Implement a KNN model to classify the animals in to categorie

**Ans :**

**R Code :**

## KNN

########## Zoo Data Set #########

Zoo\_r <- read.csv('D:\\Data Science\\Excelr\\Assignments\\Assignment\\KNN\\Zoo\_r.csv')

# table of diagnosis

table(Zoo\_r$type)

# table or proportions with more informative labels

round(prop.table(table(Zoo\_r$type)) \* 100, digits = 1)

# create normalization function

normalize <- function(x) {

return ((x - min(x)) / (max(x) - min(x)))

}

# normalize the wbcd data

zoo\_n <- as.data.frame(lapply(Zoo\_r[2:17], normalize))

zoo\_nl<-cbind(zoo\_n,Zoo\_r$type)

# create training and test data

zoo\_train <- zoo\_n[1:66, ]

zoo\_test <- zoo\_n[67:101, ]

# create labels for training and test data

zoo\_train\_labels <- Zoo\_r[1:66, 18]

zoo\_test\_labels <- Zoo\_r[67:101, 18]

#---- Training a model on the data ----

# load the "class" library

library(class)

zoo\_test\_pred <- knn(train = zoo\_train, test = zoo\_test,

cl = zoo\_train\_labels, k=20)

##--------Evaluating model performance ----

# load the "gmodels" library

library(gmodels)

# Create the cross tabulation of predicted vs. actual

CrossTable(x = zoo\_test\_labels, y = zoo\_test\_pred,

prop.chisq=FALSE,prop.c = FALSE, prop.r = FALSE)

#############################################################

## Improving model performance ----

# use the scale() function to z-score standardize a data frame

zoo\_z <- as.data.frame(scale(Zoo\_r[2:17]))

# create training and test datasets

zoo\_train <- zoo\_z[1:66, ]

zoo\_test <- zoo\_z[67:101, ]

# re-classify test cases

zoo\_test\_pred <- knn(train = zoo\_train, test = zoo\_test,

cl = zoo\_train\_labels, k=21)

# Create the cross tabulation of predicted vs. actual

CrossTable(x = zoo\_test\_labels, y = zoo\_test\_pred,

prop.chisq=FALSE,prop.c = FALSE, prop.r = FALSE)

# try several different values of k

zoo\_train <- zoo\_n[1:66, ]

zoo\_test <- zoo\_n[67:101, ]

zoo\_test\_pred <- knn(train = zoo\_train, test = zoo\_test, cl = zoo\_train\_labels, k=1)

CrossTable(x = zoo\_test\_labels, y = zoo\_test\_pred, prop.chisq=FALSE,prop.c = FALSE, prop.r = FALSE)

zoo\_test\_pred <- knn(train = zoo\_train, test = zoo\_test, cl = zoo\_train\_labels, k=4)

CrossTable(x = zoo\_test\_labels, y = zoo\_test\_pred, prop.chisq=FALSE,prop.c = FALSE, prop.r = FALSE)

zoo\_test\_pred <- knn(train = zoo\_train, test = zoo\_test, cl = zoo\_train\_labels, k=5)

CrossTable(x = zoo\_test\_labels, y = zoo\_test\_pred, prop.chisq=FALSE,prop.c = FALSE, prop.r = FALSE)

zoo\_test\_pred <- knn(train = zoo\_train, test = zoo\_test, cl = zoo\_train\_labels, k=11)

CrossTable(x = zoo\_test\_labels, y = zoo\_test\_pred, prop.chisq=FALSE,prop.c = FALSE, prop.r = FALSE)

zoo\_test\_pred <- knn(train = zoo\_train, test = zoo\_test, cl = zoo\_train\_labels, k=15)

CrossTable(x = zoo\_test\_labels, y = zoo\_test\_pred, prop.chisq=FALSE,prop.c = FALSE, prop.r = FALSE)

zoo\_test\_pred <- knn(train = zoo\_train, test = zoo\_test, cl = zoo\_train\_labels, k=21)

CrossTable(x = zoo\_test\_labels, y = zoo\_test\_pred, prop.chisq=FALSE,prop.c = FALSE, prop.r = FALSE)

zoo\_test\_pred <- knn(train = zoo\_train, test = zoo\_test, cl = zoo\_train\_labels, k=27)

CrossTable(x = zoo\_test\_labels, y = zoo\_test\_pred, prop.chisq=FALSE,prop.c = FALSE, prop.r = FALSE)

**Results :**

> zoo\_test\_pred <- knn(train = zoo\_train, test = zoo\_test,

+ cl = zoo\_train\_labels, k=20)

> ##--------Evaluating model performance ----

> # load the "gmodels" library

> library(gmodels)

> # Create the cross tabulation of predicted vs. actual

> CrossTable(x = zoo\_test\_labels, y = zoo\_test\_pred,

+ prop.chisq=FALSE,prop.c = FALSE, prop.r = FALSE)

Cell Contents

|-------------------------|

| N |

| N / Table Total |

|-------------------------|

Total Observations in Table: 35

| zoo\_test\_pred

zoo\_test\_labels | 1 | 2 | 4 | 7 | Row Total |

----------------|-----------|-----------|-----------|-----------|-----------|

1 | 13 | 0 | 0 | 0 | 13 |

| 0.371 | 0.000 | 0.000 | 0.000 | |

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2 | 0 | 7 | 0 | 0 | 7 |

| 0.000 | 0.200 | 0.000 | 0.000 | |

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3 | 1 | 1 | 0 | 0 | 2 |

| 0.029 | 0.029 | 0.000 | 0.000 | |

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4 | 0 | 0 | 5 | 0 | 5 |

| 0.000 | 0.000 | 0.143 | 0.000 | |

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5 | 0 | 1 | 1 | 0 | 2 |

| 0.000 | 0.029 | 0.029 | 0.000 | |

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6 | 0 | 3 | 0 | 0 | 3 |

| 0.000 | 0.086 | 0.000 | 0.000 | |

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7 | 0 | 2 | 0 | 1 | 3 |

| 0.000 | 0.057 | 0.000 | 0.029 | |

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Column Total | 14 | 14 | 6 | 1 | 35 |

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> #############################################################

> ## Improving model performance ----

> # use the scale() function to z-score standardize a data frame

> zoo\_z <- as.data.frame(scale(Zoo\_r[2:17]))

> # create training and test datasets

> zoo\_train <- zoo\_z[1:66, ]

> zoo\_test <- zoo\_z[67:101, ]

> # re-classify test cases

> zoo\_test\_pred <- knn(train = zoo\_train, test = zoo\_test,

+ cl = zoo\_train\_labels, k=21)

> # Create the cross tabulation of predicted vs. actual

> CrossTable(x = zoo\_test\_labels, y = zoo\_test\_pred,

+ prop.chisq=FALSE,prop.c = FALSE, prop.r = FALSE)

Cell Contents

|-------------------------|

| N |

| N / Table Total |

|-------------------------|

Total Observations in Table: 35

| zoo\_test\_pred

zoo\_test\_labels | 1 | 2 | 4 | 7 | Row Total |

----------------|-----------|-----------|-----------|-----------|-----------|

1 | 13 | 0 | 0 | 0 | 13 |

| 0.371 | 0.000 | 0.000 | 0.000 | |

----------------|-----------|-----------|-----------|-----------|-----------|

2 | 0 | 7 | 0 | 0 | 7 |

| 0.000 | 0.200 | 0.000 | 0.000 | |

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3 | 2 | 0 | 0 | 0 | 2 |

| 0.057 | 0.000 | 0.000 | 0.000 | |

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4 | 1 | 0 | 4 | 0 | 5 |

| 0.029 | 0.000 | 0.114 | 0.000 | |

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5 | 2 | 0 | 0 | 0 | 2 |

| 0.057 | 0.000 | 0.000 | 0.000 | |

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6 | 0 | 2 | 0 | 1 | 3 |

| 0.000 | 0.057 | 0.000 | 0.029 | |

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7 | 0 | 2 | 0 | 1 | 3 |

| 0.000 | 0.057 | 0.000 | 0.029 | |

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Column Total | 18 | 11 | 4 | 2 | 35 |

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> # try several different values of k

> zoo\_train <- zoo\_n[1:66, ]

> zoo\_test <- zoo\_n[67:101, ]

> zoo\_test\_pred <- knn(train = zoo\_train, test = zoo\_test, cl = zoo\_train\_labels, k=1)

> CrossTable(x = zoo\_test\_labels, y = zoo\_test\_pred, prop.chisq=FALSE,prop.c = FALSE, prop.r = FALSE)

Cell Contents

|-------------------------|

| N |

| N / Table Total |

|-------------------------|

Total Observations in Table: 35

| zoo\_test\_pred

zoo\_test\_labels | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Row Total |

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1 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |

| 0.371 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |

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2 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 7 |

| 0.000 | 0.200 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |

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3 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 |

| 0.000 | 0.029 | 0.029 | 0.000 | 0.000 | 0.000 | 0.000 | |

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4 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 5 |

| 0.000 | 0.000 | 0.000 | 0.143 | 0.000 | 0.000 | 0.000 | |

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5 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 |

| 0.000 | 0.000 | 0.000 | 0.000 | 0.057 | 0.000 | 0.000 | |

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6 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 |

| 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.086 | 0.000 | |

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7 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 3 |

| 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.057 | 0.029 | |

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Column Total | 13 | 8 | 1 | 5 | 2 | 5 | 1 | 35 |

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> zoo\_test\_pred <- knn(train = zoo\_train, test = zoo\_test, cl = zoo\_train\_labels, k=4)

> CrossTable(x = zoo\_test\_labels, y = zoo\_test\_pred, prop.chisq=FALSE,prop.c = FALSE, prop.r = FALSE)

Cell Contents

|-------------------------|

| N |

| N / Table Total |

|-------------------------|

Total Observations in Table: 35

| zoo\_test\_pred

zoo\_test\_labels | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Row Total |

----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|

1 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |

| 0.371 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |

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2 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 7 |

| 0.000 | 0.200 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |

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3 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 |

| 0.000 | 0.029 | 0.029 | 0.000 | 0.000 | 0.000 | 0.000 | |

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4 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 5 |

| 0.000 | 0.000 | 0.000 | 0.143 | 0.000 | 0.000 | 0.000 | |

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5 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 |

| 0.000 | 0.000 | 0.000 | 0.029 | 0.029 | 0.000 | 0.000 | |

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6 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 |

| 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.086 | 0.000 | |

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7 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 3 |

| 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.057 | 0.029 | |

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Column Total | 13 | 8 | 1 | 6 | 1 | 5 | 1 | 35 |

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> zoo\_test\_pred <- knn(train = zoo\_train, test = zoo\_test, cl = zoo\_train\_labels, k=5)

> CrossTable(x = zoo\_test\_labels, y = zoo\_test\_pred, prop.chisq=FALSE,prop.c = FALSE, prop.r = FALSE)

Cell Contents

|-------------------------|

| N |

| N / Table Total |

|-------------------------|

Total Observations in Table: 35

| zoo\_test\_pred

zoo\_test\_labels | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Row Total |

----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|

1 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |

| 0.371 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |

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2 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 7 |

| 0.000 | 0.200 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |

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3 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 |

| 0.000 | 0.029 | 0.029 | 0.000 | 0.000 | 0.000 | 0.000 | |

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4 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 5 |

| 0.000 | 0.000 | 0.000 | 0.143 | 0.000 | 0.000 | 0.000 | |

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5 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 |

| 0.000 | 0.000 | 0.000 | 0.029 | 0.029 | 0.000 | 0.000 | |

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6 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 |

| 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.086 | 0.000 | |

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7 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 3 |

| 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.057 | 0.029 | |

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Column Total | 13 | 8 | 1 | 6 | 1 | 5 | 1 | 35 |

----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|

> zoo\_test\_pred <- knn(train = zoo\_train, test = zoo\_test, cl = zoo\_train\_labels, k=11)

> CrossTable(x = zoo\_test\_labels, y = zoo\_test\_pred, prop.chisq=FALSE,prop.c = FALSE, prop.r = FALSE)

Cell Contents

|-------------------------|

| N |

| N / Table Total |

|-------------------------|

Total Observations in Table: 35

| zoo\_test\_pred

zoo\_test\_labels | 1 | 2 | 4 | 6 | 7 | Row Total |

----------------|-----------|-----------|-----------|-----------|-----------|-----------|

1 | 13 | 0 | 0 | 0 | 0 | 13 |

| 0.371 | 0.000 | 0.000 | 0.000 | 0.000 | |

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2 | 0 | 7 | 0 | 0 | 0 | 7 |

| 0.000 | 0.200 | 0.000 | 0.000 | 0.000 | |

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3 | 1 | 0 | 1 | 0 | 0 | 2 |

| 0.029 | 0.000 | 0.029 | 0.000 | 0.000 | |

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4 | 0 | 0 | 5 | 0 | 0 | 5 |

| 0.000 | 0.000 | 0.143 | 0.000 | 0.000 | |

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5 | 0 | 0 | 2 | 0 | 0 | 2 |

| 0.000 | 0.000 | 0.057 | 0.000 | 0.000 | |

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6 | 0 | 0 | 0 | 2 | 1 | 3 |

| 0.000 | 0.000 | 0.000 | 0.057 | 0.029 | |

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7 | 0 | 0 | 0 | 0 | 3 | 3 |

| 0.000 | 0.000 | 0.000 | 0.000 | 0.086 | |

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Column Total | 14 | 7 | 8 | 2 | 4 | 35 |

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> zoo\_test\_pred <- knn(train = zoo\_train, test = zoo\_test, cl = zoo\_train\_labels, k=15)

> CrossTable(x = zoo\_test\_labels, y = zoo\_test\_pred, prop.chisq=FALSE,prop.c = FALSE, prop.r = FALSE)

Cell Contents

|-------------------------|

| N |

| N / Table Total |

|-------------------------|

Total Observations in Table: 35

| zoo\_test\_pred

zoo\_test\_labels | 1 | 2 | 4 | 7 | Row Total |

----------------|-----------|-----------|-----------|-----------|-----------|

1 | 13 | 0 | 0 | 0 | 13 |

| 0.371 | 0.000 | 0.000 | 0.000 | |

----------------|-----------|-----------|-----------|-----------|-----------|

2 | 0 | 7 | 0 | 0 | 7 |

| 0.000 | 0.200 | 0.000 | 0.000 | |

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3 | 2 | 0 | 0 | 0 | 2 |

| 0.057 | 0.000 | 0.000 | 0.000 | |

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4 | 0 | 0 | 5 | 0 | 5 |

| 0.000 | 0.000 | 0.143 | 0.000 | |

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5 | 0 | 0 | 2 | 0 | 2 |

| 0.000 | 0.000 | 0.057 | 0.000 | |

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6 | 0 | 2 | 0 | 1 | 3 |

| 0.000 | 0.057 | 0.000 | 0.029 | |

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7 | 0 | 0 | 0 | 3 | 3 |

| 0.000 | 0.000 | 0.000 | 0.086 | |

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Column Total | 15 | 9 | 7 | 4 | 35 |

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> zoo\_test\_pred <- knn(train = zoo\_train, test = zoo\_test, cl = zoo\_train\_labels, k=21)

> CrossTable(x = zoo\_test\_labels, y = zoo\_test\_pred, prop.chisq=FALSE,prop.c = FALSE, prop.r = FALSE)

Cell Contents

|-------------------------|

| N |

| N / Table Total |

|-------------------------|

Total Observations in Table: 35

| zoo\_test\_pred

zoo\_test\_labels | 1 | 2 | 4 | 7 | Row Total |

----------------|-----------|-----------|-----------|-----------|-----------|

1 | 13 | 0 | 0 | 0 | 13 |

| 0.371 | 0.000 | 0.000 | 0.000 | |

----------------|-----------|-----------|-----------|-----------|-----------|

2 | 0 | 7 | 0 | 0 | 7 |

| 0.000 | 0.200 | 0.000 | 0.000 | |

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3 | 1 | 1 | 0 | 0 | 2 |

| 0.029 | 0.029 | 0.000 | 0.000 | |

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4 | 0 | 0 | 5 | 0 | 5 |

| 0.000 | 0.000 | 0.143 | 0.000 | |

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5 | 0 | 1 | 1 | 0 | 2 |

| 0.000 | 0.029 | 0.029 | 0.000 | |

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6 | 0 | 3 | 0 | 0 | 3 |

| 0.000 | 0.086 | 0.000 | 0.000 | |

----------------|-----------|-----------|-----------|-----------|-----------|

7 | 0 | 2 | 0 | 1 | 3 |

| 0.000 | 0.057 | 0.000 | 0.029 | |

----------------|-----------|-----------|-----------|-----------|-----------|

Column Total | 14 | 14 | 6 | 1 | 35 |

----------------|-----------|-----------|-----------|-----------|-----------|

> zoo\_test\_pred <- knn(train = zoo\_train, test = zoo\_test, cl = zoo\_train\_labels, k=27)

> CrossTable(x = zoo\_test\_labels, y = zoo\_test\_pred, prop.chisq=FALSE,prop.c = FALSE, prop.r = FALSE)

Cell Contents

|-------------------------|

| N |

| N / Table Total |

|-------------------------|

Total Observations in Table: 35

| zoo\_test\_pred

zoo\_test\_labels | 1 | 2 | 4 | 7 | Row Total |

----------------|-----------|-----------|-----------|-----------|-----------|

1 | 13 | 0 | 0 | 0 | 13 |

| 0.371 | 0.000 | 0.000 | 0.000 | |

----------------|-----------|-----------|-----------|-----------|-----------|

2 | 0 | 7 | 0 | 0 | 7 |

| 0.000 | 0.200 | 0.000 | 0.000 | |

----------------|-----------|-----------|-----------|-----------|-----------|

3 | 2 | 0 | 0 | 0 | 2 |

| 0.057 | 0.000 | 0.000 | 0.000 | |

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4 | 2 | 0 | 3 | 0 | 5 |

| 0.057 | 0.000 | 0.086 | 0.000 | |

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5 | 0 | 1 | 1 | 0 | 2 |

| 0.000 | 0.029 | 0.029 | 0.000 | |

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6 | 0 | 3 | 0 | 0 | 3 |

| 0.000 | 0.086 | 0.000 | 0.000 | |

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7 | 0 | 2 | 0 | 1 | 3 |

| 0.000 | 0.057 | 0.000 | 0.029 | |

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Column Total | 17 | 13 | 4 | 1 | 35 |

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**Inference :**

We have got more accuracy when k=4.