Final Exam

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Data Collection

data <- read.csv("C:/Users/Saipr/Downloads/diabetes.csv")  
head(data)

## Pregnancies Glucose BloodPressure SkinThickness Insulin BMI  
## 1 6 148 72 35 0 33.6  
## 2 1 85 66 29 0 26.6  
## 3 8 183 64 0 0 23.3  
## 4 1 89 66 23 94 28.1  
## 5 0 137 40 35 168 43.1  
## 6 5 116 74 0 0 25.6  
## DiabetesPedigreeFunction Age Outcome  
## 1 0.627 50 1  
## 2 0.351 31 0  
## 3 0.672 32 1  
## 4 0.167 21 0  
## 5 2.288 33 1  
## 6 0.201 30 0

Data Summary

summary(data)

## Pregnancies Glucose BloodPressure SkinThickness   
## Min. : 0.000 Min. : 0.0 Min. : 0.00 Min. : 0.00   
## 1st Qu.: 1.000 1st Qu.: 99.0 1st Qu.: 62.00 1st Qu.: 0.00   
## Median : 3.000 Median :117.0 Median : 72.00 Median :23.00   
## Mean : 3.845 Mean :120.9 Mean : 69.11 Mean :20.54   
## 3rd Qu.: 6.000 3rd Qu.:140.2 3rd Qu.: 80.00 3rd Qu.:32.00   
## Max. :17.000 Max. :199.0 Max. :122.00 Max. :99.00   
## Insulin BMI DiabetesPedigreeFunction Age   
## Min. : 0.0 Min. : 0.00 Min. :0.0780 Min. :21.00   
## 1st Qu.: 0.0 1st Qu.:27.30 1st Qu.:0.2437 1st Qu.:24.00   
## Median : 30.5 Median :32.00 Median :0.3725 Median :29.00   
## Mean : 79.8 Mean :31.99 Mean :0.4719 Mean :33.24   
## 3rd Qu.:127.2 3rd Qu.:36.60 3rd Qu.:0.6262 3rd Qu.:41.00   
## Max. :846.0 Max. :67.10 Max. :2.4200 Max. :81.00   
## Outcome   
## Min. :0.000   
## 1st Qu.:0.000   
## Median :0.000   
## Mean :0.349   
## 3rd Qu.:1.000   
## Max. :1.000

A value of 0 in these columns indicates a missing value since it is illogical.

The 0 value in the following columns or variables is invalid:Glucose,BloodPressure ,SkinThickness ,Insulin and BMI

Since counting them thereafter would be simpler and zeros need to be replaced with appropriate values, it is preferable to replace zeros with nan.

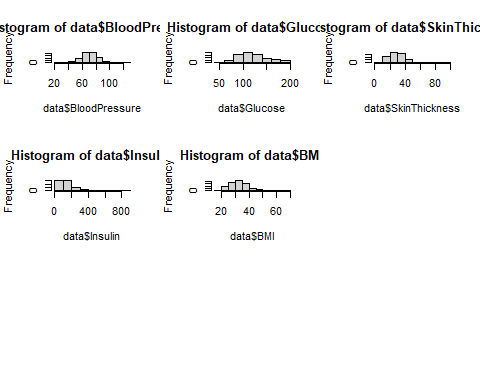
Replacing 0 with Nans

data["BloodPressure"][data["BloodPressure"] == 0] <- NA  
data["Glucose"][data["Glucose"] == 0] <- NA  
data["SkinThickness"][data["SkinThickness"] == 0] <- NA  
data["Insulin"][data["Insulin"] == 0] <- NA  
data["BMI"][data["BMI"] == 0] <- NA

summary(data)

## Pregnancies Glucose BloodPressure SkinThickness   
## Min. : 0.000 Min. : 44.0 Min. : 24.00 Min. : 7.00   
## 1st Qu.: 1.000 1st Qu.: 99.0 1st Qu.: 64.00 1st Qu.:22.00   
## Median : 3.000 Median :117.0 Median : 72.00 Median :29.00   
## Mean : 3.845 Mean :121.7 Mean : 72.41 Mean :29.15   
## 3rd Qu.: 6.000 3rd Qu.:141.0 3rd Qu.: 80.00 3rd Qu.:36.00   
## Max. :17.000 Max. :199.0 Max. :122.00 Max. :99.00   
## NA's :5 NA's :35 NA's :227   
## Insulin BMI DiabetesPedigreeFunction Age   
## Min. : 14.00 Min. :18.20 Min. :0.0780 Min. :21.00   
## 1st Qu.: 76.25 1st Qu.:27.50 1st Qu.:0.2437 1st Qu.:24.00   
## Median :125.00 Median :32.30 Median :0.3725 Median :29.00   
## Mean :155.55 Mean :32.46 Mean :0.4719 Mean :33.24   
## 3rd Qu.:190.00 3rd Qu.:36.60 3rd Qu.:0.6262 3rd Qu.:41.00   
## Max. :846.00 Max. :67.10 Max. :2.4200 Max. :81.00   
## NA's :374 NA's :11   
## Outcome   
## Min. :0.000   
## 1st Qu.:0.000   
## Median :0.000   
## Mean :0.349   
## 3rd Qu.:1.000   
## Max. :1.000   
##

par(mfrow = c(3, 3))  
hist(data$BloodPressure)  
hist(data$Glucose)  
hist(data$SkinThickness)  
hist(data$Insulin)  
hist(data$BMI)



Replacing Nan values with the appropriate median/mean according to the data histogram

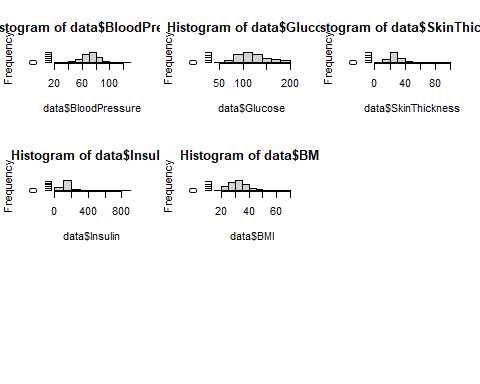
data$BloodPressure[is.na(data$BloodPressure)] <- round(mean(data$BloodPressure, na.rm = TRUE))  
data$Glucose[is.na(data$Glucose)] <- round(mean(data$Glucose, na.rm = TRUE))  
data$SkinThickness[is.na(data$SkinThickness)] <- round(median(data$SkinThickness, na.rm = TRUE))  
data$Insulin[is.na(data$Insulin)] <- round(median(data$Insulin, na.rm = TRUE))  
data$BMI[is.na(data$BMI)] <- round(mean(data$BMI, na.rm = TRUE))

summary(data)

## Pregnancies Glucose BloodPressure SkinThickness   
## Min. : 0.000 Min. : 44.00 Min. : 24.00 Min. : 7.00   
## 1st Qu.: 1.000 1st Qu.: 99.75 1st Qu.: 64.00 1st Qu.:25.00   
## Median : 3.000 Median :117.00 Median : 72.00 Median :29.00   
## Mean : 3.845 Mean :121.69 Mean : 72.39 Mean :29.11   
## 3rd Qu.: 6.000 3rd Qu.:140.25 3rd Qu.: 80.00 3rd Qu.:32.00   
## Max. :17.000 Max. :199.00 Max. :122.00 Max. :99.00   
## Insulin BMI DiabetesPedigreeFunction Age   
## Min. : 14.0 Min. :18.20 Min. :0.0780 Min. :21.00   
## 1st Qu.:121.5 1st Qu.:27.50 1st Qu.:0.2437 1st Qu.:24.00   
## Median :125.0 Median :32.00 Median :0.3725 Median :29.00   
## Mean :140.7 Mean :32.45 Mean :0.4719 Mean :33.24   
## 3rd Qu.:127.2 3rd Qu.:36.60 3rd Qu.:0.6262 3rd Qu.:41.00   
## Max. :846.0 Max. :67.10 Max. :2.4200 Max. :81.00   
## Outcome   
## Min. :0.000   
## 1st Qu.:0.000   
## Median :0.000   
## Mean :0.349   
## 3rd Qu.:1.000   
## Max. :1.000

plotting the histograms after imputation:

par(mfrow = c(3, 3))  
hist(data$BloodPressure)  
hist(data$Glucose)  
hist(data$SkinThickness)  
hist(data$Insulin)  
hist(data$BMI)



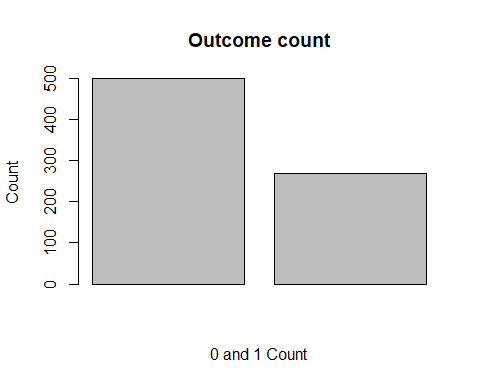
count\_0 = 0  
for (i in data$Outcome) {  
 if (i == 0)  
 count\_0 = count\_0 +1  
}  
count\_0

## [1] 500

count\_1 = length(data$Outcome) - count\_0  
count\_1

## [1] 268

A <- c(count\_0, count\_1)  
   
# Plot the bar chart   
barplot(A, xlab = "0 and 1 Count", ylab = "Count", main ="Outcome count")



length(data)

## [1] 9

length(data$Pregnancies)

## [1] 768

Correlation Heatmap for cleaned data

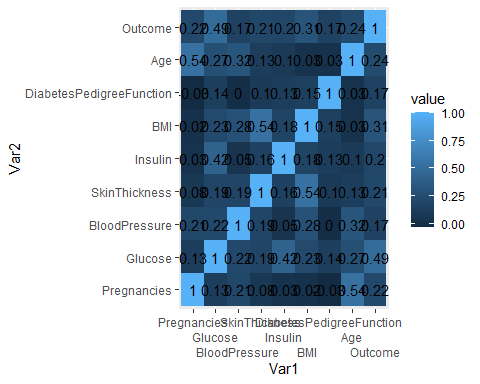
cormat <- round(cor(data),2)  
cormat

## Pregnancies Glucose BloodPressure SkinThickness  
## Pregnancies 1.00 0.13 0.21 0.08  
## Glucose 0.13 1.00 0.22 0.19  
## BloodPressure 0.21 0.22 1.00 0.19  
## SkinThickness 0.08 0.19 0.19 1.00  
## Insulin 0.03 0.42 0.05 0.16  
## BMI 0.02 0.23 0.28 0.54  
## DiabetesPedigreeFunction -0.03 0.14 0.00 0.10  
## Age 0.54 0.27 0.32 0.13  
## Outcome 0.22 0.49 0.17 0.21  
## Insulin BMI DiabetesPedigreeFunction Age Outcome  
## Pregnancies 0.03 0.02 -0.03 0.54 0.22  
## Glucose 0.42 0.23 0.14 0.27 0.49  
## BloodPressure 0.05 0.28 0.00 0.32 0.17  
## SkinThickness 0.16 0.54 0.10 0.13 0.21  
## Insulin 1.00 0.18 0.13 0.10 0.20  
## BMI 0.18 1.00 0.15 0.03 0.31  
## DiabetesPedigreeFunction 0.13 0.15 1.00 0.03 0.17  
## Age 0.10 0.03 0.03 1.00 0.24  
## Outcome 0.20 0.31 0.17 0.24 1.00

library(reshape2)  
   
  
   
melted\_corr\_mat <- melt(cormat)  
head(melted\_corr\_mat)

## Var1 Var2 value  
## 1 Pregnancies Pregnancies 1.00  
## 2 Glucose Pregnancies 0.13  
## 3 BloodPressure Pregnancies 0.21  
## 4 SkinThickness Pregnancies 0.08  
## 5 Insulin Pregnancies 0.03  
## 6 BMI Pregnancies 0.02

# plotting the correlation heatmap  
library(ggplot2)  
ggplot(data = melted\_corr\_mat, aes(x=Var1, y=Var2,  
 fill=value)) +  
geom\_tile() +  
 scale\_x\_discrete(guide = guide\_axis(n.dodge=3))+   
geom\_text(aes(Var2, Var1, label = value),  
 color = "black", size = 4)



Feature Scaling

library(dplyr)

##   
## Attaching package: 'dplyr'

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

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

library(caret)

## Loading required package: lattice

row\_labels = data[,9]  
data[,1:8]<- as.data.frame(scale(data[,1:8]))  
row\_labels

## [1] 1 0 1 0 1 0 1 0 1 1 0 1 0 1 1 1 1 1 0 1 0 0 1 1 1 1 1 0 0 0 0 1 0 0 0 0 0  
## [38] 1 1 1 0 0 0 1 0 1 0 0 1 0 0 0 0 1 0 0 1 0 0 0 0 1 0 0 1 0 1 0 0 0 1 0 1 0  
## [75] 0 0 0 0 1 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 1 1  
## [112] 1 0 0 1 1 1 0 0 0 1 0 0 0 1 1 0 0 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0  
## [149] 0 0 0 0 1 0 1 1 0 0 0 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 1 0 1 0 1 0 0 0 0 0  
## [186] 1 1 1 1 1 0 0 1 1 0 1 0 1 1 1 0 0 0 0 0 0 1 1 0 1 0 0 0 1 1 1 1 0 1 1 1 1  
## [223] 0 0 0 0 0 1 0 0 1 1 0 0 0 1 1 1 1 0 0 0 1 1 0 1 0 0 0 0 0 0 0 0 1 1 0 0 0  
## [260] 1 0 1 0 0 1 0 1 0 0 1 1 0 0 0 0 0 1 0 0 0 1 0 0 1 1 0 0 1 0 0 0 1 1 1 0 0  
## [297] 1 0 1 0 1 1 0 1 0 0 1 0 1 1 0 0 1 0 1 0 0 1 0 1 0 1 1 1 0 0 1 0 1 0 0 0 1  
## [334] 0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 1 1 1 0 1 1 0 0 1 0 0 1 0 0 1  
## [371] 1 0 0 0 0 1 0 0 1 0 0 0 0 0 0 0 1 1 1 0 0 1 0 0 1 0 0 1 0 1 1 0 1 0 1 0 1  
## [408] 0 1 1 0 0 0 0 1 1 0 1 0 1 0 0 0 0 1 1 0 1 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 1  
## [445] 1 1 0 0 1 0 0 1 0 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 1 0 0 0 1  
## [482] 0 0 0 1 1 0 0 0 0 0 0 0 1 0 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 1 1 0  
## [519] 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 1 1 1 0 0 1 1 0 0 0 0 0 0 0 0  
## [556] 0 0 0 0 0 1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 1 0 1 1 0 0 0 1 0 1 0 1 0 1 0  
## [593] 1 0 0 1 0 0 1 0 0 0 0 1 1 0 1 0 0 0 0 1 1 0 1 0 0 0 1 1 0 0 0 0 0 0 0 0 0  
## [630] 0 1 0 0 0 0 1 0 0 1 0 0 0 1 0 0 0 1 1 1 0 0 0 0 0 0 1 0 0 0 1 0 1 1 1 1 0  
## [667] 1 1 0 0 0 0 0 0 0 1 1 0 1 0 0 1 0 1 0 0 0 0 0 1 0 1 0 1 0 1 1 0 0 0 0 1 1  
## [704] 0 0 0 1 0 1 1 0 0 1 0 0 1 1 0 0 1 0 0 1 0 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 1  
## [741] 1 0 0 1 0 0 1 0 1 1 1 0 0 1 1 1 0 1 0 1 0 1 0 0 0 0 1 0

setting the seed so as to get the same result everytime and splitting the data into train and test

set.seed(123)  
size <- floor(0.8 \* nrow(data))  
train\_ind <- sample(seq\_len(nrow(data)), size = size)  
  
data\_train <- data[train\_ind,1:8]  
data\_test <- data[-train\_ind,1:8]  
  
train\_labels <- data[train\_ind, 9]  
test\_labels <- row\_labels[-train\_ind]  
length(data$Pregnancies)

## [1] 768

data\_test

## Pregnancies Glucose BloodPressure SkinThickness Insulin  
## 1 0.63953049 0.86447737 -0.0319691 0.67020577 -0.181423013  
## 3 1.23307662 2.01443290 -0.6933097 -0.01229328 -0.181423013  
## 9 -0.54756176 2.47441512 -0.1973042 1.80770419 4.657488707  
## 17 -1.14110788 -0.12119881 0.9600418 2.03520387 1.034093089  
## 22 1.23307662 -0.74546039 0.9600418 -0.01229328 -0.181423013  
## 27 0.93630355 0.83162149 0.2987012 -0.01229328 -0.181423013  
## 28 -0.84433482 -0.81117213 -0.5279745 -1.60479106 -0.007777856  
## 32 -0.25078869 1.19303609 0.2987012 0.78395561 1.207738246  
## 42 0.93630355 0.37163928 0.9600418 -0.01229328 -0.181423013  
## 43 0.93630355 -0.51546928 1.6213823 -1.26354154 -0.181423013  
## 44 1.52984968 1.62016243 3.1093986 -0.58104249 1.149856527  
## 58 -1.14110788 -0.71260452 1.2907120 3.51395182 -0.355068171  
## 60 -1.14110788 -0.54832515 -0.6933097 1.35270482 0.015374832  
## 62 1.23307662 0.37163928 -0.0319691 -0.01229328 -0.181423013  
## 63 0.34275743 -2.55253338 -0.8586448 -0.01229328 -0.181423013  
## 70 0.04598437 0.79876562 1.0427093 -0.23979296 -0.470831609  
## 77 0.93630355 -1.96112767 0.4640363 -0.01229328 -0.181423013  
## 82 -0.54756176 -1.56685720 -0.0319691 -0.01229328 -0.181423013  
## 86 -0.54756176 -0.38404579 0.1333660 -0.01229328 -0.181423013  
## 92 0.04598437 0.04308055 0.6293715 -1.60479106 0.408970522  
## 93 0.93630355 -1.33686610 0.4640363 1.23895498 -1.072801488  
## 97 -0.54756176 -0.97545150 -0.8586448 -0.12604312 -0.181423013  
## 99 0.63953049 -0.94259562 -1.8506557 0.10145656 -0.887579987  
## 102 -0.84433482 0.96304498 -1.0239800 -0.01229328 -0.181423013  
## 107 -0.84433482 -0.84402801 4.1014095 -0.01229328 -0.181423013  
## 109 -0.25078869 -1.27115435 -1.1893151 0.21520641 -1.420091803  
## 123 -0.54756176 -0.48261341 0.1333660 0.10145656 -0.470831609  
## 126 -0.84433482 -1.10687499 -3.5040071 1.46645467 -0.482407953  
## 140 0.34275743 -0.54832515 -0.0319691 -0.01229328 2.133845752  
## 142 0.34275743 -0.51546928 0.7947066 0.10145656 -0.181423013  
## 144 1.82662274 -0.44975754 -0.5279745 -0.01229328 -0.181423013  
## 145 0.04598437 1.06161260 -0.8586448 0.21520641 1.659215655  
## 146 -1.14110788 -0.64689277 0.2160336 -0.69479233 -0.181423013  
## 147 1.52984968 -2.12540704 0.6293715 0.89770546 -0.181423013  
## 149 0.34275743 0.83162149 0.4640363 -0.01229328 -0.181423013  
## 150 -0.54756176 -1.04116324 -0.1973042 -1.37729138 -0.181423013  
## 154 -0.84433482 1.02875673 0.7947066 1.46645467 3.986060765  
## 157 -0.54756176 -0.74546039 -1.6853205 -1.60479106 -0.540289672  
## 182 -1.14110788 -0.08834294 -0.6933097 -1.26354154 -0.563442360  
## 183 -0.84433482 0.01022468 0.1333660 -1.03604185 -1.362210084  
## 192 1.52984968 0.04308055 -0.1973042 1.69395435 -0.540289672  
## 194 2.12339580 0.43735102 -0.0319691 -0.01229328 -0.181423013  
## 208 0.34275743 1.32445958 2.6133932 -0.01229328 -0.181423013  
## 216 2.42016887 0.96304498 -0.1973042 1.23895498 1.508723186  
## 245 -0.54756176 0.79876562 0.2987012 0.67020577 0.617344711  
## 249 1.52984968 0.07593642 -0.1973042 0.44270609 3.025224227  
## 253 -0.54756176 -1.04116324 0.6293715 -1.71854090 -0.991767081  
## 254 -1.14110788 -1.17258673 -0.3626394 0.32895625 -0.181423013  
## 256 -0.84433482 -0.28547817 -0.6933097 0.67020577 -0.181423013  
## 264 -0.25078869 0.66734213 0.6293715 -1.60479106 -0.181423013  
## 271 1.82662274 -0.67974864 1.1253769 0.89770546 -0.181423013  
## 274 -0.84433482 -1.66542482 0.4640363 2.37645340 -1.107530520  
## 275 2.71694193 -0.51546928 -0.1973042 -0.01229328 -0.181423013  
## 293 -0.54756176 0.20735991 0.4640363 0.89770546 0.478428585  
## 295 -1.14110788 1.29160371 -1.8506557 -0.01229328 -0.181423013  
## 300 1.23307662 -0.31833405 -0.0319691 -0.01229328 -0.181423013  
## 312 -1.14110788 -0.51546928 -0.1973042 0.89770546 0.084832895  
## 314 -0.25078869 -0.28547817 -1.8506557 -2.17354027 -0.644476767  
## 318 -0.25078869 1.98157703 0.1333660 -0.01229328 -0.181423013  
## 320 0.63953049 2.37584750 0.4640363 -0.01229328 -0.181423013  
## 322 -0.25078869 -0.31833405 0.1333660 0.10145656 -0.181423013  
## 324 2.71694193 0.99590086 1.4560472 0.44270609 -1.292752021  
## 325 -0.54756176 -0.31833405 0.2160336 0.32895625 -0.181423013  
## 327 -0.84433482 0.01022468 -0.6933097 0.32895625 0.177443645  
## 328 1.82662274 1.88300941 -0.1973042 -0.01229328 -0.181423013  
## 329 -0.54756176 -0.64689277 1.1253769 0.78395561 -0.239304733  
## 336 -1.14110788 1.42302720 0.2987012 1.58020451 1.323501684  
## 341 -0.84433482 0.27307166 -0.1973042 -1.83229074 -0.412949890  
## 351 0.04598437 -0.97545150 0.6293715 -0.01229328 -0.181423013  
## 354 -0.84433482 -1.04116324 -0.8586448 -1.94604059 -1.130683207  
## 356 1.52984968 1.42302720 1.2907120 -0.01229328 -0.181423013  
## 359 2.42016887 -1.10687499 0.1333660 1.23895498 -1.003343425  
## 360 -0.84433482 2.44155925 0.2987012 0.78395561 1.254043621  
## 365 0.04598437 0.83162149 0.1333660 -0.46729264 1.763402750  
## 368 -1.14110788 -0.67974864 -0.6933097 -1.37729138 -0.181423013  
## 369 -0.25078869 -1.33686610 1.1253769 -1.49104122 -0.864427299  
## 370 -0.84433482 0.37163928 2.4480581 -0.12604312 -0.007777856  
## 383 -0.84433482 -0.41690166 -1.0239800 -2.40103995 0.478428585  
## 387 0.34275743 -0.18691056 0.1333660 -0.01229328 -0.181423013  
## 388 1.23307662 -0.54832515 2.2827229 0.78395561 -0.181423013  
## 394 0.04598437 -0.18691056 -0.0319691 -1.94604059 -0.621324079  
## 408 -1.14110788 -0.67974864 -0.8586448 -0.01229328 -0.181423013  
## 410 -0.84433482 1.65301831 -0.3626394 2.26270356 5.074237085  
## 411 0.63953049 -0.64689277 1.4560472 1.12520514 -0.181423013  
## 419 -0.84433482 -1.27115435 -0.3626394 -0.01229328 -0.181423013  
## 439 -0.84433482 -0.81117213 -0.1973042 -1.60479106 -0.181423013  
## 441 -1.14110788 2.21156814 2.6133932 -0.46729264 -0.181423013  
## 443 0.04598437 -0.15405468 -0.6933097 -0.23979296 -0.239304733  
## 444 1.23307662 -0.44975754 -0.1973042 -0.01229328 -0.181423013  
## 452 -0.54756176 0.40449515 -0.1973042 -0.01229328 -0.181423013  
## 453 -1.14110788 -1.00830737 -0.3626394 0.32895625 0.802566212  
## 469 1.23307662 -0.05548707 -0.0319691 -0.01229328 -0.181423013  
## 471 -0.84433482 0.73305388 0.7947066 1.23895498 -0.181423013  
## 474 0.93630355 0.47020689 1.4560472 -0.01229328 -0.181423013  
## 485 -1.14110788 0.76590975 -0.0319691 -0.01229328 -0.181423013  
## 493 0.04598437 -0.74546039 -0.3626394 1.01145530 -0.181423013  
## 495 -0.25078869 -1.36972197 -0.0319691 -0.01229328 -0.181423013  
## 496 0.63953049 1.45588307 0.1333660 -0.01229328 -0.181423013  
## 506 1.82662274 -1.53400133 0.7947066 -0.01229328 -0.181423013  
## 510 1.23307662 -0.05548707 0.4640363 -0.01229328 -0.181423013  
## 511 2.42016887 -1.23829848 -0.0319691 0.21520641 -0.181423013  
## 512 -1.14110788 0.56877451 -0.8586448 -1.37729138 0.802566212  
## 524 1.52984968 0.27307166 -0.1973042 -0.01229328 -0.181423013  
## 530 -1.14110788 -0.35118992 -0.6106421 -0.01229328 -0.181423013  
## 531 -0.54756176 0.01022468 -1.0239800 -1.26354154 -0.401373546  
## 535 -0.84433482 -1.46828959 -1.3546503 0.10145656 -0.980190738  
## 541 1.23307662 -0.71260452 0.1333660 1.23895498 0.860447931  
## 561 0.63953049 0.10879230 0.2987012 -0.01229328 -0.181423013  
## 565 -1.14110788 -1.00830737 0.6293715 -0.01229328 -0.181423013  
## 568 0.63953049 -0.97545150 -0.8586448 0.32895625 -0.169846670  
## 569 0.04598437 1.06161260 -0.0319691 -0.01229328 -0.169846670  
## 570 -1.14110788 -0.02263119 -0.5279745 0.10145656 0.281630740  
## 584 1.23307662 -0.71260452 0.2987012 -0.01229328 -0.181423013  
## 586 -0.84433482 -0.94259562 -1.3546503 -2.05979043 -0.181423013  
## 587 1.23307662 0.70019800 -0.5279745 -0.01229328 -0.181423013  
## 592 -0.54756176 -0.31833405 0.4640363 2.37645340 -0.007777856  
## 601 -0.84433482 -0.44975754 1.2907120 -1.14979169 -0.181423013  
## 605 0.04598437 2.01443290 -0.0319691 -0.01229328 -0.181423013  
## 608 -0.84433482 -0.97545150 -0.8586448 -0.46729264 -1.153835895  
## 613 0.93630355 1.52159482 1.2907120 1.46645467 2.087540377  
## 616 -0.25078869 -0.51546928 -0.0319691 -0.01229328 -0.181423013  
## 618 -0.54756176 -1.76399244 -0.8586448 -1.83229074 -1.454820835  
## 623 0.63953049 2.01443290 1.7867175 -0.01229328 -0.181423013  
## 624 -1.14110788 -0.90973975 -0.1973042 -0.23979296 -0.297186452  
## 626 0.04598437 -1.04116324 1.2907120 2.03520387 -1.003343425  
## 630 0.04598437 -0.90973975 -0.6106421 -0.80854217 -0.181423013  
## 634 -0.84433482 0.20735991 0.7947066 -1.37729138 0.490004929  
## 639 0.93630355 -0.81117213 0.2987012 0.32895625 -0.575018704  
## 642 0.04598437 0.20735991 -0.1973042 -0.01229328 -0.181423013  
## 644 0.04598437 -1.04116324 -0.0319691 -0.01229328 -0.181423013  
## 647 -0.84433482 1.48873894 0.1333660 -1.37729138 0.038527519  
## 651 -0.84433482 -1.00830737 -1.5199854 -0.46729264 -0.470831609  
## 655 -0.84433482 -0.51546928 -0.1973042 -0.12604312 -0.065659575  
## 660 -0.25078869 -1.36972197 0.7947066 0.21520641 -0.818121924  
## 676 0.63953049 2.40870338 -0.1973042 -0.01229328 -0.181423013  
## 677 1.52984968 1.12732435 1.1253769 -0.01229328 -0.181423013  
## 680 -0.54756176 -0.67974864 -1.1893151 -1.37729138 1.439265123  
## 692 2.71694193 1.19303609 3.4400689 -0.01229328 -0.181423013  
## 703 -0.84433482 1.52159482 1.2907120 -0.01229328 -0.181423013  
## 705 0.04598437 -0.38404579 0.2987012 -1.03604185 -0.470831609  
## 715 -0.25078869 -0.64689277 0.1333660 -0.01229328 -0.181423013  
## 718 1.82662274 -0.90973975 -0.0319691 -1.26354154 -0.181423013  
## 720 0.34275743 -0.81117213 0.2987012 -0.23979296 -0.181423013  
## 724 0.34275743 -0.15405468 1.1253769 0.10145656 -0.412949890  
## 726 0.04598437 -0.31833405 0.4640363 1.23895498 -0.181423013  
## 730 -0.54756176 -0.97545150 -1.6853205 -0.01229328 -0.181423013  
## 732 1.23307662 -0.05548707 1.1253769 -0.01229328 -0.181423013  
## 737 -1.14110788 0.14164817 1.1253769 -0.23979296 -0.239304733  
## 740 -0.84433482 -0.64689277 0.1333660 -0.01229328 -0.181423013  
## 742 -0.25078869 -0.64689277 -2.3466611 -1.03604185 -0.540289672  
## 756 -0.84433482 0.20735991 1.2907120 1.12520514 -0.355068171  
## 757 0.93630355 0.50306277 1.4560472 1.35270482 -0.181423013  
## 765 -0.54756176 0.01022468 -0.1973042 -0.23979296 -0.181423013  
## 766 0.34275743 -0.02263119 -0.0319691 -0.69479233 -0.331915483  
## BMI DiabetesPedigreeFunction Age  
## 1 0.167131243 0.4681868702 1.42506672  
## 3 -1.330970720 0.6040037019 -0.10551539  
## 9 -0.283753814 -0.9473263304 1.68016374  
## 17 1.941582111 0.2388073324 -0.19054773  
## 22 0.428935469 -0.2531514133 1.42506672  
## 27 1.010722639 -0.6485293009 0.82984034  
## 28 -1.345515399 0.0456456163 -0.95583878  
## 32 -0.123762342 1.1442528765 -0.44564475  
## 42 1.127080073 0.6764393454 0.31964631  
## 43 -1.418238795 -0.7149286408 1.25500204  
## 44 1.883403394 0.7518931407 1.76519608  
## 58 2.087028903 1.4792677279 -0.19054773  
## 60 1.316160903 -0.9020540532 -0.95583878  
## 62 0.065318488 -0.6092933273 0.48971099  
## 63 -1.083711172 0.3474607977 0.23461397  
## 70 -0.516468682 -0.8537636242 -0.53067709  
## 77 0.021684450 -0.2440969578 0.65977566  
## 82 -0.065583625 -1.1163428320 -0.95583878  
## 86 -0.007404908 0.6824756490 -0.53067709  
## 92 -0.065583625 -0.0871530635 0.06454929  
## 93 2.072484224 -0.6364566936 0.74480800  
## 97 -0.123762342 -1.0318345812 -0.78577411  
## 99 -0.545558040 -0.3497322713 -0.87080644  
## 102 -0.923719701 -0.8839451424 -0.95583878  
## 107 -1.461872833 -0.7994368916 -0.53067709  
## 109 0.268943997 -0.4100953076 -0.70074177  
## 123 0.167131243 -0.2048609842 -0.87080644  
## 126 3.279692601 0.0728089826 -0.61570943  
## 140 0.647105658 -0.9443081786 -0.44564475  
## 142 1.025267318 -0.5610028983 0.40467865  
## 144 -0.007404908 -0.6032570237 0.74480800  
## 145 0.050773809 -0.7088923372 -0.87080644  
## 146 -0.065583625 0.3021885205 -1.04087112  
## 147 0.050773809 -1.1344517429 0.65977566  
## 149 0.181675922 -0.7662372216 2.70055181  
## 150 -0.749183550 -1.1676514128 -0.95583878  
## 154 1.185258790 0.6492759791 -0.87080644  
## 157 -1.141889889 0.4983683884 -1.04087112  
## 182 0.356212073 0.7639657480 -0.87080644  
## 183 -0.691004833 -0.5217669247 -1.04087112  
## 192 0.094407846 -0.2954055387 0.57474333  
## 194 2.886986262 0.3202974314 0.57474333  
## 208 0.763463092 -0.9684533931 1.59513140  
## 216 1.359794941 0.8152743288 0.40467865  
## 245 0.836186488 -0.4312223703 -0.36061241  
## 249 0.428935469 -0.5730755055 0.06454929  
## 253 -1.170979248 -0.6726745154 -0.78577411  
## 254 0.487114186 -0.7058741853 -0.70074177  
## 256 0.167131243 0.2146621179 -1.04087112  
## 264 -0.007404908 -0.8205639543 2.53048713  
## 271 1.912492752 2.0044261435 0.40467865  
## 274 0.108952526 -0.1505342516 -1.04087112  
## 275 0.254399318 -0.6666382118 1.59513140  
## 293 1.577965129 2.2700235031 -0.19054773  
## 295 -1.534596229 -0.6575837563 2.70055181  
## 300 -1.287336682 1.1110532066 2.10532543  
## 312 1.010722639 0.4017875303 -0.95583878  
## 314 -0.429200606 0.4651687184 -0.70074177  
## 318 -0.283753814 -0.3829319413 -0.36061241  
## 320 -1.301881361 -1.0348527330 2.19035777  
## 322 -0.123762342 -0.8296184097 -0.70074177  
## 324 -0.821906946 0.7820746589 0.82984034  
## 325 0.472569507 -0.9775078486 -1.04087112  
## 327 0.385301431 0.6643667381 -0.27558007  
## 328 0.385301431 -0.8205639543 0.31964631  
## 329 1.897948073 -1.0408890367 -0.87080644  
## 336 2.247020375 -0.6424929972 -0.61570943  
## 341 -0.952809059 0.0003733391 -0.95583878  
## 351 1.417973658 -0.7088923372 -0.36061241  
## 354 -0.763728229 0.3263337350 -0.78577411  
## 356 -0.298298493 -0.5127124693 1.34003438  
## 359 0.414390790 -0.2833329314 1.25500204  
## 360 0.588926941 1.2166885201 -0.36061241  
## 365 0.356212073 -0.2622058687 -0.27558007  
## 368 -1.665498342 -0.6636200599 -1.04087112  
## 369 -0.720094191 -0.5006398620 -0.95583878  
## 370 0.050773809 -0.7179467926 0.99990502  
## 383 -1.025532455 1.4339954506 -1.04087112  
## 387 -0.021949588 0.5677858801 0.14958163  
## 388 1.577965129 -0.7028560335 0.99990502  
## 394 -1.505506871 -0.0267900272 0.31964631  
## 408 -1.534596229 -0.4100953076 -0.70074177  
## 410 1.447063016 0.6945482563 -0.44564475  
## 411 0.472569507 0.6100400055 -0.44564475  
## 419 -2.072749361 0.4591324148 -0.53067709  
## 439 -2.072749361 -0.9805260004 -1.04087112  
## 441 0.268943997 -0.1112982780 0.65977566  
## 443 0.108952526 -0.7300193998 -0.78577411  
## 444 -0.283753814 1.4581406652 -0.02048305  
## 452 -0.516468682 0.2116439661 -0.87080644  
## 453 1.083446035 -0.2742784760 -0.70074177  
## 469 -0.356477210 -0.8718725351 0.40467865  
## 471 1.287071545 0.4078238340 -0.44564475  
## 474 -0.371021889 -0.7903824361 1.42506672  
## 485 1.708867243 0.4772413257 -0.19054773  
## 493 0.050773809 -0.9865623040 -0.02048305  
## 495 -0.065583625 -0.8990359014 -0.95583878  
## 496 -0.850996305 -0.5066761656 2.78558415  
## 506 0.123497205 -0.6304203900 0.40467865  
## 510 -1.083711172 -0.1897702252 2.61551947  
## 511 -0.400111248 -0.5278032283 1.08493736  
## 512 -1.505506871 -0.7994368916 -1.04087112  
## 524 0.254399318 0.5436406656 0.99990502  
## 530 -1.141889889 0.5677858801 -0.19054773  
## 531 -0.385566569 0.7398205335 -0.95583878  
## 535 0.123497205 2.3515136020 -0.78577411  
## 541 1.010722639 0.5708040319 0.82984034  
## 561 0.196220601 -1.0589979476 1.76519608  
## 565 -0.007404908 0.3897149231 -0.53067709  
## 568 -0.065583625 -1.1676514128 1.08493736  
## 569 -0.167396380 -0.4040590040 0.31964631  
## 570 0.268943997 -0.8115094988 -0.02048305  
## 584 0.908909884 -0.8507454724 0.74480800  
## 586 -1.447328154 -0.1656250107 -0.95583878  
## 587 0.356212073 -1.0348527330 0.65977566  
## 592 1.010722639 -0.8960177496 -0.78577411  
## 601 -0.778272908 -0.2169335915 -0.78577411  
## 605 -0.589192078 -0.7843461325 0.23461397  
## 608 -1.883668531 0.0305548572 -0.70074177  
## 613 0.836186488 0.9510911604 0.57474333  
## 616 -0.967353739 -0.7994368916 -0.53067709  
## 618 -1.796400455 -0.6485293009 -0.87080644  
## 623 1.214348148 2.9853254829 0.99990502  
## 624 1.607054488 -0.3768956376 -1.04087112  
## 626 0.763463092 -0.3316233604 -0.36061241  
## 630 -1.127345210 -0.9775078486 -1.04087112  
## 634 -0.720094191 -1.0771068584 -0.95583878  
## 639 1.228892828 1.2046159128 -0.10551539  
## 642 0.268943997 -0.5096943174 -0.78577411  
## 644 -0.647370795 0.4168782894 -0.19054773  
## 647 -1.316426040 -0.0750804563 -0.02048305  
## 651 -1.054621814 -0.7179467926 -0.87080644  
## 655 0.254399318 -0.9956167595 -0.95583878  
## 660 0.254399318 2.4752578264 -0.53067709  
## 676 -0.225575097 -0.4342405221 -0.19054773  
## 677 -1.112800531 -0.7300193998 1.68016374  
## 680 -1.200068606 0.4289508967 -0.87080644  
## 692 1.432518337 -0.6485293009 0.91487268  
## 703 0.370756752 1.3072330745 1.59513140  
## 705 -0.589192078 -1.0680524030 -0.53067709  
## 715 -0.429200606 -1.0589979476 -0.10551539  
## 718 -1.360060078 0.3716060122 1.93526076  
## 720 0.458024828 -0.2833329314 1.59513140  
## 724 0.967088601 -0.6666382118 0.74480800  
## 726 1.010722639 -0.7119104890 0.40467865  
## 730 -0.341932531 -0.9986349113 -0.95583878  
## 732 -0.589192078 -0.6424929972 -0.95583878  
## 737 -0.734638871 0.1301538671 -1.04087112  
## 740 1.025267318 -0.5398758356 0.74480800  
## 742 -0.240119776 -0.2169335915 -0.61570943  
## 756 0.588926941 1.7659921502 0.31964631  
## 757 -0.065583625 -0.2440969578 0.48971099  
## 765 0.632560978 -0.3980227003 -0.53067709  
## 766 -0.909175022 -0.6847471226 -0.27558007

library(class)  
  
predictions <- knn(train = data\_train,  
 test = data\_test,  
 cl = train\_labels,  
 k= 9)  
length(predictions)

## [1] 154

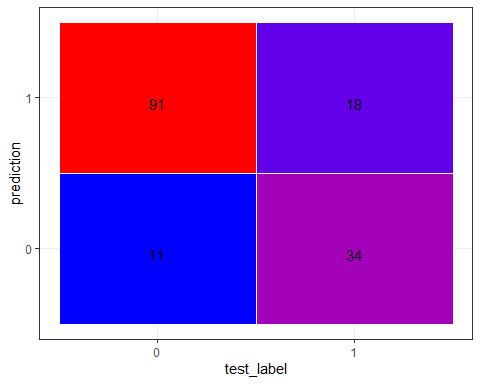
Confusion Matrix

##create confusion matrix  
tab <- table( predictions, test\_labels )   
tab

## test\_labels  
## predictions 0 1  
## 0 91 18  
## 1 11 34

prediction <- factor(c(0, 0, 1, 1))  
test\_label <- factor(c(0, 1, 0, 1))  
Y <- c(11, 34, 91, 18)  
df <- data.frame(prediction, test\_label, Y)

library(ggplot2)  
ggplot(data = df, mapping = aes(x = test\_label, y = prediction)) +  
 geom\_tile(aes(fill = Y), colour = "white") +  
 geom\_text(aes(label = sprintf("%1.0f", Y)), vjust = 1) +  
 scale\_fill\_gradient(low = "blue", high = "red") +  
 theme\_bw() + theme(legend.position = "none")



Accuracy

##check the accuracy  
accuracy <- function( matriz ){  
 sum( diag( x = matriz ) / sum( rowSums( x = matriz )) ) \* 100.0  
}  
  
  
  
print( paste('accuracy ' , round( accuracy( tab ) , digits = 3 ) ) )

## [1] "accuracy 81.169"

data\_test

## Pregnancies Glucose BloodPressure SkinThickness Insulin  
## 1 0.63953049 0.86447737 -0.0319691 0.67020577 -0.181423013  
## 3 1.23307662 2.01443290 -0.6933097 -0.01229328 -0.181423013  
## 9 -0.54756176 2.47441512 -0.1973042 1.80770419 4.657488707  
## 17 -1.14110788 -0.12119881 0.9600418 2.03520387 1.034093089  
## 22 1.23307662 -0.74546039 0.9600418 -0.01229328 -0.181423013  
## 27 0.93630355 0.83162149 0.2987012 -0.01229328 -0.181423013  
## 28 -0.84433482 -0.81117213 -0.5279745 -1.60479106 -0.007777856  
## 32 -0.25078869 1.19303609 0.2987012 0.78395561 1.207738246  
## 42 0.93630355 0.37163928 0.9600418 -0.01229328 -0.181423013  
## 43 0.93630355 -0.51546928 1.6213823 -1.26354154 -0.181423013  
## 44 1.52984968 1.62016243 3.1093986 -0.58104249 1.149856527  
## 58 -1.14110788 -0.71260452 1.2907120 3.51395182 -0.355068171  
## 60 -1.14110788 -0.54832515 -0.6933097 1.35270482 0.015374832  
## 62 1.23307662 0.37163928 -0.0319691 -0.01229328 -0.181423013  
## 63 0.34275743 -2.55253338 -0.8586448 -0.01229328 -0.181423013  
## 70 0.04598437 0.79876562 1.0427093 -0.23979296 -0.470831609  
## 77 0.93630355 -1.96112767 0.4640363 -0.01229328 -0.181423013  
## 82 -0.54756176 -1.56685720 -0.0319691 -0.01229328 -0.181423013  
## 86 -0.54756176 -0.38404579 0.1333660 -0.01229328 -0.181423013  
## 92 0.04598437 0.04308055 0.6293715 -1.60479106 0.408970522  
## 93 0.93630355 -1.33686610 0.4640363 1.23895498 -1.072801488  
## 97 -0.54756176 -0.97545150 -0.8586448 -0.12604312 -0.181423013  
## 99 0.63953049 -0.94259562 -1.8506557 0.10145656 -0.887579987  
## 102 -0.84433482 0.96304498 -1.0239800 -0.01229328 -0.181423013  
## 107 -0.84433482 -0.84402801 4.1014095 -0.01229328 -0.181423013  
## 109 -0.25078869 -1.27115435 -1.1893151 0.21520641 -1.420091803  
## 123 -0.54756176 -0.48261341 0.1333660 0.10145656 -0.470831609  
## 126 -0.84433482 -1.10687499 -3.5040071 1.46645467 -0.482407953  
## 140 0.34275743 -0.54832515 -0.0319691 -0.01229328 2.133845752  
## 142 0.34275743 -0.51546928 0.7947066 0.10145656 -0.181423013  
## 144 1.82662274 -0.44975754 -0.5279745 -0.01229328 -0.181423013  
## 145 0.04598437 1.06161260 -0.8586448 0.21520641 1.659215655  
## 146 -1.14110788 -0.64689277 0.2160336 -0.69479233 -0.181423013  
## 147 1.52984968 -2.12540704 0.6293715 0.89770546 -0.181423013  
## 149 0.34275743 0.83162149 0.4640363 -0.01229328 -0.181423013  
## 150 -0.54756176 -1.04116324 -0.1973042 -1.37729138 -0.181423013  
## 154 -0.84433482 1.02875673 0.7947066 1.46645467 3.986060765  
## 157 -0.54756176 -0.74546039 -1.6853205 -1.60479106 -0.540289672  
## 182 -1.14110788 -0.08834294 -0.6933097 -1.26354154 -0.563442360  
## 183 -0.84433482 0.01022468 0.1333660 -1.03604185 -1.362210084  
## 192 1.52984968 0.04308055 -0.1973042 1.69395435 -0.540289672  
## 194 2.12339580 0.43735102 -0.0319691 -0.01229328 -0.181423013  
## 208 0.34275743 1.32445958 2.6133932 -0.01229328 -0.181423013  
## 216 2.42016887 0.96304498 -0.1973042 1.23895498 1.508723186  
## 245 -0.54756176 0.79876562 0.2987012 0.67020577 0.617344711  
## 249 1.52984968 0.07593642 -0.1973042 0.44270609 3.025224227  
## 253 -0.54756176 -1.04116324 0.6293715 -1.71854090 -0.991767081  
## 254 -1.14110788 -1.17258673 -0.3626394 0.32895625 -0.181423013  
## 256 -0.84433482 -0.28547817 -0.6933097 0.67020577 -0.181423013  
## 264 -0.25078869 0.66734213 0.6293715 -1.60479106 -0.181423013  
## 271 1.82662274 -0.67974864 1.1253769 0.89770546 -0.181423013  
## 274 -0.84433482 -1.66542482 0.4640363 2.37645340 -1.107530520  
## 275 2.71694193 -0.51546928 -0.1973042 -0.01229328 -0.181423013  
## 293 -0.54756176 0.20735991 0.4640363 0.89770546 0.478428585  
## 295 -1.14110788 1.29160371 -1.8506557 -0.01229328 -0.181423013  
## 300 1.23307662 -0.31833405 -0.0319691 -0.01229328 -0.181423013  
## 312 -1.14110788 -0.51546928 -0.1973042 0.89770546 0.084832895  
## 314 -0.25078869 -0.28547817 -1.8506557 -2.17354027 -0.644476767  
## 318 -0.25078869 1.98157703 0.1333660 -0.01229328 -0.181423013  
## 320 0.63953049 2.37584750 0.4640363 -0.01229328 -0.181423013  
## 322 -0.25078869 -0.31833405 0.1333660 0.10145656 -0.181423013  
## 324 2.71694193 0.99590086 1.4560472 0.44270609 -1.292752021  
## 325 -0.54756176 -0.31833405 0.2160336 0.32895625 -0.181423013  
## 327 -0.84433482 0.01022468 -0.6933097 0.32895625 0.177443645  
## 328 1.82662274 1.88300941 -0.1973042 -0.01229328 -0.181423013  
## 329 -0.54756176 -0.64689277 1.1253769 0.78395561 -0.239304733  
## 336 -1.14110788 1.42302720 0.2987012 1.58020451 1.323501684  
## 341 -0.84433482 0.27307166 -0.1973042 -1.83229074 -0.412949890  
## 351 0.04598437 -0.97545150 0.6293715 -0.01229328 -0.181423013  
## 354 -0.84433482 -1.04116324 -0.8586448 -1.94604059 -1.130683207  
## 356 1.52984968 1.42302720 1.2907120 -0.01229328 -0.181423013  
## 359 2.42016887 -1.10687499 0.1333660 1.23895498 -1.003343425  
## 360 -0.84433482 2.44155925 0.2987012 0.78395561 1.254043621  
## 365 0.04598437 0.83162149 0.1333660 -0.46729264 1.763402750  
## 368 -1.14110788 -0.67974864 -0.6933097 -1.37729138 -0.181423013  
## 369 -0.25078869 -1.33686610 1.1253769 -1.49104122 -0.864427299  
## 370 -0.84433482 0.37163928 2.4480581 -0.12604312 -0.007777856  
## 383 -0.84433482 -0.41690166 -1.0239800 -2.40103995 0.478428585  
## 387 0.34275743 -0.18691056 0.1333660 -0.01229328 -0.181423013  
## 388 1.23307662 -0.54832515 2.2827229 0.78395561 -0.181423013  
## 394 0.04598437 -0.18691056 -0.0319691 -1.94604059 -0.621324079  
## 408 -1.14110788 -0.67974864 -0.8586448 -0.01229328 -0.181423013  
## 410 -0.84433482 1.65301831 -0.3626394 2.26270356 5.074237085  
## 411 0.63953049 -0.64689277 1.4560472 1.12520514 -0.181423013  
## 419 -0.84433482 -1.27115435 -0.3626394 -0.01229328 -0.181423013  
## 439 -0.84433482 -0.81117213 -0.1973042 -1.60479106 -0.181423013  
## 441 -1.14110788 2.21156814 2.6133932 -0.46729264 -0.181423013  
## 443 0.04598437 -0.15405468 -0.6933097 -0.23979296 -0.239304733  
## 444 1.23307662 -0.44975754 -0.1973042 -0.01229328 -0.181423013  
## 452 -0.54756176 0.40449515 -0.1973042 -0.01229328 -0.181423013  
## 453 -1.14110788 -1.00830737 -0.3626394 0.32895625 0.802566212  
## 469 1.23307662 -0.05548707 -0.0319691 -0.01229328 -0.181423013  
## 471 -0.84433482 0.73305388 0.7947066 1.23895498 -0.181423013  
## 474 0.93630355 0.47020689 1.4560472 -0.01229328 -0.181423013  
## 485 -1.14110788 0.76590975 -0.0319691 -0.01229328 -0.181423013  
## 493 0.04598437 -0.74546039 -0.3626394 1.01145530 -0.181423013  
## 495 -0.25078869 -1.36972197 -0.0319691 -0.01229328 -0.181423013  
## 496 0.63953049 1.45588307 0.1333660 -0.01229328 -0.181423013  
## 506 1.82662274 -1.53400133 0.7947066 -0.01229328 -0.181423013  
## 510 1.23307662 -0.05548707 0.4640363 -0.01229328 -0.181423013  
## 511 2.42016887 -1.23829848 -0.0319691 0.21520641 -0.181423013  
## 512 -1.14110788 0.56877451 -0.8586448 -1.37729138 0.802566212  
## 524 1.52984968 0.27307166 -0.1973042 -0.01229328 -0.181423013  
## 530 -1.14110788 -0.35118992 -0.6106421 -0.01229328 -0.181423013  
## 531 -0.54756176 0.01022468 -1.0239800 -1.26354154 -0.401373546  
## 535 -0.84433482 -1.46828959 -1.3546503 0.10145656 -0.980190738  
## 541 1.23307662 -0.71260452 0.1333660 1.23895498 0.860447931  
## 561 0.63953049 0.10879230 0.2987012 -0.01229328 -0.181423013  
## 565 -1.14110788 -1.00830737 0.6293715 -0.01229328 -0.181423013  
## 568 0.63953049 -0.97545150 -0.8586448 0.32895625 -0.169846670  
## 569 0.04598437 1.06161260 -0.0319691 -0.01229328 -0.169846670  
## 570 -1.14110788 -0.02263119 -0.5279745 0.10145656 0.281630740  
## 584 1.23307662 -0.71260452 0.2987012 -0.01229328 -0.181423013  
## 586 -0.84433482 -0.94259562 -1.3546503 -2.05979043 -0.181423013  
## 587 1.23307662 0.70019800 -0.5279745 -0.01229328 -0.181423013  
## 592 -0.54756176 -0.31833405 0.4640363 2.37645340 -0.007777856  
## 601 -0.84433482 -0.44975754 1.2907120 -1.14979169 -0.181423013  
## 605 0.04598437 2.01443290 -0.0319691 -0.01229328 -0.181423013  
## 608 -0.84433482 -0.97545150 -0.8586448 -0.46729264 -1.153835895  
## 613 0.93630355 1.52159482 1.2907120 1.46645467 2.087540377  
## 616 -0.25078869 -0.51546928 -0.0319691 -0.01229328 -0.181423013  
## 618 -0.54756176 -1.76399244 -0.8586448 -1.83229074 -1.454820835  
## 623 0.63953049 2.01443290 1.7867175 -0.01229328 -0.181423013  
## 624 -1.14110788 -0.90973975 -0.1973042 -0.23979296 -0.297186452  
## 626 0.04598437 -1.04116324 1.2907120 2.03520387 -1.003343425  
## 630 0.04598437 -0.90973975 -0.6106421 -0.80854217 -0.181423013  
## 634 -0.84433482 0.20735991 0.7947066 -1.37729138 0.490004929  
## 639 0.93630355 -0.81117213 0.2987012 0.32895625 -0.575018704  
## 642 0.04598437 0.20735991 -0.1973042 -0.01229328 -0.181423013  
## 644 0.04598437 -1.04116324 -0.0319691 -0.01229328 -0.181423013  
## 647 -0.84433482 1.48873894 0.1333660 -1.37729138 0.038527519  
## 651 -0.84433482 -1.00830737 -1.5199854 -0.46729264 -0.470831609  
## 655 -0.84433482 -0.51546928 -0.1973042 -0.12604312 -0.065659575  
## 660 -0.25078869 -1.36972197 0.7947066 0.21520641 -0.818121924  
## 676 0.63953049 2.40870338 -0.1973042 -0.01229328 -0.181423013  
## 677 1.52984968 1.12732435 1.1253769 -0.01229328 -0.181423013  
## 680 -0.54756176 -0.67974864 -1.1893151 -1.37729138 1.439265123  
## 692 2.71694193 1.19303609 3.4400689 -0.01229328 -0.181423013  
## 703 -0.84433482 1.52159482 1.2907120 -0.01229328 -0.181423013  
## 705 0.04598437 -0.38404579 0.2987012 -1.03604185 -0.470831609  
## 715 -0.25078869 -0.64689277 0.1333660 -0.01229328 -0.181423013  
## 718 1.82662274 -0.90973975 -0.0319691 -1.26354154 -0.181423013  
## 720 0.34275743 -0.81117213 0.2987012 -0.23979296 -0.181423013  
## 724 0.34275743 -0.15405468 1.1253769 0.10145656 -0.412949890  
## 726 0.04598437 -0.31833405 0.4640363 1.23895498 -0.181423013  
## 730 -0.54756176 -0.97545150 -1.6853205 -0.01229328 -0.181423013  
## 732 1.23307662 -0.05548707 1.1253769 -0.01229328 -0.181423013  
## 737 -1.14110788 0.14164817 1.1253769 -0.23979296 -0.239304733  
## 740 -0.84433482 -0.64689277 0.1333660 -0.01229328 -0.181423013  
## 742 -0.25078869 -0.64689277 -2.3466611 -1.03604185 -0.540289672  
## 756 -0.84433482 0.20735991 1.2907120 1.12520514 -0.355068171  
## 757 0.93630355 0.50306277 1.4560472 1.35270482 -0.181423013  
## 765 -0.54756176 0.01022468 -0.1973042 -0.23979296 -0.181423013  
## 766 0.34275743 -0.02263119 -0.0319691 -0.69479233 -0.331915483  
## BMI DiabetesPedigreeFunction Age  
## 1 0.167131243 0.4681868702 1.42506672  
## 3 -1.330970720 0.6040037019 -0.10551539  
## 9 -0.283753814 -0.9473263304 1.68016374  
## 17 1.941582111 0.2388073324 -0.19054773  
## 22 0.428935469 -0.2531514133 1.42506672  
## 27 1.010722639 -0.6485293009 0.82984034  
## 28 -1.345515399 0.0456456163 -0.95583878  
## 32 -0.123762342 1.1442528765 -0.44564475  
## 42 1.127080073 0.6764393454 0.31964631  
## 43 -1.418238795 -0.7149286408 1.25500204  
## 44 1.883403394 0.7518931407 1.76519608  
## 58 2.087028903 1.4792677279 -0.19054773  
## 60 1.316160903 -0.9020540532 -0.95583878  
## 62 0.065318488 -0.6092933273 0.48971099  
## 63 -1.083711172 0.3474607977 0.23461397  
## 70 -0.516468682 -0.8537636242 -0.53067709  
## 77 0.021684450 -0.2440969578 0.65977566  
## 82 -0.065583625 -1.1163428320 -0.95583878  
## 86 -0.007404908 0.6824756490 -0.53067709  
## 92 -0.065583625 -0.0871530635 0.06454929  
## 93 2.072484224 -0.6364566936 0.74480800  
## 97 -0.123762342 -1.0318345812 -0.78577411  
## 99 -0.545558040 -0.3497322713 -0.87080644  
## 102 -0.923719701 -0.8839451424 -0.95583878  
## 107 -1.461872833 -0.7994368916 -0.53067709  
## 109 0.268943997 -0.4100953076 -0.70074177  
## 123 0.167131243 -0.2048609842 -0.87080644  
## 126 3.279692601 0.0728089826 -0.61570943  
## 140 0.647105658 -0.9443081786 -0.44564475  
## 142 1.025267318 -0.5610028983 0.40467865  
## 144 -0.007404908 -0.6032570237 0.74480800  
## 145 0.050773809 -0.7088923372 -0.87080644  
## 146 -0.065583625 0.3021885205 -1.04087112  
## 147 0.050773809 -1.1344517429 0.65977566  
## 149 0.181675922 -0.7662372216 2.70055181  
## 150 -0.749183550 -1.1676514128 -0.95583878  
## 154 1.185258790 0.6492759791 -0.87080644  
## 157 -1.141889889 0.4983683884 -1.04087112  
## 182 0.356212073 0.7639657480 -0.87080644  
## 183 -0.691004833 -0.5217669247 -1.04087112  
## 192 0.094407846 -0.2954055387 0.57474333  
## 194 2.886986262 0.3202974314 0.57474333  
## 208 0.763463092 -0.9684533931 1.59513140  
## 216 1.359794941 0.8152743288 0.40467865  
## 245 0.836186488 -0.4312223703 -0.36061241  
## 249 0.428935469 -0.5730755055 0.06454929  
## 253 -1.170979248 -0.6726745154 -0.78577411  
## 254 0.487114186 -0.7058741853 -0.70074177  
## 256 0.167131243 0.2146621179 -1.04087112  
## 264 -0.007404908 -0.8205639543 2.53048713  
## 271 1.912492752 2.0044261435 0.40467865  
## 274 0.108952526 -0.1505342516 -1.04087112  
## 275 0.254399318 -0.6666382118 1.59513140  
## 293 1.577965129 2.2700235031 -0.19054773  
## 295 -1.534596229 -0.6575837563 2.70055181  
## 300 -1.287336682 1.1110532066 2.10532543  
## 312 1.010722639 0.4017875303 -0.95583878  
## 314 -0.429200606 0.4651687184 -0.70074177  
## 318 -0.283753814 -0.3829319413 -0.36061241  
## 320 -1.301881361 -1.0348527330 2.19035777  
## 322 -0.123762342 -0.8296184097 -0.70074177  
## 324 -0.821906946 0.7820746589 0.82984034  
## 325 0.472569507 -0.9775078486 -1.04087112  
## 327 0.385301431 0.6643667381 -0.27558007  
## 328 0.385301431 -0.8205639543 0.31964631  
## 329 1.897948073 -1.0408890367 -0.87080644  
## 336 2.247020375 -0.6424929972 -0.61570943  
## 341 -0.952809059 0.0003733391 -0.95583878  
## 351 1.417973658 -0.7088923372 -0.36061241  
## 354 -0.763728229 0.3263337350 -0.78577411  
## 356 -0.298298493 -0.5127124693 1.34003438  
## 359 0.414390790 -0.2833329314 1.25500204  
## 360 0.588926941 1.2166885201 -0.36061241  
## 365 0.356212073 -0.2622058687 -0.27558007  
## 368 -1.665498342 -0.6636200599 -1.04087112  
## 369 -0.720094191 -0.5006398620 -0.95583878  
## 370 0.050773809 -0.7179467926 0.99990502  
## 383 -1.025532455 1.4339954506 -1.04087112  
## 387 -0.021949588 0.5677858801 0.14958163  
## 388 1.577965129 -0.7028560335 0.99990502  
## 394 -1.505506871 -0.0267900272 0.31964631  
## 408 -1.534596229 -0.4100953076 -0.70074177  
## 410 1.447063016 0.6945482563 -0.44564475  
## 411 0.472569507 0.6100400055 -0.44564475  
## 419 -2.072749361 0.4591324148 -0.53067709  
## 439 -2.072749361 -0.9805260004 -1.04087112  
## 441 0.268943997 -0.1112982780 0.65977566  
## 443 0.108952526 -0.7300193998 -0.78577411  
## 444 -0.283753814 1.4581406652 -0.02048305  
## 452 -0.516468682 0.2116439661 -0.87080644  
## 453 1.083446035 -0.2742784760 -0.70074177  
## 469 -0.356477210 -0.8718725351 0.40467865  
## 471 1.287071545 0.4078238340 -0.44564475  
## 474 -0.371021889 -0.7903824361 1.42506672  
## 485 1.708867243 0.4772413257 -0.19054773  
## 493 0.050773809 -0.9865623040 -0.02048305  
## 495 -0.065583625 -0.8990359014 -0.95583878  
## 496 -0.850996305 -0.5066761656 2.78558415  
## 506 0.123497205 -0.6304203900 0.40467865  
## 510 -1.083711172 -0.1897702252 2.61551947  
## 511 -0.400111248 -0.5278032283 1.08493736  
## 512 -1.505506871 -0.7994368916 -1.04087112  
## 524 0.254399318 0.5436406656 0.99990502  
## 530 -1.141889889 0.5677858801 -0.19054773  
## 531 -0.385566569 0.7398205335 -0.95583878  
## 535 0.123497205 2.3515136020 -0.78577411  
## 541 1.010722639 0.5708040319 0.82984034  
## 561 0.196220601 -1.0589979476 1.76519608  
## 565 -0.007404908 0.3897149231 -0.53067709  
## 568 -0.065583625 -1.1676514128 1.08493736  
## 569 -0.167396380 -0.4040590040 0.31964631  
## 570 0.268943997 -0.8115094988 -0.02048305  
## 584 0.908909884 -0.8507454724 0.74480800  
## 586 -1.447328154 -0.1656250107 -0.95583878  
## 587 0.356212073 -1.0348527330 0.65977566  
## 592 1.010722639 -0.8960177496 -0.78577411  
## 601 -0.778272908 -0.2169335915 -0.78577411  
## 605 -0.589192078 -0.7843461325 0.23461397  
## 608 -1.883668531 0.0305548572 -0.70074177  
## 613 0.836186488 0.9510911604 0.57474333  
## 616 -0.967353739 -0.7994368916 -0.53067709  
## 618 -1.796400455 -0.6485293009 -0.87080644  
## 623 1.214348148 2.9853254829 0.99990502  
## 624 1.607054488 -0.3768956376 -1.04087112  
## 626 0.763463092 -0.3316233604 -0.36061241  
## 630 -1.127345210 -0.9775078486 -1.04087112  
## 634 -0.720094191 -1.0771068584 -0.95583878  
## 639 1.228892828 1.2046159128 -0.10551539  
## 642 0.268943997 -0.5096943174 -0.78577411  
## 644 -0.647370795 0.4168782894 -0.19054773  
## 647 -1.316426040 -0.0750804563 -0.02048305  
## 651 -1.054621814 -0.7179467926 -0.87080644  
## 655 0.254399318 -0.9956167595 -0.95583878  
## 660 0.254399318 2.4752578264 -0.53067709  
## 676 -0.225575097 -0.4342405221 -0.19054773  
## 677 -1.112800531 -0.7300193998 1.68016374  
## 680 -1.200068606 0.4289508967 -0.87080644  
## 692 1.432518337 -0.6485293009 0.91487268  
## 703 0.370756752 1.3072330745 1.59513140  
## 705 -0.589192078 -1.0680524030 -0.53067709  
## 715 -0.429200606 -1.0589979476 -0.10551539  
## 718 -1.360060078 0.3716060122 1.93526076  
## 720 0.458024828 -0.2833329314 1.59513140  
## 724 0.967088601 -0.6666382118 0.74480800  
## 726 1.010722639 -0.7119104890 0.40467865  
## 730 -0.341932531 -0.9986349113 -0.95583878  
## 732 -0.589192078 -0.6424929972 -0.95583878  
## 737 -0.734638871 0.1301538671 -1.04087112  
## 740 1.025267318 -0.5398758356 0.74480800  
## 742 -0.240119776 -0.2169335915 -0.61570943  
## 756 0.588926941 1.7659921502 0.31964631  
## 757 -0.065583625 -0.2440969578 0.48971099  
## 765 0.632560978 -0.3980227003 -0.53067709  
## 766 -0.909175022 -0.6847471226 -0.27558007

plot\_predictions <- data.frame(  
 data\_test$Pregnancies,  
 data\_test$Glucose,  
 data\_test$BloodPressure,  
 data\_test$SkinThickness,  
 data\_test$Insulin,  
 data\_test$BMI,  
 data\_test$DiabetesPedigreeFunction,  
 data\_test$Age,  
   
 predicted = predictions)  
  
colnames(plot\_predictions) <- c("data\_test$Pregnancies",  
 "data\_test$Glucose",  
 "data\_test$BloodPressure",  
 "data\_test$SkinThickness",  
 "data\_test$Insulin",  
 "data\_test$BMI",  
 "data\_test$DiabetesPedigreeFunction",  
 "data\_test$Age",  
 "predicted")  
# Visualize the KNN algorithm results.  
library(ggplot2)  
library(plyr)

## ------------------------------------------------------------------------------

## You have loaded plyr after dplyr - this is likely to cause problems.  
## If you need functions from both plyr and dplyr, please load plyr first, then dplyr:  
## library(plyr); library(dplyr)

## ------------------------------------------------------------------------------

##   
## Attaching package: 'plyr'

## The following objects are masked from 'package:dplyr':  
##   
## arrange, count, desc, failwith, id, mutate, rename, summarise,  
## summarize

require(gridExtra)

## Loading required package: gridExtra

##   
## Attaching package: 'gridExtra'

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

p1 <- ggplot(plot\_predictions, aes(data\_test$Pregnancies,data\_test$Glucose, color = predicted, fill = predicted)) +   
 geom\_point(size = 5) +   
 geom\_text(aes(label=test\_labels),hjust=1, vjust=2) +  
 ggtitle("Predicted relationship between Pregnancies and Glucose Intake") +  
 theme(plot.title = element\_text(hjust = 0.5)) +  
 theme(legend.position = "none")  
  
  
p2 <- ggplot(plot\_predictions, aes(data\_test$BloodPressure, data\_test$SkinThickness, color = predicted, fill = predicted)) +   
 geom\_point(size = 5) +   
 geom\_text(aes(label=test\_labels),hjust=1, vjust=2) +  
 ggtitle("Predicted relationship between BloodPressure and Skinthickness") +  
 theme(plot.title = element\_text(hjust = 0.5)) +  
 theme(legend.position = "none")  
  
grid.arrange(p1, p2, ncol=1)

