Output variable -> y

y -> Whether the client has subscribed a term deposit or not

Binomial ("yes" or "no")

**Ans :**

**R Code :**

## Logistic Regression

########## Bank Data Set #########

bank.full <- read.csv('D:\\Data Science\\Excelr\\Assignments\\Assignment\\Logistic Regression\\bank-full\_r.csv')

# GLM function use sigmoid curve to produce desirable results

# The output of sigmoid function lies in between 0-1

model <- glm(y~.,data=bank.full,family = "binomial")

summary(model) # Confusion matrix table

prob <- predict(model,bank.full,type="response")

prob

# Confusion matrix and considering the threshold value as 0.5

confusion<-table(prob>0.5,bank.full$y)

confusion

# Model Accuracy

Accuracy<-sum(diag(confusion)/sum(confusion))

Accuracy

##ROC

library(ROCR)

rocrpred<-prediction(prob,bank.full$y)

rocrperf<-performance(rocrpred,'tpr','fpr')

plot(rocrperf,colorize=T,text.adj=c(-0.2,1.7))

**Results :**

> summary(model) # Confusion matrix table

Call:

glm(formula = y ~ ., family = "binomial", data = bank.full)

Deviance Residuals:

Min 1Q Median 3Q Max

-5.7286 -0.3744 -0.2530 -0.1502 3.4288

Coefficients:

Estimate Std. Error z value Pr(>|z|)

(Intercept) -2.536e+00 1.837e-01 -13.803 < 2e-16 \*\*\*

age 1.127e-04 2.205e-03 0.051 0.959233

jobblue-collar -3.099e-01 7.267e-02 -4.264 2.01e-05 \*\*\*

jobentrepreneur -3.571e-01 1.256e-01 -2.844 0.004455 \*\*

jobhousemaid -5.040e-01 1.365e-01 -3.693 0.000221 \*\*\*

jobmanagement -1.653e-01 7.329e-02 -2.255 0.024130 \*

jobretired 2.524e-01 9.722e-02 2.596 0.009436 \*\*

jobself-employed -2.983e-01 1.120e-01 -2.664 0.007726 \*\*

jobservices -2.238e-01 8.406e-02 -2.662 0.007763 \*\*

jobstudent 3.821e-01 1.090e-01 3.505 0.000457 \*\*\*

jobtechnician -1.760e-01 6.893e-02 -2.554 0.010664 \*

jobunemployed -1.767e-01 1.116e-01 -1.583 0.113456

jobunknown -3.133e-01 2.335e-01 -1.342 0.179656

maritalmarried -1.795e-01 5.891e-02 -3.046 0.002318 \*\*

maritalsingle 9.250e-02 6.726e-02 1.375 0.169066

educationsecondary 1.835e-01 6.479e-02 2.833 0.004618 \*\*

educationtertiary 3.789e-01 7.532e-02 5.031 4.88e-07 \*\*\*

educationunknown 2.505e-01 1.039e-01 2.411 0.015915 \*

defaultyes -1.668e-02 1.628e-01 -0.102 0.918407

balance 1.283e-05 5.148e-06 2.493 0.012651 \*

housingyes -6.754e-01 4.387e-02 -15.395 < 2e-16 \*\*\*

loanyes -4.254e-01 5.999e-02 -7.091 1.33e-12 \*\*\*

contacttelephone -1.634e-01 7.519e-02 -2.173 0.029784 \*

contactunknown -1.623e+00 7.317e-02 -22.184 < 2e-16 \*\*\*

day 9.969e-03 2.497e-03 3.993 6.53e-05 \*\*\*

monthaug -6.939e-01 7.847e-02 -8.842 < 2e-16 \*\*\*

monthdec 6.911e-01 1.767e-01 3.912 9.17e-05 \*\*\*

monthfeb -1.473e-01 8.941e-02 -1.648 0.099427 .

monthjan -1.262e+00 1.217e-01 -10.367 < 2e-16 \*\*\*

monthjul -8.308e-01 7.740e-02 -10.733 < 2e-16 \*\*\*

monthjun 4.536e-01 9.367e-02 4.843 1.28e-06 \*\*\*

monthmar 1.590e+00 1.199e-01 13.265 < 2e-16 \*\*\*

monthmay -3.991e-01 7.229e-02 -5.521 3.36e-08 \*\*\*

monthnov -8.734e-01 8.441e-02 -10.347 < 2e-16 \*\*\*

monthoct 8.814e-01 1.080e-01 8.159 3.37e-16 \*\*\*

monthsep 8.741e-01 1.195e-01 7.314 2.58e-13 \*\*\*

duration 4.194e-03 6.453e-05 64.986 < 2e-16 \*\*\*

campaign -9.078e-02 1.014e-02 -8.955 < 2e-16 \*\*\*

pdays -1.027e-04 3.061e-04 -0.335 0.737268

previous 1.015e-02 6.503e-03 1.561 0.118476

poutcomeother 2.035e-01 8.986e-02 2.265 0.023543 \*

poutcomesuccess 2.291e+00 8.235e-02 27.821 < 2e-16 \*\*\*

poutcomeunknown -9.179e-02 9.347e-02 -0.982 0.326093

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 32631 on 45210 degrees of freedom

Residual deviance: 21562 on 45168 degrees of freedom

AIC: 21648

Number of Fisher Scoring iterations: 6

> # Confusion matrix and considering the threshold value as 0.5

> confusion<-table(prob>0.5,bank.full$y)

> confusion

no yes

FALSE 38940 3456

TRUE 982 1833

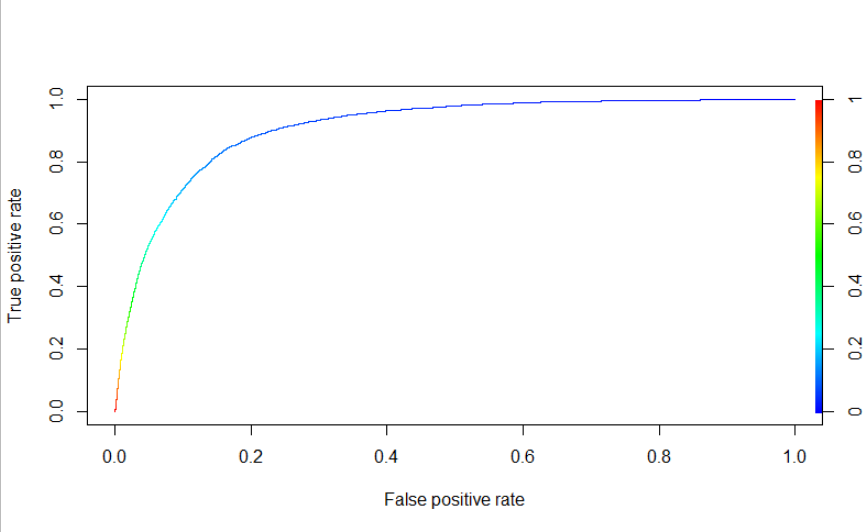
> # Model Accuracy

> Accuracy<-sum(diag(confusion)/sum(confusion))

> Accuracy

[1] 0.901838

**Plots :**



**Inference :**

Getting good Accuracy in Model.