1.07572709 2.20519432 asymptomatic  
## 266 -1.37619299 0.24490300 1.319254485 -1.07572709 0.65490690 asymptomatic  
## 267 -0.26983460 -0.20964897 -0.824557956 0.27946397 -0.03410973 asymptomatic  
## 268 0.50461627 -0.32328696 -0.554167198 -0.68228452 0.99941521 nonanginal  
## 269 -1.59746467 1.15400694 -0.457599070 1.37235999 -0.89538052 asymptomatic  
## 270 -1.37619299 -0.09601098 -1.288084971 0.01716893 -0.89538052 nonanginal  
## 271 0.72588794 0.47217899 -0.766617079 -0.50742116 0.74103398 asymptomatic  
## 272 1.27906714 1.60855891 -0.361030942 -0.50742116 1.08554229 asymptomatic  
## 273 -0.93364964 0.47217899 1.241999983 -1.29430629 0.65490690 asymptomatic  
## 274 1.83224633 -1.11875291 -1.886807364 -1.07572709 0.48265274 asymptomatic  
## 275 0.50461627 0.13126501 -0.824557956 0.54175902 -0.20636389 typical  
## 276 1.05779546 2.17674887 -0.380344567 0.23574813 -0.37861805 typical  
## 277 1.27906714 0.81309296 0.604650338 0.10460061 -0.89538052 nonanginal  
## 278 -1.70810051 0.35854099 -0.515539947 0.10460061 -0.89538052 nonanginal  
## 279 0.28334459 1.26764493 -0.283776439 0.62919070 -0.89538052 nontypical  
## 280 0.39398043 -0.09601098 -0.959753335 -0.81343205 -0.37861805 asymptomatic  
## 281 0.28334459 -1.23239090 1.705526997 -0.28884196 1.68843184 asymptomatic  
## 282 -0.82301380 -0.09601098 0.121809698 1.28492831 -0.89538052 nonanginal  
## 283 0.06207291 -0.20964897 -0.805244331 -0.85714789 0.82716105 asymptomatic  
## 284 -2.15064386 -0.55056295 -1.056321463 1.06634911 -0.89538052 nontypical  
## 285 0.72588794 0.92673096 -0.843871582 0.49804318 -0.89538052 asymptomatic  
## 286 0.39398043 -1.00511492 1.377195362 -0.41998948 2.89421095 asymptomatic  
## 287 0.39398043 2.17674887 -0.418971819 -0.15769444 1.51617769 asymptomatic  
## 288 0.39398043 -0.38010596 -0.515539947 -0.24512612 -0.55087221 nontypical  
## 289 0.17270875 -0.09601098 -0.496226321 0.58547486 -0.89538052 nontypical  
## 290 0.17270875 -0.66420094 -0.129267435 0.84776990 -0.89538052 nontypical  
## 291 1.38970298 1.15400694 -0.670048951 0.01716893 -0.20636389 nonanginal  
## 292 0.06207291 0.01762702 1.840722376 0.71662238 0.13814442 nontypical  
## 293 -1.15492131 -0.66420094 -1.500534852 -0.24512612 1.51617769 asymptomatic  
## 294 0.94715962 0.47217899 -1.152889591 -0.24512612 2.54970263 asymptomatic  
## 295 0.94715962 -0.43692495 -0.959753335 -0.59485284 -0.89538052 asymptomatic  
## 296 -1.48682883 -0.66420094 -1.732298359 1.41607583 -0.89538052 nontypical  
## 297 0.50461627 1.83583489 -1.365339473 -2.60578152 -0.03410973 asymptomatic  
## 298 0.28334459 0.47217899 -0.109953809 -1.16315877 -0.72312637 asymptomatic  
## 299 -1.04428547 -1.23239090 0.334259580 -0.76971621 0.13814442 typical  
## 300 1.50033882 0.69945497 -1.037007838 -0.37627364 2.03294016 asymptomatic  
## 301 0.28334459 -0.09601098 -2.234452625 -1.51288550 0.13814442 asymptomatic  
## 302 0.28334459 -0.09601098 -0.206521937 1.06634911 -0.89538052 nontypical  
## 303 -1.81873635 0.35854099 -1.384653099 1.02263326 -0.89538052 nonanginal  
## Sex Fbs RestECG ExAng Slope Ca Thal1 AHD id  
## 1 1 1 2 0 3 0 0 No 1  
## 2 1 0 2 1 2 3 1 Yes 2  
## 3 1 0 2 1 2 2 2 Yes 3  
## 4 1 0 0 0 3 0 1 No 4  
## 5 0 0 2 0 1 0 1 No 5  
## 6 1 0 0 0 1 0 1 No 6  
## 7 0 0 2 0 3 2 1 Yes 7  
## 8 0 0 0 1 1 0 1 No 8  
## 9 1 0 2 0 2 1 2 Yes 9  
## 10 1 1 2 1 3 0 2 Yes 10  
## 11 1 0 0 0 2 0 0 No 11  
## 12 0 0 2 0 2 0 1 No 12  
## 13 1 1 2 1 2 1 0 Yes 13  
## 14 1 0 0 0 1 0 2 No 14  
## 15 1 1 0 0 1 0 2 No 15  
## 16 1 0 0 0 1 0 1 No 16  
## 17 1 0 0 0 3 0 2 Yes 17  
## 18 1 0 0 0 1 0 1 No 18  
## 19 0 0 0 0 1 0 1 No 19  
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## 21 1 0 2 1 2 0 1 No 21  
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## 32 1 1 0 1 1 2 2 Yes 32  
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## 37 1 0 2 1 2 0 2 Yes 37  
## 38 1 0 2 1 2 1 0 Yes 38  
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## 40 1 1 0 1 2 0 1 No 40  
## 41 0 0 2 0 2 3 2 Yes 41  
## 42 1 0 0 1 1 0 2 No 42  
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## 46 1 0 2 0 2 1 2 Yes 46  
## 47 1 0 0 0 1 0 1 No 47  
## 48 1 0 2 0 2 0 2 Yes 48  
## 49 0 1 2 0 1 1 1 No 49  
## 50 1 1 2 0 3 0 1 No 50  
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## 96 1 0 0 1 1 1 2 Yes 96  
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## 289 1 0 2 0 1 0 2 No 289  
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## 295 0 0 0 1 2 0 1 Yes 295  
## 296 1 0 0 0 1 0 1 No 296  
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## 300 1 1 0 0 2 2 2 Yes 300  
## 301 1 0 0 1 2 1 2 Yes 301  
## 302 0 0 2 0 2 1 1 Yes 302  
## 303 1 0 0 0 1 0 1 No 303

## Seperating AHD from the dataset since we have to predict the value of AHD.  
  
cp\_new5 = cp\_new4 %>% select(-AHD)  
cp\_new5

## Age RestBP Chol MaxHR Oldpeak ChestPain  
## 1 0.94715962 0.75627397 -0.264462814 0.01716893 1.08554229 typical  
## 2 1.38970298 1.60855891 0.759159343 -1.81889638 0.39652566 asymptomatic  
## 3 1.38970298 -0.66420094 -0.341717316 -0.90086373 1.34392353 asymptomatic  
## 4 -1.92937218 -0.09601098 0.063868821 1.63465503 2.11906724 nonanginal  
## 5 -1.48682883 -0.09601098 -0.824557956 0.97891742 0.31039858 nontypical  
## 6 0.17270875 -0.66420094 -0.206521937 1.24121247 -0.20636389 nontypical  
## 7 0.83652378 0.47217899 0.411514082 0.45432733 2.20519432 asymptomatic  
## 8 0.28334459 -0.66420094 2.072485883 0.58547486 -0.37861805 asymptomatic  
## 9 0.94715962 -0.09601098 0.141123324 -0.11397859 0.31039858 asymptomatic  
## 10 -0.15919876 0.47217899 -0.843871582 0.23574813 1.77455892 asymptomatic  
## 11 0.28334459 0.47217899 -1.056321463 -0.07026275 -0.55087221 asymptomatic  
## 12 0.17270875 0.47217899 0.913668348 0.14831645 0.22427150 nontypical  
## 13 0.17270875 -0.09601098 0.179750575 -0.33255780 -0.37861805 nonanginal  
## 14 -1.15492131 -0.66420094 0.314945954 1.02263326 -0.89538052 nontypical  
## 15 -0.26983460 2.29038686 -0.921126084 0.54175902 -0.46474513 nonanginal  
## 16 0.28334459 1.04036895 -1.519848478 1.06634911 0.48265274 nonanginal  
## 17 -0.71237796 -1.23239090 -0.341717316 0.80405406 -0.03410973 nontypical  
## 18 -0.04856293 0.47217899 -0.148581060 0.45432733 0.13814442 asymptomatic  
## 19 -0.71237796 -0.09601098 0.546709461 -0.46370532 -0.72312637 nonanginal  
## 20 -0.60174212 -0.09601098 0.372886831 0.93520158 -0.37861805 nontypical  
## 21 1.05779546 -1.23239090 -0.689362577 -0.24512612 0.65490690 typical  
## 22 0.39398043 1.04036895 0.701218466 0.54175902 -0.03410973 typical  
## 23 0.39398043 -0.66420094 0.720532092 0.45432733 0.65490690 nontypical  
## 24 0.39398043 0.01762702 -0.438285444 1.02263326 1.86068600 nonanginal  
## 25 0.61525211 -0.09601098 -0.785930705 -0.76971621 1.17166937 asymptomatic  
## 26 -0.49110628 -0.66420094 -0.534853572 0.36689565 0.48265274 nonanginal  
## 27 0.39398043 -0.66420094 1.802095125 0.97891742 -0.89538052 nonanginal  
## 28 1.27906714 1.04036895 -0.399658193 -1.55660134 1.34392353 typical  
## 29 -1.26555715 1.04036895 0.005927944 0.93520158 0.39652566 asymptomatic  
## 30 -1.59746467 -1.23239090 -1.539162103 -1.55660134 0.82716105 asymptomatic  
## 31 1.61097465 0.47217899 -0.148581060 0.06088477 0.65490690 typical  
## 32 0.61525211 -0.83465793 -0.322403691 0.45432733 0.31039858 asymptomatic  
## 33 1.05779546 0.47217899 1.705526997 0.36689565 -0.89538052 nonanginal  
## 34 0.50461627 0.18808400 -0.245149188 0.49804318 -0.46474513 asymptomatic  
## 35 -1.15492131 -0.09601098 -0.264462814 1.28492831 -0.55087221 nonanginal  
## 36 -1.37619299 0.47217899 -0.399658193 1.24121247 -0.89538052 asymptomatic  
## 37 -1.26555715 -0.66420094 -1.346025847 -1.29430629 1.25779645 asymptomatic  
## 38 0.28334459 1.04036895 0.566023087 -1.64403302 -0.37861805 asymptomatic  
## 39 0.06207291 0.01762702 2.053172258 -0.76971621 0.13814442 asymptomatic  
## 40 0.72588794 1.04036895 -0.071326558 -0.55113700 -0.03410973 nonanginal  
## 41 1.16843130 1.04036895 -0.418971819 -1.55660134 -0.03410973 asymptomatic  
## 42 -1.59746467 0.47217899 -0.921126084 1.24121247 0.31039858 typical  
## 43 1.83224633 1.60855891 1.068177352 0.54175902 -0.55087221 nontypical  
## 44 0.50461627 1.04036895 -0.670048951 0.32317981 0.48265274 nonanginal  
## 45 0.72588794 -0.09601098 1.608958869 0.84776990 -0.89538052 asymptomatic  
## 46 0.39398043 -1.11875291 -0.322403691 0.67290654 1.25779645 nonanginal  
## 47 -0.38047044 -1.23239090 -1.384653099 -1.16315877 -0.37861805 nonanginal  
## 48 -0.49110628 1.04036895 -0.071326558 -0.94457957 1.34392353 asymptomatic  
## 49 1.16843130 0.47217899 3.289244296 0.32317981 -0.20636389 nonanginal  
## 50 -0.15919876 -0.09601098 -0.959753335 0.10460061 0.13814442 nonanginal  
## 51 -1.48682883 -1.51648588 -0.940439710 0.80405406 -0.89538052 nontypical  
## 52 1.16843130 -0.66420094 -1.346025847 -0.41998948 -0.55087221 asymptomatic  
## 53 -1.15492131 -1.11875291 0.836413845 0.14831645 -0.89538052 asymptomatic  
## 54 -1.15492131 -0.09601098 -0.534853572 1.67837088 -0.89538052 nontypical  
## 55 0.61525211 -0.09601098 0.121809698 -0.24512612 0.31039858 asymptomatic  
## 56 -0.04856293 -0.43692495 0.372886831 -1.77518054 0.99941521 asymptomatic  
## 57 -0.49110628 0.47217899 -0.264462814 0.58547486 -0.37861805 nonanginal  
## 58 -1.48682883 -1.23239090 -1.442593975 0.36689565 -0.89538052 asymptomatic  
## 59 -0.04856293 -0.38010596 0.508082210 0.10460061 -0.46474513 nonanginal  
## 60 -0.38047044 -0.38010596 -0.650735326 -1.07572709 0.31039858 typical  
## 61 -0.38047044 -0.09601098 1.126118229 -0.33255780 0.13814442 asymptomatic  
## 62 -0.93364964 0.58581698 -1.346025847 0.45432733 0.31039858 nonanginal  
## 63 0.39398043 -0.20964897 -0.592794449 -0.81343205 0.99941521 asymptomatic  
## 64 -0.04856293 0.18808400 1.106804604 0.89148574 -0.89538052 nonanginal  
## 65 -0.04856293 -0.66420094 -1.133575966 -1.60031718 0.31039858 asymptomatic  
## 66 0.61525211 0.75627397 0.681904840 -0.33255780 1.51617769 asymptomatic  
## 67 0.61525211 0.47217899 -1.191516843 0.23574813 1.68843184 nonanginal  
## 68 -0.04856293 1.04036895 -0.283776439 0.67290654 0.48265274 nonanginal  
## 69 0.50461627 2.17674887 1.531704367 -0.41998948 2.03294016 asymptomatic  
## 70 -0.93364964 1.04036895 -0.303090065 -0.11397859 2.20519432 nonanginal  
## 71 1.16843130 1.32446393 0.430827708 -0.07026275 -0.20636389 nonanginal  
## 72 1.38970298 -0.38010596 0.141123324 0.58547486 -0.72312637 asymptomatic  
## 73 0.83652378 -0.66420094 0.392200456 -2.21233895 0.65490690 asymptomatic  
## 74 1.16843130 -1.23239090 0.025241570 0.36689565 -0.37861805 asymptomatic  
## 75 -1.15492131 -1.23239090 -0.959753335 1.19749663 -0.89538052 asymptomatic  
## 76 1.16843130 1.60855891 2.188367637 0.06088477 -0.20636389 nonanginal  
## 77 0.61525211 -0.38010596 0.218377826 -0.37627364 1.51617769 asymptomatic  
## 78 -0.38047044 0.47217899 1.184059106 -0.33255780 0.39652566 nonanginal  
## 79 -0.71237796 -0.09601098 -0.032699307 1.32864415 -0.72312637 nontypical  
## 80 0.39398043 1.04036895 0.450141333 -1.68774886 -0.20636389 asymptomatic  
## 81 -1.04428547 -1.57330488 -0.747303454 -0.07026275 1.68843184 asymptomatic  
## 82 -0.15919876 -0.09601098 0.334259580 -0.28884196 -0.55087221 asymptomatic  
## 83 -1.70810051 0.47217899 1.435136239 1.41607583 -0.89538052 nonanginal  
## 84 1.50033882 2.74493883 0.527395836 0.01716893 0.48265274 nonanginal  
## 85 -0.26983460 -0.66420094 1.512390741 0.97891742 -0.72312637 nontypical  
## 86 -1.15492131 0.47217899 -0.225835563 1.32864415 -0.89538052 nonanginal  
## 87 -0.82301380 0.35854099 0.199064200 0.27946397 -0.89538052 nonanginal  
## 88 -0.15919876 -0.20964897 -0.592794449 -1.51288550 -0.89538052 nonanginal  
## 89 -0.15919876 0.35854099 -0.245149188 0.45432733 -0.89538052 asymptomatic  
## 90 -0.38047044 -0.09601098 0.179750575 -0.02654691 -0.46474513 nonanginal  
## 91 1.27906714 -0.66420094 1.068177352 0.06088477 -0.55087221 asymptomatic  
## 92 0.83652378 1.60855891 -1.597102980 -0.20141028 4.44449837 asymptomatic  
## 93 0.83652378 -0.09601098 -0.303090065 -0.15769444 0.65490690 nonanginal  
## 94 -1.15492131 -1.34602889 -2.041316369 1.11006495 -0.37861805 nonanginal  
## 95 0.94715962 0.18808400 0.102496072 0.97891742 -0.89538052 nonanginal  
## 96 -0.26983460 -0.20964897 0.160436949 0.49804318 -0.89538052 asymptomatic  
## 97 0.50461627 -1.23239090 -0.148581060 -0.33255780 0.13814442 asymptomatic  
## 98 0.61525211 1.04036895 0.218377826 0.32317981 1.34392353 asymptomatic  
## 99 -0.26983460 0.13126501 -0.882498833 0.36689565 -0.20636389 nontypical  
## 100 -0.71237796 -0.55056295 -0.476912695 1.59093919 -0.89538052 asymptomatic  
## 101 -1.04428547 -0.94829592 0.257005077 1.54722335 -0.89538052 asymptomatic  
## 102 -2.26127970 -0.77783893 -1.249457719 1.06634911 -0.89538052 typical  
## 103 0.28334459 -0.20964897 1.087490978 0.41061149 -0.89538052 asymptomatic  
## 104 1.83224633 -1.23239090 0.353573205 -0.85714789 -0.89538052 nonanginal  
## 105 -0.60174212 -0.66420094 -1.133575966 -0.46370532 0.82716105 nonanginal  
## 106 -0.04856293 -1.34602889 1.203372732 0.27946397 -0.89538052 nontypical  
## 107 0.50461627 0.47217899 -1.346025847 0.54175902 -0.89538052 asymptomatic  
## 108 0.28334459 -0.20964897 -0.341717316 0.01716893 -0.55087221 nonanginal  
## 109 0.72588794 -0.66420094 0.257005077 -0.41998948 2.20519432 asymptomatic  
## 110 -1.70810051 -0.77783893 -0.534853572 -0.41998948 0.13814442 asymptomatic  
## 111 0.72588794 0.75627397 1.164745480 -0.15769444 -0.03410973 asymptomatic  
## 112 0.17270875 -0.38010596 0.044555196 -0.24512612 0.13814442 asymptomatic  
## 113 -0.26983460 -0.77783893 -1.172203217 1.76580256 -0.89538052 typical  
## 114 -1.26555715 0.01762702 1.821408751 -0.59485284 1.68843184 asymptomatic  
## 115 0.83652378 -0.09601098 0.314945954 -2.29977063 0.13814442 nonanginal  
## 116 -1.48682883 0.18808400 -0.843871582 -0.76971621 -0.89538052 nontypical  
## 117 0.39398043 0.47217899 -0.689362577 0.67290654 -0.89538052 nonanginal  
## 118 -2.15064386 0.35854099 -1.230144094 1.41607583 0.31039858 asymptomatic  
## 119 0.94715962 -0.09601098 1.608958869 -0.76971621 0.65490690 asymptomatic  
## 120 1.16843130 0.18808400 0.141123324 -0.98829541 1.51617769 asymptomatic  
## 121 -0.71237796 -0.09601098 0.179750575 0.01716893 -0.89538052 asymptomatic  
## 122 0.94715962 1.04036895 3.096108040 0.19203229 2.54970263 asymptomatic  
## 123 -0.38047044 -1.80058086 -0.476912695 -0.28884196 0.13814442 nonanginal  
## 124 0.06207291 0.47217899 -0.573480823 -1.68774886 3.92773589 asymptomatic  
## 125 1.16843130 0.35854099 0.681904840 1.06634911 0.31039858 typical  
## 126 -1.04428547 -0.09601098 -0.245149188 1.11006495 -0.37861805 nontypical  
## 127 0.17270875 3.88131876 0.797786594 -0.72600036 2.54970263 asymptomatic  
## 128 -0.04856293 -1.23239090 -0.148581060 -1.03201125 1.51617769 asymptomatic  
## 129 -1.15492131 -0.66420094 -0.515539947 0.89148574 -0.89538052 nontypical  
## 130 0.83652378 -0.43692495 -0.727989828 0.58547486 -0.89538052 asymptomatic  
## 131 -0.04856293 -0.66420094 0.218377826 -0.11397859 -0.55087221 nonanginal  
## 132 -0.38047044 -2.14149484 -0.380344567 0.19203229 -0.89538052 nonanginal  
## 133 -2.81445889 -0.09601098 -0.824557956 2.29039265 -0.89538052 nontypical  
## 134 -0.38047044 0.47217899 0.276318703 1.59093919 -0.89538052 asymptomatic  
## 135 -1.26555715 -0.55056295 -0.650735326 0.67290654 -0.72312637 nonanginal  
## 136 0.06207291 0.18808400 0.063868821 0.49804318 0.31039858 nontypical  
## 137 1.72161049 0.75627397 -1.403966724 -1.07572709 1.34392353 asymptomatic  
## 138 0.83652378 -0.66420094 0.662591215 -2.03747559 0.31039858 nontypical  
## 139 -2.15064386 -0.66420094 -0.940439710 -0.85714789 0.48265274 asymptomatic  
## 140 -0.38047044 -0.38010596 -0.032699307 0.71662238 1.17166937 nonanginal  
## 141 0.50461627 0.47217899 -0.496226321 0.62919070 -0.89538052 nontypical  
## 142 0.50461627 2.17674887 0.797786594 0.41061149 -0.72312637 typical  
## 143 -0.26983460 -0.20964897 -0.805244331 1.50350751 -0.89538052 nontypical  
## 144 1.05779546 -0.38010596 1.203372732 -0.81343205 0.65490690 nonanginal  
## 145 0.39398043 -1.51648588 -0.129267435 0.19203229 -0.37861805 nonanginal  
## 146 -0.82301380 -1.34602889 -0.071326558 0.10460061 -0.89538052 nonanginal  
## 147 0.28334459 1.89265389 0.817100220 -1.11944293 -0.03410973 asymptomatic  
## 148 -1.48682883 -1.11875291 0.063868821 1.28492831 -0.89538052 nonanginal  
## 149 -1.04428547 -0.20964897 1.184059106 0.89148574 -0.89538052 nontypical  
## 150 0.61525211 -1.68694287 1.377195362 0.45432733 -0.89538052 nonanginal  
## 151 -0.26983460 1.15400694 0.990922850 1.24121247 0.13814442 typical  
## 152 -1.37619299 -1.68694287 0.353573205 -1.20687461 -0.37861805 asymptomatic  
## 153 1.38970298 -0.94829592 6.128347259 0.45432733 0.48265274 nonanginal  
## 154 0.06207291 1.60855891 0.817100220 -0.20141028 -0.20636389 asymptomatic  
## 155 1.05779546 -0.66420094 -0.013385681 -2.34348647 0.99941521 asymptomatic  
## 156 1.72161049 -0.09601098 1.454449864 -1.77518054 1.17166937 asymptomatic  
## 157 -0.38047044 0.47217899 1.010236476 1.02263326 0.48265274 asymptomatic  
## 158 0.39398043 -0.38010596 1.029550101 0.93520158 -0.89538052 asymptomatic  
## 159 0.61525211 0.47217899 0.894354722 0.89148574 0.13814442 asymptomatic  
## 160 1.50033882 -0.77783893 0.585336712 0.06088477 -0.03410973 nonanginal  
## 161 -0.93364964 -1.74376187 -0.959753335 0.27946397 -0.89538052 nontypical  
## 162 2.49606136 -0.38010596 1.106804604 0.54175902 -0.89538052 asymptomatic  
## 163 -0.04856293 -1.23239090 -0.631421700 0.36689565 0.48265274 nonanginal  
## 164 0.39398043 -1.80058086 0.025241570 -1.20687461 -0.03410973 asymptomatic  
## 165 -0.71237796 -0.43692495 0.160436949 1.11006495 -0.89538052 nonanginal  
## 166 0.28334459 0.01762702 -0.766617079 0.80405406 -0.89538052 asymptomatic  
## 167 -0.26983460 0.35854099 -0.457599070 0.84776990 -0.89538052 nonanginal  
## 168 -0.04856293 0.01762702 0.797786594 0.41061149 -0.89538052 nontypical  
## 169 -2.15064386 -0.32328696 0.681904840 0.27946397 -0.89538052 asymptomatic  
## 170 -1.04428547 -1.11875291 -1.674357482 -0.50742116 -0.89538052 nontypical  
## 171 1.72161049 1.60855891 0.430827708 -1.64403302 1.60230476 nonanginal  
## 172 -0.15919876 0.58581698 -0.399658193 -1.68774886 -0.89538052 asymptomatic  
## 173 0.50461627 2.40402486 0.044555196 -0.28884196 -0.89538052 asymptomatic  
## 174 0.83652378 0.47217899 2.845030907 0.32317981 0.13814442 asymptomatic  
## 175 1.05779546 0.75627397 -0.670048951 -0.76971621 0.82716105 asymptomatic  
## 176 0.28334459 1.15400694 0.527395836 -2.69321320 0.13814442 asymptomatic  
## 177 -0.26983460 -1.34602889 -0.264462814 -0.11397859 -0.80925344 asymptomatic  
## 178 0.17270875 0.01762702 -1.210830468 -1.95004391 0.91328813 asymptomatic  
## 179 -1.26555715 -0.09601098 1.319254485 0.54175902 0.74103398 nonanginal  
## 180 -0.15919876 -0.09601098 -0.013385681 1.02263326 -0.89538052 nonanginal  
## 181 -0.71237796 -0.43692495 0.527395836 0.71662238 -0.46474513 asymptomatic  
## 182 0.17270875 0.13126501 3.134735291 0.01716893 0.74103398 asymptomatic  
## 183 -1.37619299 0.92673096 -0.052012932 1.24121247 -0.20636389 typical  
## 184 0.50461627 2.63130084 0.450141333 -0.20141028 2.72195679 typical  
## 185 0.61525211 1.49492092 1.126118229 0.49804318 -0.89538052 asymptomatic  
## 186 0.94715962 0.47217899 -0.998380587 1.28492831 -0.89538052 nontypical  
## 187 -1.37619299 -0.66420094 -0.129267435 1.94066592 -0.20636389 nonanginal  
## 188 1.27906714 1.60855891 -0.013385681 -1.29430629 -0.89538052 nontypical  
## 189 -0.04856293 3.42676679 0.701218466 1.98438176 -0.89538052 nontypical  
## 190 1.61097465 0.47217899 0.141123324 -0.15769444 0.82716105 nonanginal  
## 191 -0.49110628 -0.15282997 -0.979066961 0.58547486 -0.89538052 nonanginal  
## 192 -0.38047044 0.47217899 0.990922850 -1.20687461 2.72195679 asymptomatic  
## 193 -1.26555715 0.01762702 0.005927944 -0.28884196 -0.80925344 asymptomatic  
## 194 0.83652378 0.35854099 0.913668348 -1.90632806 0.74103398 asymptomatic  
## 195 1.50033882 -0.66420094 -0.689362577 -1.51288550 0.39652566 nonanginal  
## 196 1.38970298 -1.80058086 1.010236476 -1.07572709 -0.12023681 asymptomatic  
## 197 1.61097465 1.60855891 -0.245149188 -0.81343205 -0.80925344 typical  
## 198 -1.04428547 0.35854099 -0.206521937 0.10460061 -0.72312637 asymptomatic  
## 199 -0.49110628 -0.66420094 -0.052012932 0.54175902 0.05201734 nontypical  
## 200 0.50461627 1.60855891 0.508082210 -1.07572709 -0.89538052 typical  
## 201 -0.49110628 -1.23239090 0.141123324 0.41061149 -0.89538052 asymptomatic  
## 202 1.05779546 2.74493883 1.512390741 0.19203229 -0.89538052 asymptomatic  
## 203 0.28334459 1.04036895 -2.331020753 1.02263326 -0.72312637 nonanginal  
## 204 1.05779546 0.47217899 1.280627234 -0.72600036 -0.72312637 nonanginal  
## 205 -1.26555715 -1.23239090 -0.689362577 0.49804318 -0.89538052 asymptomatic  
## 206 -1.04428547 0.58581698 1.203372732 -0.11397859 -0.89538052 asymptomatic  
## 207 0.39398043 -0.20964897 0.237691452 -0.85714789 1.68843184 asymptomatic  
## 208 -0.49110628 0.69945497 -0.901812459 -1.03201125 -0.12023681 asymptomatic  
## 209 0.06207291 -0.09601098 0.295632328 0.23574813 -0.89538052 nontypical  
## 210 0.83652378 1.04036895 -0.052012932 0.19203229 0.31039858 asymptomatic  
## 211 -1.92937218 -0.66420094 -0.612108075 0.89148574 -0.89538052 nonanginal  
## 212 -1.81873635 -0.66420094 -0.303090065 1.41607583 2.37744847 typical  
## 213 -1.48682883 -0.09601098 -0.631421700 0.80405406 0.82716105 nonanginal  
## 214 1.27906714 2.63130084 -0.361030942 0.67290654 -0.03410973 asymptomatic  
## 215 -0.26983460 -1.11875291 -0.322403691 0.45432733 -0.89538052 asymptomatic  
## 216 0.17270875 -0.66420094 -1.037007838 0.54175902 0.74103398 typical  
## 217 -0.93364964 -1.51648588 -0.824557956 0.97891742 -0.89538052 nontypical  
## 218 -0.93364964 0.35854099 -0.071326558 0.10460061 -0.89538052 asymptomatic  
## 219 1.05779546 -0.09601098 1.087490978 -1.20687461 0.82716105 asymptomatic  
## 220 0.50461627 0.35854099 0.469454959 1.41607583 -0.89538052 asymptomatic  
## 221 -1.48682883 -1.11875291 0.411514082 0.97891742 -0.89538052 nonanginal  
## 222 -0.04856293 -1.34602889 0.392200456 0.76033822 -0.89538052 nonanginal  
## 223 -1.70810051 -2.14149484 -0.921126084 1.28492831 -0.89538052 nonanginal  
## 224 -0.15919876 -0.49374395 0.681904840 -2.38720231 0.82716105 asymptomatic  
## 225 0.94715962 -1.34602889 0.430827708 0.84776990 0.65490690 asymptomatic  
## 226 -2.26127970 -0.77783893 -0.708676203 1.85323424 -0.29249097 nontypical  
## 227 -0.82301380 -1.11875291 -0.824557956 -0.28884196 -0.80925344 asymptomatic  
## 228 1.38970298 1.15400694 0.585336712 0.97891742 -0.89538052 nonanginal  
## 229 -0.04856293 -1.23239090 -0.785930705 -1.81889638 -0.89538052 asymptomatic  
## 230 1.27906714 -1.11875291 -0.670048951 -0.76971621 -0.80925344 asymptomatic  
## 231 -0.26983460 0.24490300 -0.979066961 0.84776990 -0.80925344 nonanginal  
## 232 0.06207291 2.74493883 1.551017992 -1.42545382 2.03294016 asymptomatic  
## 233 -0.60174212 -0.77783893 -1.886807364 -1.03201125 -0.20636389 nonanginal  
## 234 2.16415385 -0.66420094 0.430827708 -1.25059045 -0.72312637 nontypical  
## 235 -0.04856293 1.60855891 -0.882498833 0.58547486 -0.89538052 nonanginal  
## 236 -0.04856293 -0.55056295 0.759159343 -1.46916966 1.86068600 asymptomatic  
## 237 0.17270875 -0.09601098 0.701218466 -2.03747559 0.48265274 asymptomatic  
## 238 -0.93364964 -0.66420094 0.044555196 -0.24512612 -0.20636389 asymptomatic  
## 239 -0.60174212 0.13126501 0.469454959 0.54175902 -0.89538052 nontypical  
## 240 -1.37619299 -0.66420094 0.932981973 0.54175902 -0.89538052 nontypical  
## 241 -1.48682883 -1.23239090 -0.225835563 0.14831645 -0.89538052 nontypical  
## 242 -1.48682883 -0.32328696 1.145431855 0.58547486 -0.89538052 nontypical  
## 243 -0.60174212 -0.09601098 0.430827708 0.58547486 -0.89538052 asymptomatic  
## 244 0.72588794 0.13126501 -0.245149188 -0.20141028 1.34392353 typical  
## 245 0.61525211 -0.66420094 -1.326712222 -2.34348647 -0.89538052 nonanginal  
## 246 1.38970298 -0.66420094 -0.187208311 -3.43638249 -0.03410973 asymptomatic  
## 247 0.39398043 -1.80058086 -0.245149188 0.27946397 -0.80925344 asymptomatic  
## 248 -0.82301380 -1.23239090 0.546709461 -1.38173798 -0.03410973 asymptomatic  
## 249 -0.26983460 -0.38010596 -0.670048951 0.80405406 -0.03410973 asymptomatic  
## 250 0.83652378 -0.20964897 -0.747303454 -0.41998948 -0.89538052 nontypical  
## 251 0.28334459 -1.23239090 -0.882498833 -1.03201125 0.39652566 asymptomatic  
## 252 0.39398043 0.81309296 -0.554167198 -1.95004391 0.82716105 asymptomatic  
## 253 1.05779546 -0.20964897 0.314945954 -1.95004391 -0.72312637 asymptomatic  
## 254 -0.38047044 -0.66420094 0.932981973 0.32317981 -0.37861805 nonanginal  
## 255 -1.26555715 -0.94829592 1.087490978 1.37235999 0.13814442 asymptomatic  
## 256 -1.37619299 -0.66420094 -0.727989828 1.02263326 -0.89538052 nonanginal  
## 257 1.38970298 -1.45966689 -0.457599070 -0.33255780 -0.63699929 asymptomatic  
## 258 2.38542553 0.47217899 -0.959753335 -1.46916966 0.05201734 nonanginal  
## 259 1.72161049 1.38128292 -0.032699307 -0.28884196 -0.89538052 nontypical  
## 260 0.28334459 -0.43692495 0.276318703 -0.37627364 -0.63699929 nontypical  
## 261 -1.15492131 -0.77783893 -0.090640183 -0.02654691 -0.63699929 nonanginal  
## 262 0.39398043 0.24490300 1.396508987 0.10460061 -0.89538052 nontypical  
## 263 0.61525211 1.04036895 -0.129267435 0.93520158 -0.12023681 typical  
## 264 -1.15492131 -0.66420094 -0.399658193 0.84776990 -0.89538052 nonanginal  
## 265 0.72588794 0.35854099 -1.558475729 -1.07572709 2.20519432 asymptomatic  
## 266 -1.37619299 0.24490300 1.319254485 -1.07572709 0.65490690 asymptomatic  
## 267 -0.26983460 -0.20964897 -0.824557956 0.27946397 -0.03410973 asymptomatic  
## 268 0.50461627 -0.32328696 -0.554167198 -0.68228452 0.99941521 nonanginal  
## 269 -1.59746467 1.15400694 -0.457599070 1.37235999 -0.89538052 asymptomatic  
## 270 -1.37619299 -0.09601098 -1.288084971 0.01716893 -0.89538052 nonanginal  
## 271 0.72588794 0.47217899 -0.766617079 -0.50742116 0.74103398 asymptomatic  
## 272 1.27906714 1.60855891 -0.361030942 -0.50742116 1.08554229 asymptomatic  
## 273 -0.93364964 0.47217899 1.241999983 -1.29430629 0.65490690 asymptomatic  
## 274 1.83224633 -1.11875291 -1.886807364 -1.07572709 0.48265274 asymptomatic  
## 275 0.50461627 0.13126501 -0.824557956 0.54175902 -0.20636389 typical  
## 276 1.05779546 2.17674887 -0.380344567 0.23574813 -0.37861805 typical  
## 277 1.27906714 0.81309296 0.604650338 0.10460061 -0.89538052 nonanginal  
## 278 -1.70810051 0.35854099 -0.515539947 0.10460061 -0.89538052 nonanginal  
## 279 0.28334459 1.26764493 -0.283776439 0.62919070 -0.89538052 nontypical  
## 280 0.39398043 -0.09601098 -0.959753335 -0.81343205 -0.37861805 asymptomatic  
## 281 0.28334459 -1.23239090 1.705526997 -0.28884196 1.68843184 asymptomatic  
## 282 -0.82301380 -0.09601098 0.121809698 1.28492831 -0.89538052 nonanginal  
## 283 0.06207291 -0.20964897 -0.805244331 -0.85714789 0.82716105 asymptomatic  
## 284 -2.15064386 -0.55056295 -1.056321463 1.06634911 -0.89538052 nontypical  
## 285 0.72588794 0.92673096 -0.843871582 0.49804318 -0.89538052 asymptomatic  
## 286 0.39398043 -1.00511492 1.377195362 -0.41998948 2.89421095 asymptomatic  
## 287 0.39398043 2.17674887 -0.418971819 -0.15769444 1.51617769 asymptomatic  
## 288 0.39398043 -0.38010596 -0.515539947 -0.24512612 -0.55087221 nontypical  
## 289 0.17270875 -0.09601098 -0.496226321 0.58547486 -0.89538052 nontypical  
## 290 0.17270875 -0.66420094 -0.129267435 0.84776990 -0.89538052 nontypical  
## 291 1.38970298 1.15400694 -0.670048951 0.01716893 -0.20636389 nonanginal  
## 292 0.06207291 0.01762702 1.840722376 0.71662238 0.13814442 nontypical  
## 293 -1.15492131 -0.66420094 -1.500534852 -0.24512612 1.51617769 asymptomatic  
## 294 0.94715962 0.47217899 -1.152889591 -0.24512612 2.54970263 asymptomatic  
## 295 0.94715962 -0.43692495 -0.959753335 -0.59485284 -0.89538052 asymptomatic  
## 296 -1.48682883 -0.66420094 -1.732298359 1.41607583 -0.89538052 nontypical  
## 297 0.50461627 1.83583489 -1.365339473 -2.60578152 -0.03410973 asymptomatic  
## 298 0.28334459 0.47217899 -0.109953809 -1.16315877 -0.72312637 asymptomatic  
## 299 -1.04428547 -1.23239090 0.334259580 -0.76971621 0.13814442 typical  
## 300 1.50033882 0.69945497 -1.037007838 -0.37627364 2.03294016 asymptomatic  
## 301 0.28334459 -0.09601098 -2.234452625 -1.51288550 0.13814442 asymptomatic  
## 302 0.28334459 -0.09601098 -0.206521937 1.06634911 -0.89538052 nontypical  
## 303 -1.81873635 0.35854099 -1.384653099 1.02263326 -0.89538052 nonanginal  
## Sex Fbs RestECG ExAng Slope Ca Thal1 id  
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## 3 1 0 2 1 2 2 2 3  
## 4 1 0 0 0 3 0 1 4  
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## 300 1 1 0 0 2 2 2 300  
## 301 1 0 0 1 2 1 2 301  
## 302 0 0 2 0 2 1 1 302  
## 303 1 0 0 0 1 0 1 303

cp\_new6 = cp\_new4 %>% select(AHD)  
cp\_new6 = cp\_new6 %>% mutate(id = row\_number())  
cp\_new6

## AHD id  
## 1 No 1  
## 2 Yes 2  
## 3 Yes 3  
## 4 No 4  
## 5 No 5  
## 6 No 6  
## 7 Yes 7  
## 8 No 8  
## 9 Yes 9  
## 10 Yes 10  
## 11 No 11  
## 12 No 12  
## 13 Yes 13  
## 14 No 14  
## 15 No 15  
## 16 No 16  
## 17 Yes 17  
## 18 No 18  
## 19 No 19  
## 20 No 20  
## 21 No 21  
## 22 No 22  
## 23 Yes 23  
## 24 Yes 24  
## 25 Yes 25  
## 26 No 26  
## 27 No 27  
## 28 No 28  
## 29 No 29  
## 30 Yes 30  
## 31 No 31  
## 32 Yes 32  
## 33 Yes 33  
## 34 No 34  
## 35 No 35  
## 36 No 36  
## 37 Yes 37  
## 38 Yes 38  
## 39 Yes 39  
## 40 No 40  
## 41 Yes 41  
## 42 No 42  
## 43 No 43  
## 44 No 44  
## 45 Yes 45  
## 46 Yes 46  
## 47 No 47  
## 48 Yes 48  
## 49 No 49  
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## 78 No 78  
## 79 No 79  
## 80 Yes 80  
## 81 No 81  
## 82 No 82  
## 83 No 83  
## 84 Yes 84  
## 85 No 85  
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## 93 No 93  
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## 95 No 95  
## 96 Yes 96  
## 97 Yes 97  
## 98 Yes 98  
## 99 No 99  
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## 101 No 101  
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## 104 No 104  
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## 133 No 133  
## 134 No 134  
## 135 No 135  
## 136 No 136  
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## 279 Yes 279  
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## 287 Yes 287  
## 288 No 288  
## 289 No 289  
## 290 No 290  
## 291 Yes 291  
## 292 No 292  
## 293 Yes 293  
## 294 Yes 294  
## 295 Yes 295  
## 296 No 296  
## 297 Yes 297  
## 298 Yes 298  
## 299 Yes 299  
## 300 Yes 300  
## 301 Yes 301  
## 302 Yes 302  
## 303 No 303

## Dummycoding

##Convering the categorical variables to numeric.  
  
require(caret)

## Loading required package: caret

## Loading required package: lattice

##   
## Attaching package: 'caret'

## The following object is masked from 'package:purrr':  
##   
## lift

cp = dummyVars('~.' , data = cp\_new5)  
cp\_new5=data.frame(predict(cp,newdata = cp\_new5))  
cp\_new5

## Age RestBP Chol MaxHR Oldpeak  
## 1 0.94715962 0.75627397 -0.264462814 0.01716893 1.08554229  
## 2 1.38970298 1.60855891 0.759159343 -1.81889638 0.39652566  
## 3 1.38970298 -0.66420094 -0.341717316 -0.90086373 1.34392353  
## 4 -1.92937218 -0.09601098 0.063868821 1.63465503 2.11906724  
## 5 -1.48682883 -0.09601098 -0.824557956 0.97891742 0.31039858  
## 6 0.17270875 -0.66420094 -0.206521937 1.24121247 -0.20636389  
## 7 0.83652378 0.47217899 0.411514082 0.45432733 2.20519432  
## 8 0.28334459 -0.66420094 2.072485883 0.58547486 -0.37861805  
## 9 0.94715962 -0.09601098 0.141123324 -0.11397859 0.31039858  
## 10 -0.15919876 0.47217899 -0.843871582 0.23574813 1.77455892  
## 11 0.28334459 0.47217899 -1.056321463 -0.07026275 -0.55087221  
## 12 0.17270875 0.47217899 0.913668348 0.14831645 0.22427150  
## 13 0.17270875 -0.09601098 0.179750575 -0.33255780 -0.37861805  
## 14 -1.15492131 -0.66420094 0.314945954 1.02263326 -0.89538052  
## 15 -0.26983460 2.29038686 -0.921126084 0.54175902 -0.46474513  
## 16 0.28334459 1.04036895 -1.519848478 1.06634911 0.48265274  
## 17 -0.71237796 -1.23239090 -0.341717316 0.80405406 -0.03410973  
## 18 -0.04856293 0.47217899 -0.148581060 0.45432733 0.13814442  
## 19 -0.71237796 -0.09601098 0.546709461 -0.46370532 -0.72312637  
## 20 -0.60174212 -0.09601098 0.372886831 0.93520158 -0.37861805  
## 21 1.05779546 -1.23239090 -0.689362577 -0.24512612 0.65490690  
## 22 0.39398043 1.04036895 0.701218466 0.54175902 -0.03410973  
## 23 0.39398043 -0.66420094 0.720532092 0.45432733 0.65490690  
## 24 0.39398043 0.01762702 -0.438285444 1.02263326 1.86068600  
## 25 0.61525211 -0.09601098 -0.785930705 -0.76971621 1.17166937  
## 26 -0.49110628 -0.66420094 -0.534853572 0.36689565 0.48265274  
## 27 0.39398043 -0.66420094 1.802095125 0.97891742 -0.89538052  
## 28 1.27906714 1.04036895 -0.399658193 -1.55660134 1.34392353  
## 29 -1.26555715 1.04036895 0.005927944 0.93520158 0.39652566  
## 30 -1.59746467 -1.23239090 -1.539162103 -1.55660134 0.82716105  
## 31 1.61097465 0.47217899 -0.148581060 0.06088477 0.65490690  
## 32 0.61525211 -0.83465793 -0.322403691 0.45432733 0.31039858  
## 33 1.05779546 0.47217899 1.705526997 0.36689565 -0.89538052  
## 34 0.50461627 0.18808400 -0.245149188 0.49804318 -0.46474513  
## 35 -1.15492131 -0.09601098 -0.264462814 1.28492831 -0.55087221  
## 36 -1.37619299 0.47217899 -0.399658193 1.24121247 -0.89538052  
## 37 -1.26555715 -0.66420094 -1.346025847 -1.29430629 1.25779645  
## 38 0.28334459 1.04036895 0.566023087 -1.64403302 -0.37861805  
## 39 0.06207291 0.01762702 2.053172258 -0.76971621 0.13814442  
## 40 0.72588794 1.04036895 -0.071326558 -0.55113700 -0.03410973  
## 41 1.16843130 1.04036895 -0.418971819 -1.55660134 -0.03410973  
## 42 -1.59746467 0.47217899 -0.921126084 1.24121247 0.31039858  
## 43 1.83224633 1.60855891 1.068177352 0.54175902 -0.55087221  
## 44 0.50461627 1.04036895 -0.670048951 0.32317981 0.48265274  
## 45 0.72588794 -0.09601098 1.608958869 0.84776990 -0.89538052  
## 46 0.39398043 -1.11875291 -0.322403691 0.67290654 1.25779645  
## 47 -0.38047044 -1.23239090 -1.384653099 -1.16315877 -0.37861805  
## 48 -0.49110628 1.04036895 -0.071326558 -0.94457957 1.34392353  
## 49 1.16843130 0.47217899 3.289244296 0.32317981 -0.20636389  
## 50 -0.15919876 -0.09601098 -0.959753335 0.10460061 0.13814442  
## 51 -1.48682883 -1.51648588 -0.940439710 0.80405406 -0.89538052  
## 52 1.16843130 -0.66420094 -1.346025847 -0.41998948 -0.55087221  
## 53 -1.15492131 -1.11875291 0.836413845 0.14831645 -0.89538052  
## 54 -1.15492131 -0.09601098 -0.534853572 1.67837088 -0.89538052  
## 55 0.61525211 -0.09601098 0.121809698 -0.24512612 0.31039858  
## 56 -0.04856293 -0.43692495 0.372886831 -1.77518054 0.99941521  
## 57 -0.49110628 0.47217899 -0.264462814 0.58547486 -0.37861805  
## 58 -1.48682883 -1.23239090 -1.442593975 0.36689565 -0.89538052  
## 59 -0.04856293 -0.38010596 0.508082210 0.10460061 -0.46474513  
## 60 -0.38047044 -0.38010596 -0.650735326 -1.07572709 0.31039858  
## 61 -0.38047044 -0.09601098 1.126118229 -0.33255780 0.13814442  
## 62 -0.93364964 0.58581698 -1.346025847 0.45432733 0.31039858  
## 63 0.39398043 -0.20964897 -0.592794449 -0.81343205 0.99941521  
## 64 -0.04856293 0.18808400 1.106804604 0.89148574 -0.89538052  
## 65 -0.04856293 -0.66420094 -1.133575966 -1.60031718 0.31039858  
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## 67 0.61525211 0.47217899 -1.191516843 0.23574813 1.68843184  
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## 297 0.50461627 1.83583489 -1.365339473 -2.60578152 -0.03410973  
## 298 0.28334459 0.47217899 -0.109953809 -1.16315877 -0.72312637  
## 299 -1.04428547 -1.23239090 0.334259580 -0.76971621 0.13814442  
## 300 1.50033882 0.69945497 -1.037007838 -0.37627364 2.03294016  
## 301 0.28334459 -0.09601098 -2.234452625 -1.51288550 0.13814442  
## 302 0.28334459 -0.09601098 -0.206521937 1.06634911 -0.89538052  
## 303 -1.81873635 0.35854099 -1.384653099 1.02263326 -0.89538052  
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##Adding AHD to the dataset and thereby creating the final dataset.  
  
cp\_new7 = cp\_new5 %>% left\_join(cp\_new6,by= c('id'= 'id'))  
cp\_new7

## Age RestBP Chol MaxHR Oldpeak  
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## 2 1.38970298 1.60855891 0.759159343 -1.81889638 0.39652566  
## 3 1.38970298 -0.66420094 -0.341717316 -0.90086373 1.34392353  
## 4 -1.92937218 -0.09601098 0.063868821 1.63465503 2.11906724  
## 5 -1.48682883 -0.09601098 -0.824557956 0.97891742 0.31039858  
## 6 0.17270875 -0.66420094 -0.206521937 1.24121247 -0.20636389  
## 7 0.83652378 0.47217899 0.411514082 0.45432733 2.20519432  
## 8 0.28334459 -0.66420094 2.072485883 0.58547486 -0.37861805  
## 9 0.94715962 -0.09601098 0.141123324 -0.11397859 0.31039858  
## 10 -0.15919876 0.47217899 -0.843871582 0.23574813 1.77455892  
## 11 0.28334459 0.47217899 -1.056321463 -0.07026275 -0.55087221  
## 12 0.17270875 0.47217899 0.913668348 0.14831645 0.22427150  
## 13 0.17270875 -0.09601098 0.179750575 -0.33255780 -0.37861805  
## 14 -1.15492131 -0.66420094 0.314945954 1.02263326 -0.89538052  
## 15 -0.26983460 2.29038686 -0.921126084 0.54175902 -0.46474513  
## 16 0.28334459 1.04036895 -1.519848478 1.06634911 0.48265274  
## 17 -0.71237796 -1.23239090 -0.341717316 0.80405406 -0.03410973  
## 18 -0.04856293 0.47217899 -0.148581060 0.45432733 0.13814442  
## 19 -0.71237796 -0.09601098 0.546709461 -0.46370532 -0.72312637  
## 20 -0.60174212 -0.09601098 0.372886831 0.93520158 -0.37861805  
## 21 1.05779546 -1.23239090 -0.689362577 -0.24512612 0.65490690  
## 22 0.39398043 1.04036895 0.701218466 0.54175902 -0.03410973  
## 23 0.39398043 -0.66420094 0.720532092 0.45432733 0.65490690  
## 24 0.39398043 0.01762702 -0.438285444 1.02263326 1.86068600  
## 25 0.61525211 -0.09601098 -0.785930705 -0.76971621 1.17166937  
## 26 -0.49110628 -0.66420094 -0.534853572 0.36689565 0.48265274  
## 27 0.39398043 -0.66420094 1.802095125 0.97891742 -0.89538052  
## 28 1.27906714 1.04036895 -0.399658193 -1.55660134 1.34392353  
## 29 -1.26555715 1.04036895 0.005927944 0.93520158 0.39652566  
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## 276 1 1 0 2 0 2 0 2 276 No  
## 277 0 0 0 2 0 2 1 1 277 No  
## 278 0 0 0 0 0 2 0 1 278 No  
## 279 0 1 0 2 0 1 1 1 279 Yes  
## 280 0 0 0 0 0 2 0 1 280 No  
## 281 0 1 0 0 1 2 1 2 281 Yes  
## 282 0 1 0 0 0 1 0 1 282 No  
## 283 0 0 0 1 1 2 1 2 283 Yes  
## 284 0 1 0 0 0 1 0 1 284 No  
## 285 0 1 0 0 0 1 1 2 285 Yes  
## 286 0 1 0 1 0 3 3 0 286 Yes  
## 287 0 0 1 2 1 2 2 0 287 Yes  
## 288 0 1 0 0 0 2 0 2 288 No  
## 289 0 1 0 2 0 1 0 2 289 No  
## 290 0 1 0 0 0 3 0 1 290 No  
## 291 0 1 0 2 0 2 0 2 291 Yes  
## 292 0 0 0 0 0 1 0 1 292 No  
## 293 0 1 0 0 1 3 0 0 293 Yes  
## 294 0 1 0 2 1 1 2 2 294 Yes  
## 295 0 0 0 0 1 2 0 1 295 Yes  
## 296 0 1 0 0 0 1 0 1 296 No  
## 297 0 1 1 2 0 2 2 0 297 Yes  
## 298 0 0 0 0 1 2 0 2 298 Yes  
## 299 1 1 0 0 0 2 0 2 299 Yes  
## 300 0 1 1 0 0 2 2 2 300 Yes  
## 301 0 1 0 0 1 2 1 2 301 Yes  
## 302 0 0 0 2 0 2 1 1 302 Yes  
## 303 0 1 0 0 0 1 0 1 303 No

## Predict

Please use random train/split for your prediction, Use 60/40 split

set.seed(1234)  
training\_data = cp\_new7 %>% sample\_frac(0.6)  
testing\_data = anti\_join(cp\_new7 , training\_data , by='id')

training\_data

## Age RestBP Chol MaxHR Oldpeak  
## 1 -2.15064386 -0.55056295 -1.056321463 1.06634911 -0.89538052  
## 2 -1.04428547 -0.94829592 0.257005077 1.54722335 -0.89538052  
## 3 0.72588794 0.75627397 1.164745480 -0.15769444 -0.03410973  
## 4 -2.81445889 -0.09601098 -0.824557956 2.29039265 -0.89538052  
## 5 0.61525211 1.04036895 0.218377826 0.32317981 1.34392353  
## 6 0.28334459 -0.20964897 1.087490978 0.41061149 -0.89538052  
## 7 1.27906714 2.63130084 -0.361030942 0.67290654 -0.03410973  
## 8 -0.38047044 -0.09601098 0.179750575 -0.02654691 -0.46474513  
## 9 -0.71237796 -0.09601098 -0.032699307 1.32864415 -0.72312637  
## 10 -1.37619299 -0.09601098 -1.288084971 0.01716893 -0.89538052  
## 11 0.50461627 2.63130084 0.450141333 -0.20141028 2.72195679  
## 12 -0.93364964 0.58581698 -1.346025847 0.45432733 0.31039858  
## 13 -1.92937218 -0.09601098 0.063868821 1.63465503 2.11906724  
## 14 -1.04428547 -0.20964897 1.184059106 0.89148574 -0.89538052  
## 15 0.72588794 1.04036895 -0.071326558 -0.55113700 -0.03410973  
## 16 -1.81873635 -0.66420094 -0.303090065 1.41607583 2.37744847  
## 17 1.50033882 -0.66420094 -0.689362577 -1.51288550 0.39652566  
## 18 0.83652378 -0.09601098 -0.303090065 -0.15769444 0.65490690  
## 19 0.94715962 1.04036895 3.096108040 0.19203229 2.54970263  
## 20 0.61525211 0.75627397 0.681904840 -0.33255780 1.51617769  
## 21 1.05779546 0.75627397 -0.670048951 -0.76971621 0.82716105  
## 22 0.28334459 -0.20964897 -0.341717316 0.01716893 -0.55087221  
## 23 -0.04856293 -0.66420094 0.218377826 -0.11397859 -0.55087221  
## 24 1.16843130 1.04036895 -0.418971819 -1.55660134 -0.03410973  
## 25 0.83652378 -0.09601098 0.314945954 -2.29977063 0.13814442  
## 26 1.38970298 1.15400694 0.585336712 0.97891742 -0.89538052  
## 27 2.38542553 0.47217899 -0.959753335 -1.46916966 0.05201734  
## 28 0.39398043 0.47217899 -0.689362577 0.67290654 -0.89538052  
## 29 0.94715962 -0.43692495 -0.959753335 -0.59485284 -0.89538052  
## 30 0.17270875 0.13126501 3.134735291 0.01716893 0.74103398  
## 31 -1.15492131 -0.66420094 -1.500534852 -0.24512612 1.51617769  
## 32 -1.48682883 -1.11875291 0.411514082 0.97891742 -0.89538052  
## 33 -0.15919876 -0.49374395 0.681904840 -2.38720231 0.82716105  
## 34 1.16843130 0.47217899 3.289244296 0.32317981 -0.20636389  
## 35 0.06207291 0.18808400 0.063868821 0.49804318 0.31039858  
## 36 0.39398043 -1.51648588 -0.129267435 0.19203229 -0.37861805  
## 37 -0.38047044 -1.80058086 -0.476912695 -0.28884196 0.13814442  
## 38 -1.15492131 -0.66420094 -0.399658193 0.84776990 -0.89538052  
## 39 2.16415385 -0.66420094 0.430827708 -1.25059045 -0.72312637  
## 40 -0.26983460 -0.20964897 0.160436949 0.49804318 -0.89538052  
## 41 0.39398043 1.04036895 0.701218466 0.54175902 -0.03410973  
## 42 -0.49110628 0.69945497 -0.901812459 -1.03201125 -0.12023681  
## 43 0.28334459 -1.23239090 1.705526997 -0.28884196 1.68843184  
## 44 -0.49110628 0.47217899 -0.264462814 0.58547486 -0.37861805  
## 45 -0.15919876 0.47217899 -0.843871582 0.23574813 1.77455892  
## 46 -0.82301380 -1.23239090 0.546709461 -1.38173798 -0.03410973  
## 47 1.38970298 -0.94829592 6.128347259 0.45432733 0.48265274  
## 48 -1.15492131 -0.77783893 -0.090640183 -0.02654691 -0.63699929  
## 49 -1.70810051 0.47217899 1.435136239 1.41607583 -0.89538052  
## 50 0.17270875 0.01762702 -1.210830468 -1.95004391 0.91328813  
## 51 0.61525211 -0.66420094 -1.326712222 -2.34348647 -0.89538052  
## 52 1.27906714 0.81309296 0.604650338 0.10460061 -0.89538052  
## 53 -0.93364964 0.35854099 -0.071326558 0.10460061 -0.89538052  
## 54 -0.26983460 -1.11875291 -0.322403691 0.45432733 -0.89538052  
## 55 -0.93364964 1.04036895 -0.303090065 -0.11397859 2.20519432  
## 56 -0.60174212 -0.09601098 0.372886831 0.93520158 -0.37861805  
## 57 -2.15064386 -0.32328696 0.681904840 0.27946397 -0.89538052  
## 58 -0.49110628 -0.15282997 -0.979066961 0.58547486 -0.89538052  
## 59 1.16843130 1.32446393 0.430827708 -0.07026275 -0.20636389  
## 60 -0.38047044 -0.09601098 1.126118229 -0.33255780 0.13814442  
## 61 -1.37619299 0.24490300 1.319254485 -1.07572709 0.65490690  
## 62 -1.26555715 -0.09601098 1.319254485 0.54175902 0.74103398  
## 63 -0.26983460 -0.38010596 -0.670048951 0.80405406 -0.03410973  
## 64 0.17270875 3.88131876 0.797786594 -0.72600036 2.54970263  
## 65 -0.04856293 -1.23239090 -0.785930705 -1.81889638 -0.89538052  
## 66 1.05779546 -0.66420094 -0.013385681 -2.34348647 0.99941521  
## 67 1.05779546 0.47217899 1.280627234 -0.72600036 -0.72312637  
## 68 1.38970298 -0.38010596 0.141123324 0.58547486 -0.72312637  
## 69 -0.49110628 1.04036895 -0.071326558 -0.94457957 1.34392353  
## 70 -0.38047044 -0.38010596 -0.650735326 -1.07572709 0.31039858  
## 71 -1.26555715 0.01762702 0.005927944 -0.28884196 -0.80925344  
## 72 -1.37619299 0.47217899 -0.399658193 1.24121247 -0.89538052  
## 73 0.94715962 -0.09601098 1.608958869 -0.76971621 0.65490690  
## 74 1.72161049 -0.09601098 1.454449864 -1.77518054 1.17166937  
## 75 -0.71237796 -0.09601098 0.546709461 -0.46370532 -0.72312637  
## 76 1.72161049 0.75627397 -1.403966724 -1.07572709 1.34392353  
## 77 -1.04428547 -0.09601098 -0.245149188 1.11006495 -0.37861805  
## 78 0.39398043 -0.38010596 1.029550101 0.93520158 -0.89538052  
## 79 0.39398043 -0.20964897 -0.592794449 -0.81343205 0.99941521  
## 80 -1.48682883 0.18808400 -0.843871582 -0.76971621 -0.89538052  
## 81 0.50461627 -0.32328696 -0.554167198 -0.68228452 0.99941521  
## 82 -2.26127970 -0.77783893 -1.249457719 1.06634911 -0.89538052  
## 83 0.50461627 1.83583489 -1.365339473 -2.60578152 -0.03410973  
## 84 -1.48682883 -1.23239090 -1.442593975 0.36689565 -0.89538052  
## 85 -0.38047044 0.47217899 0.276318703 1.59093919 -0.89538052  
## 86 -0.26983460 -0.66420094 1.512390741 0.97891742 -0.72312637  
## 87 0.28334459 -1.23239090 -0.882498833 -1.03201125 0.39652566  
## 88 1.50033882 -0.77783893 0.585336712 0.06088477 -0.03410973  
## 89 0.61525211 -0.38010596 0.218377826 -0.37627364 1.51617769  
## 90 -0.71237796 -1.23239090 -0.341717316 0.80405406 -0.03410973  
## 91 0.83652378 0.35854099 0.913668348 -1.90632806 0.74103398  
## 92 -0.82301380 -1.11875291 -0.824557956 -0.28884196 -0.80925344  
## 93 0.17270875 -0.66420094 -0.206521937 1.24121247 -0.20636389  
## 94 0.94715962 0.47217899 -0.998380587 1.28492831 -0.89538052  
## 95 0.83652378 -0.43692495 -0.727989828 0.58547486 -0.89538052  
## 96 -0.71237796 -0.43692495 0.527395836 0.71662238 -0.46474513  
## 97 0.28334459 0.47217899 -1.056321463 -0.07026275 -0.55087221  
## 98 0.72588794 0.35854099 -1.558475729 -1.07572709 2.20519432  
## 99 -0.71237796 -0.55056295 -0.476912695 1.59093919 -0.89538052  
## 100 -0.04856293 -1.23239090 -0.631421700 0.36689565 0.48265274  
## 101 1.05779546 -1.23239090 -0.689362577 -0.24512612 0.65490690  
## 102 -1.04428547 -1.11875291 -1.674357482 -0.50742116 -0.89538052  
## 103 -0.04856293 -1.34602889 0.392200456 0.76033822 -0.89538052  
## 104 1.05779546 -0.09601098 1.087490978 -1.20687461 0.82716105  
## 105 0.94715962 -0.09601098 0.141123324 -0.11397859 0.31039858  
## 106 1.72161049 1.60855891 0.430827708 -1.64403302 1.60230476  
## 107 -0.60174212 0.13126501 0.469454959 0.54175902 -0.89538052  
## 108 0.61525211 1.04036895 -0.129267435 0.93520158 -0.12023681  
## 109 0.83652378 0.47217899 2.845030907 0.32317981 0.13814442  
## 110 0.17270875 -0.09601098 -0.496226321 0.58547486 -0.89538052  
## 111 -1.26555715 1.04036895 0.005927944 0.93520158 0.39652566  
## 112 0.72588794 -0.66420094 0.257005077 -0.41998948 2.20519432  
## 113 0.61525211 1.49492092 1.126118229 0.49804318 -0.89538052  
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## 115 0.28334459 1.04036895 0.566023087 -1.64403302 -0.37861805  
## 116 -0.15919876 -0.20964897 -0.592794449 -1.51288550 -0.89538052  
## 117 -2.26127970 -0.77783893 -0.708676203 1.85323424 -0.29249097  
## 118 0.50461627 0.47217899 -1.346025847 0.54175902 -0.89538052  
## 119 -1.48682883 -1.23239090 -0.225835563 0.14831645 -0.89538052  
## 120 0.28334459 1.89265389 0.817100220 -1.11944293 -0.03410973  
## 121 -0.26983460 0.24490300 -0.979066961 0.84776990 -0.80925344  
## 122 0.50461627 0.13126501 -0.824557956 0.54175902 -0.20636389  
## 123 -1.15492131 0.47217899 -0.225835563 1.32864415 -0.89538052  
## 124 0.50461627 2.17674887 0.797786594 0.41061149 -0.72312637  
## 125 -0.26983460 1.15400694 0.990922850 1.24121247 0.13814442  
## 126 -0.93364964 0.47217899 1.241999983 -1.29430629 0.65490690  
## 127 -0.38047044 -0.66420094 0.932981973 0.32317981 -0.37861805  
## 128 1.05779546 -0.20964897 0.314945954 -1.95004391 -0.72312637  
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## 130 0.06207291 -0.20964897 -0.805244331 -0.85714789 0.82716105  
## 131 -0.26983460 0.13126501 -0.882498833 0.36689565 -0.20636389  
## 132 -0.49110628 -0.66420094 -0.534853572 0.36689565 0.48265274  
## 133 1.61097465 0.47217899 0.141123324 -0.15769444 0.82716105  
## 134 1.38970298 -1.80058086 1.010236476 -1.07572709 -0.12023681  
## 135 1.27906714 1.04036895 -0.399658193 -1.55660134 1.34392353  
## 136 -1.04428547 -1.23239090 0.334259580 -0.76971621 0.13814442  
## 137 0.28334459 -0.09601098 -0.206521937 1.06634911 -0.89538052  
## 138 0.17270875 -0.66420094 -0.129267435 0.84776990 -0.89538052  
## 139 0.17270875 -0.09601098 0.701218466 -2.03747559 0.48265274  
## 140 -1.48682883 -0.09601098 -0.631421700 0.80405406 0.82716105  
## 141 0.61525211 0.47217899 -1.191516843 0.23574813 1.68843184  
## 142 -0.04856293 -0.55056295 0.759159343 -1.46916966 1.86068600  
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## 144 -0.71237796 -0.09601098 0.179750575 0.01716893 -0.89538052  
## 145 1.16843130 0.18808400 0.141123324 -0.98829541 1.51617769  
## 146 1.50033882 2.74493883 0.527395836 0.01716893 0.48265274  
## 147 -1.26555715 -0.94829592 1.087490978 1.37235999 0.13814442  
## 148 -0.60174212 -0.09601098 0.430827708 0.58547486 -0.89538052  
## 149 1.27906714 1.60855891 -0.361030942 -0.50742116 1.08554229  
## 150 0.61525211 -0.09601098 -0.785930705 -0.76971621 1.17166937  
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## 152 -0.26983460 0.35854099 -0.457599070 0.84776990 -0.89538052  
## 153 -1.59746467 -1.23239090 -1.539162103 -1.55660134 0.82716105  
## 154 1.72161049 1.38128292 -0.032699307 -0.28884196 -0.89538052  
## 155 1.05779546 2.74493883 1.512390741 0.19203229 -0.89538052  
## 156 0.94715962 0.47217899 -1.152889591 -0.24512612 2.54970263  
## 157 -0.15919876 0.35854099 -0.245149188 0.45432733 -0.89538052  
## 158 0.39398043 1.04036895 0.450141333 -1.68774886 -0.20636389  
## 159 0.83652378 -0.66420094 0.392200456 -2.21233895 0.65490690  
## 160 0.17270875 0.47217899 0.913668348 0.14831645 0.22427150  
## 161 -1.26555715 -0.66420094 -1.346025847 -1.29430629 1.25779645  
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## 163 -0.38047044 -1.23239090 -1.384653099 -1.16315877 -0.37861805  
## 164 0.39398043 0.24490300 1.396508987 0.10460061 -0.89538052  
## 165 -0.15919876 -0.09601098 0.334259580 -0.28884196 -0.55087221  
## 166 -1.15492131 -1.34602889 -2.041316369 1.11006495 -0.37861805  
## 167 0.83652378 1.04036895 -0.052012932 0.19203229 0.31039858  
## 168 1.61097465 0.47217899 -0.148581060 0.06088477 0.65490690  
## 169 -1.92937218 -0.66420094 -0.612108075 0.89148574 -0.89538052  
## 170 0.83652378 0.47217899 0.411514082 0.45432733 2.20519432  
## 171 2.49606136 -0.38010596 1.106804604 0.54175902 -0.89538052  
## 172 1.38970298 1.15400694 -0.670048951 0.01716893 -0.20636389  
## 173 1.83224633 1.60855891 1.068177352 0.54175902 -0.55087221  
## 174 0.06207291 0.01762702 2.053172258 -0.76971621 0.13814442  
## 175 -1.59746467 0.47217899 -0.921126084 1.24121247 0.31039858  
## 176 1.27906714 1.60855891 -0.013385681 -1.29430629 -0.89538052  
## 177 -1.70810051 0.35854099 -0.515539947 0.10460061 -0.89538052  
## 178 -1.15492131 -0.09601098 -0.264462814 1.28492831 -0.55087221  
## 179 0.50461627 0.35854099 0.469454959 1.41607583 -0.89538052  
## 180 -0.04856293 0.47217899 -0.148581060 0.45432733 0.13814442  
## 181 0.39398043 -0.20964897 0.237691452 -0.85714789 1.68843184  
## 182 -0.04856293 -0.43692495 0.372886831 -1.77518054 0.99941521  
## ChestPainasymptomatic ChestPainnonanginal ChestPainnontypical  
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testing\_data

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## 4 -1.48682883 -0.09601098 -0.82455796 0.97891742 0.31039858  
## 5 0.28334459 -0.66420094 2.07248588 0.58547486 -0.37861805  
## 6 0.17270875 -0.09601098 0.17975057 -0.33255780 -0.37861805  
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## 8 -0.26983460 2.29038686 -0.92112608 0.54175902 -0.46474513  
## 9 0.28334459 1.04036895 -1.51984848 1.06634911 0.48265274  
## 10 0.39398043 -0.66420094 0.72053209 0.45432733 0.65490690  
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## 13 0.61525211 -0.83465793 -0.32240369 0.45432733 0.31039858  
## 14 1.05779546 0.47217899 1.70552700 0.36689565 -0.89538052  
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## 29 0.50461627 2.17674887 1.53170437 -0.41998948 2.03294016  
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## 112 1 0 0  
## 113 1 0 0  
## 114 1 0 0  
## 115 0 0 1  
## 116 0 0 1  
## 117 0 0 1  
## 118 1 0 0  
## 119 1 0 0  
## 120 1 0 0  
## 121 0 1 0  
## ChestPaintypical Sex Fbs RestECG ExAng Slope Ca Thal1 id AHD  
## 1 1 1 1 2 0 3 0 0 1 No  
## 2 0 1 0 2 1 2 3 1 2 Yes  
## 3 0 1 0 2 1 2 2 2 3 Yes  
## 4 0 0 0 2 0 1 0 1 5 No  
## 5 0 0 0 0 1 1 0 1 8 No  
## 6 0 1 1 2 1 2 1 0 13 Yes  
## 7 0 1 0 0 0 1 0 2 14 No  
## 8 0 1 1 0 0 1 0 2 15 No  
## 9 0 1 0 0 0 1 0 1 16 No  
## 10 0 1 0 2 0 2 0 1 23 Yes  
## 11 0 1 0 2 0 1 2 2 24 Yes  
## 12 0 0 0 0 0 1 0 1 27 No  
## 13 0 1 1 0 1 1 2 2 32 Yes  
## 14 0 1 0 0 0 1 0 1 33 Yes  
## 15 0 1 0 0 0 2 0 2 34 No  
## 16 0 1 1 0 0 1 0 1 44 No  
## 17 0 0 0 2 0 1 0 1 45 Yes  
## 18 0 1 0 2 0 2 1 2 46 Yes  
## 19 0 1 1 2 0 3 0 1 50 No  
## 20 0 0 0 0 0 1 1 1 51 No  
## 21 0 1 0 0 0 1 0 2 52 No  
## 22 0 1 0 2 0 1 1 1 53 Yes  
## 23 0 1 0 2 0 1 0 1 54 No  
## 24 0 1 0 0 1 1 1 2 55 Yes  
## 25 0 1 0 2 0 3 1 1 59 No  
## 26 0 0 1 0 0 1 0 1 64 No  
## 27 0 1 0 0 0 2 1 2 65 Yes  
## 28 0 1 0 2 0 1 0 2 68 No  
## 29 0 1 0 2 1 3 0 2 69 Yes  
## 30 0 1 0 2 0 1 2 0 74 Yes  
## 31 0 1 0 2 0 1 1 1 75 Yes  
## 32 0 0 0 2 0 1 0 1 76 No  
## 33 0 0 0 2 0 1 1 1 78 No  
## 34 0 1 0 2 0 1 0 1 87 No  
## 35 0 1 0 2 0 2 0 1 91 No  
## 36 0 0 0 2 0 3 3 2 92 Yes  
## 37 0 0 0 2 0 1 0 1 95 No  
## 38 0 1 0 2 1 2 1 2 97 Yes  
## 39 0 0 1 2 0 1 1 1 104 No  
## 40 0 1 0 0 0 2 3 2 105 Yes  
## 41 0 1 0 0 0 1 0 2 106 No  
## 42 0 1 0 0 0 2 0 2 110 Yes  
## 43 0 1 1 2 1 2 1 1 112 Yes  
## 44 1 1 0 2 0 2 0 0 113 No  
## 45 0 0 1 2 1 2 0 2 114 Yes  
## 46 0 0 0 0 0 1 0 1 118 No  
## 47 0 1 0 0 1 3 0 2 124 Yes  
## 48 1 1 1 2 0 2 1 1 125 Yes  
## 49 0 1 0 0 1 2 1 2 128 Yes  
## 50 0 1 0 0 0 1 0 1 129 No  
## 51 0 1 0 0 1 1 1 2 132 No  
## 52 0 0 0 0 0 2 0 1 135 No  
## 53 0 1 0 2 0 2 1 2 138 Yes  
## 54 0 1 0 0 1 2 0 2 139 Yes  
## 55 0 1 1 2 0 2 0 1 140 No  
## 56 0 1 0 0 1 1 0 1 141 No  
## 57 0 1 1 0 0 1 0 1 143 No  
## 58 0 1 0 0 0 1 0 1 146 Yes  
## 59 0 1 0 0 0 1 0 1 148 No  
## 60 0 0 0 0 0 1 1 1 150 No  
## 61 0 0 0 2 0 2 0 1 152 No  
## 62 0 1 0 2 1 2 1 2 154 Yes  
## 63 0 1 0 0 1 1 0 2 157 Yes  
## 64 0 1 0 2 0 2 2 2 159 Yes  
## 65 0 1 1 0 0 1 0 2 161 No  
## 66 0 0 0 2 0 2 0 1 164 No  
## 67 0 1 1 0 0 1 2 1 165 No  
## 68 0 1 0 0 1 1 0 2 166 No  
## 69 0 0 1 2 1 1 1 1 168 No  
## 70 0 1 0 2 1 1 0 2 172 No  
## 71 0 0 0 0 1 2 0 1 173 Yes  
## 72 0 1 0 0 1 2 1 2 176 Yes  
## 73 0 1 1 2 0 1 3 1 180 No  
## 74 1 1 0 2 0 1 2 1 183 No  
## 75 0 1 1 0 0 3 0 2 187 No  
## 76 0 1 0 2 0 1 1 2 189 Yes  
## 77 0 1 0 0 1 2 3 2 192 Yes  
## 78 1 1 1 2 0 2 1 1 197 No  
## 79 0 0 0 2 1 2 0 1 198 No  
## 80 0 0 0 0 0 1 0 1 199 No  
## 81 1 1 0 2 0 1 0 1 200 Yes  
## 82 0 0 0 2 0 1 0 1 201 No  
## 83 0 1 1 0 0 1 1 2 203 No  
## 84 0 1 0 0 0 1 0 2 205 No  
## 85 0 1 0 2 1 2 3 2 206 Yes  
## 86 1 1 0 2 0 2 0 2 216 No  
## 87 0 0 0 0 0 1 0 1 217 No  
## 88 0 0 0 0 0 1 0 1 223 No  
## 89 0 0 0 0 1 2 2 1 225 Yes  
## 90 0 1 0 2 1 1 1 1 230 Yes  
## 91 0 0 0 1 1 2 0 1 232 Yes  
## 92 0 1 0 2 0 1 3 1 233 Yes  
## 93 0 0 0 0 0 1 1 1 235 No  
## 94 0 1 0 2 0 1 0 2 238 Yes  
## 95 0 1 0 0 0 1 0 1 240 No  
## 96 0 0 0 0 0 1 0 1 242 No  
## 97 1 1 0 0 0 2 2 1 244 Yes  
## 98 0 1 0 0 0 2 0 1 246 Yes  
## 99 0 1 0 0 0 1 1 2 247 Yes  
## 100 0 1 1 2 0 1 0 1 250 No  
## 101 0 1 0 0 0 2 1 2 252 Yes  
## 102 0 0 0 0 0 2 0 1 256 No  
## 103 0 0 0 0 0 1 2 1 257 No  
## 104 0 1 0 0 0 1 0 2 260 Yes  
## 105 0 1 0 0 0 1 0 2 269 Yes  
## 106 0 1 0 2 1 1 1 2 271 Yes  
## 107 0 0 0 0 0 2 0 1 274 No  
## 108 1 1 0 2 0 2 0 2 276 No  
## 109 0 1 0 2 0 1 1 1 279 Yes  
## 110 0 0 0 0 0 2 0 1 280 No  
## 111 0 1 0 0 0 1 0 1 282 No  
## 112 0 1 0 0 0 1 1 2 285 Yes  
## 113 0 1 0 1 0 3 3 0 286 Yes  
## 114 0 0 1 2 1 2 2 0 287 Yes  
## 115 0 1 0 0 0 2 0 2 288 No  
## 116 0 0 0 0 0 1 0 1 292 No  
## 117 0 1 0 0 0 1 0 1 296 No  
## 118 0 0 0 0 1 2 0 2 298 Yes  
## 119 0 1 1 0 0 2 2 2 300 Yes  
## 120 0 1 0 0 1 2 1 2 301 Yes  
## 121 0 1 0 0 0 1 0 1 303 No

`

require(class)

## Loading required package: class

require(e1071)

## Loading required package: e1071

##Run Knn

predict\_AHD= knn(train=training\_data[,-18], test=testing\_data[,-18], cl=training\_data$AHD, k=3, prob=TRUE)  
predict\_AHD

## [1] No No No No No No No No No No No No No No No No No No   
## [19] No No Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes No No No   
## [37] Yes Yes No Yes Yes Yes Yes No Yes No Yes No No No No No Yes Yes  
## [55] Yes Yes Yes No No No No Yes Yes Yes No No No No No Yes Yes Yes  
## [73] No Yes No Yes Yes Yes Yes No No No No No Yes No No No No No   
## [91] No No No No No No No No Yes Yes No No No No Yes No Yes No   
## [109] No Yes No No Yes Yes No No Yes Yes Yes Yes Yes  
## attr(,"prob")  
## [1] 0.6666667 0.6666667 0.6666667 0.6666667 0.6666667 0.6666667 0.6666667  
## [8] 0.6666667 0.6666667 0.6666667 0.6666667 1.0000000 1.0000000 1.0000000  
## [15] 1.0000000 1.0000000 0.6666667 0.6666667 0.6666667 0.6666667 0.6666667  
## [22] 1.0000000 1.0000000 1.0000000 0.6666667 0.6666667 1.0000000 1.0000000  
## [29] 1.0000000 1.0000000 0.6666667 0.6666667 0.6666667 1.0000000 1.0000000  
## [36] 0.6666667 0.6666667 0.6666667 0.6666667 0.6666667 0.6666667 1.0000000  
## [43] 1.0000000 0.6666667 0.6666667 0.6666667 0.6666667 0.6666667 1.0000000  
## [50] 1.0000000 1.0000000 1.0000000 0.6666667 0.6666667 0.6666667 0.6666667  
## [57] 0.6666667 0.6666667 1.0000000 1.0000000 0.6666667 0.6666667 0.6666667  
## [64] 0.6666667 0.6666667 0.6666667 0.6666667 0.6666667 0.6666667 0.6666667  
## [71] 0.6666667 0.6666667 0.6666667 1.0000000 0.6666667 0.6666667 1.0000000  
## [78] 0.6666667 0.6666667 0.6666667 0.6666667 0.6666667 0.6666667 0.6666667  
## [85] 0.6666667 0.6666667 0.6666667 1.0000000 0.6666667 0.6666667 0.6666667  
## [92] 0.6666667 1.0000000 0.6666667 1.0000000 1.0000000 1.0000000 0.6666667  
## [99] 0.6666667 0.6666667 0.6666667 1.0000000 1.0000000 0.6666667 0.6666667  
## [106] 0.6666667 0.6666667 0.6666667 0.6666667 0.6666667 0.6666667 0.6666667  
## [113] 0.6666667 0.6666667 0.6666667 0.6666667 1.0000000 1.0000000 1.0000000  
## [120] 1.0000000 1.0000000  
## Levels: No Yes

## EValuate

confusionMatrix(predict\_AHD, reference = as.factor(testing\_data$AHD),positive = 'Yes' )

## Confusion Matrix and Statistics  
##   
## Reference  
## Prediction No Yes  
## No 45 26  
## Yes 21 29  
##   
## Accuracy : 0.6116   
## 95% CI : (0.5187, 0.6988)  
## No Information Rate : 0.5455   
## P-Value [Acc > NIR] : 0.08494   
##   
## Kappa : 0.2107   
##   
## Mcnemar's Test P-Value : 0.55958   
##   
## Sensitivity : 0.5273   
## Specificity : 0.6818   
## Pos Pred Value : 0.5800   
## Neg Pred Value : 0.6338   
## Prevalence : 0.4545   
## Detection Rate : 0.2397   
## Detection Prevalence : 0.4132   
## Balanced Accuracy : 0.6045   
##   
## 'Positive' Class : Yes   
##

## So we can say that prediction for "No" value is 45+26 = 71 and true value is 45+21 = 66  
## Similarly the prediction for "Yes" value is 21+29 = 50 and true value is 26+29 = 55

## Optimize k

seq(1,22,2)

## [1] 1 3 5 7 9 11 13 15 17 19 21

rs=list()  
for (i in seq(1,22,2)){  
predict\_AHD= knn(train=training\_data[,-18], test=testing\_data[,-18], cl=training\_data$AHD, k=2, prob=TRUE)  
 results=confusionMatrix(predict\_AHD, reference = as.factor(testing\_data$AHD),positive = 'Yes' )  
 results=results$overall  
 rs[[as.character(i)]]=results  
}  
  
  
final\_results=rs%>%as\_tibble()%>%t()  
final\_results=final\_results[,1:2]  
results\_df=data.frame(final\_results)  
names(results\_df)<-c('Accuracy','Kappa')  
row.names(results\_df)

## [1] "1" "3" "5" "7" "9" "11" "13" "15" "17" "19" "21"

results\_df$k=as.numeric(row.names(results\_df))  
results\_df%>%arrange(desc(Accuracy))

## Accuracy Kappa k  
## 1 0.6694215 0.3353474 1  
## 2 0.6363636 0.2666667 3  
## 3 0.6280992 0.2419602 7  
## 4 0.6115702 0.2202112 11  
## 5 0.6115702 0.2154780 15  
## 6 0.6033058 0.2095808 21  
## 7 0.5785124 0.1355932 5  
## 8 0.5785124 0.1487102 9  
## 9 0.5785124 0.1487102 17  
## 10 0.5702479 0.1333333 13  
## 11 0.5619835 0.1180030 19

## The best value for K is 1.

ggplot(results\_df)+geom\_line(aes(x=k, y=Accuracy))

