EDA

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It will clear all the plots, the console and the workspace. It also sets the overall format for numbers.

PART 1:

1

Statement: "We have more customers than before, but our new customers are streaming less than before."

There are some questions raised for data analysis which are mentioned below.
1. Who are the new customers? What are the age categories and gender?
2. What is the most popular streaming content in the system?
3. When compared to regular consumers, how do new customers stream on average?
4. Was streaming content free before and now paid or partial pay for premium content?
5. Is a decline in streaming activity specific to new customers, or is it a broader trend across the entire customer base?

2

Hint, Site A had 28 downloads on the first day, 29 on the second and so on

```
site_A_DVH <- c(28, 29, 31, 28, 30, 30, 30, 32, 28, 33)
site_B_DVH <- c(23, 19, 23, 33, 32, 27, 20, 24, 42, 32)
site_C_DVH <- c(27, 26, 28, 25, 27, 27, 30, 30, 28, 26)

cat("Downoads of Site A: ",site_A_DVH,'\n')

## Downoads of Site A:  28 29 31 28 30 30 30 32 28 33

cat("Downoads of Site B: ",site_B_DVH,"\n")

## Downoads of Site B:  23 19 23 33 32 27 20 24 42 32

cat("Downoads of Site C: ",site_C_DVH,"\n")

## Downoads of Site C:  27 26 28 25 27 27 30 30 28 26
```

A). Which site has the least downloads on a typical day?

```
Least_dwnld_site_A_DVH <- min(site_A_DVH)
cat("The Least Download of site A is: ",Least_dwnld_site_A_DVH,"\n")

## The Least Download of site A is:  28
```

```
Days_site_A_DVH <- which(site_A_DVH == Least_dwnld_site_A_DVH)
cat("Downloads of site A were low on this days: ",Days_site_A_DVH,"\n\n")

## Downloads of site A were low on this days:  1 4 9

Least_dwnld_site_B_DVH <- min(site_B_DVH)
cat("The Least Download of site B is: ",Least_dwnld_site_B_DVH,"\n")

## The Least Download of site B is:  19

Days_site_B_DVH <- which(site_B_DVH == Least_dwnld_site_B_DVH)
cat("Downloads of site B were low on this day: ",Days_site_B_DVH,"\n\n")

## Downloads of site B were low on this day:  2

Least_dwnld_site_C_DVH <- min(site_C_DVH)
cat("The Least Download of site C is: ",Least_dwnld_site_C_DVH,"\n")

## The Least Download of site C is:  25

Days_site_C_DVH <- which(site_C_DVH == Least_dwnld_site_C_DVH)
cat("Downloads of site C were low on this day: ",Days_site_C_DVH,"\n\n")

## Downloads of site C were low on this day:  4
```

Interpretation
This problem is solved by finding minimum value of each site data set of site A, site B, site C.
Site A: 28
Site B: 19
Site C: 25
Therefore, Site B has least downloads on typical day with 19 downloads on day 2.

B). Which site has the most inconsistent usage?

```
cat("CV of Site A: ",sd(site_A_DVH)/mean(site_A_DVH),"\n")

## CV of Site A:  0.05782075

cat("CV of Site B: ",sd(site_B_DVH)/mean(site_B_DVH),"\n")

## CV of Site B:  0.2606765

cat("Cv of Site C: ",sd(site_C_DVH)/mean(site_C_DVH),"\n")

## Cv of Site C:  0.06009289
```

Interpretation
To check the most inconsistent usage of the site, we need to check the Coefficient of Variation of each site. The high Coefficient of Variation of the site is considered the most inconsistent site usage.

CV = standard Deviation/mean

The above output clearly shows that Site B has a high Coefficient of Variation. Hence Site B has the most inconsistent usage.

PART 2:

1. Basic Manipulation

1. Read in the text file and change to a data frame

```
data_DVH <- read.table("PROG8430-23W-Assign01.txt",sep=",",header = TRUE)
head(data_DVH)
```

```
##        Manufacturer Server        DC   SMBR  SMBT Conn
## 1              Lled MG9696  Waterloo 102479 43473 6625
## 2            Ovonel RX8838  Waterloo 103678 62534 7580
## 3              Lled MB3406 Cambridge 102003 35916 5957
## 4              Lled MB3406 Kitchener  98889 40245 6120
## 5 Highway-Passenger DF6726 Cambridge 104907 25422 5839
## 6 Highway-Passenger DF6726 Kitchener 102659 53168 7076
```

Interpretation

Text file shall be read with ‘read.table’ function in R.
Text file is comma separated hence, sep=” ,” is used to identify a rows and column.
header=TRUE is used due to the text file is generated with header in first line.
By default, 6 records are displayed with ‘head’ function as shown above.
There are total 6 columns with manufacturer, server, dc of Character data type and smbr, smbt, conn of integer datatype.

2. Append your initials to all variables in the data frame.

```
#Append data_DVH initials to column names
colnames(data_DVH) <- paste(colnames(data_DVH), "DVH", sep = "_")
head(data_DVH,10)
```

```
##     Manufacturer_DVH Server_DVH    DC_DVH SMBR_DVH SMBT_DVH Conn_DVH
## 1               Lled     MG9696  Waterloo   102479    43473     6625
## 2             Ovonel     RX8838  Waterloo   103678    62534     7580
## 3               Lled     MB3406 Cambridge   102003    35916     5957
## 4               Lled     MB3406 Kitchener    98889    40245     6120
## 5  Highway-Passenger     DF6726 Cambridge   104907    25422     5839
## 6  Highway-Passenger     DF6726 Kitchener   102659    53168     7076
## 7  Highway-Passenger     DF6726    Elmira   106037    59596     7258
## 8               Lled     MB3406  Waterloo   101077    64132     7391
## 9               Lled     MG9696 Cambridge   101662    42928     6608
## 10            Ovonel     RQ8547 Kitchener    90592    61989     6671
```

Interpretation

Every column are replaced with initials.
Manufacturer –> Manufacturer_DH
Server –> Server_DH
DC –> DC_DH

SMBR –> SMBR_DH
SMBT –> SMBT_DH
Conn –> Conn_DH

3. Change each character variable to a factor variable.

```
data_DVH$Manufacturer_DVH <- as.factor(data_DVH$Manufacturer_DVH)
data_DVH$Server_DVH <- as.factor(data_DVH$Server_DVH)
data_DVH$DC_DVH <- as.factor(data_DVH$DC_DVH)

head(data_DVH,10)

##     Manufacturer_DVH Server_DVH    DC_DVH SMBR_DVH SMBT_DVH Conn_DVH
## 1               Lled     MG9696  Waterloo   102479    43473     6625
## 2             Ovonel     RX8838  Waterloo   103678    62534     7580
## 3               Lled     MB3406 Cambridge   102003    35916     5957
## 4               Lled     MB3406 Kitchener    98889    40245     6120
## 5  Highway-Passenger     DF6726 Cambridge   104907    25422     5839
## 6  Highway-Passenger     DF6726 Kitchener   102659    53168     7076
## 7  Highway-Passenger     DF6726    Elmira   106037    59596     7258
## 8               Lled     MB3406  Waterloo   101077    64132     7391
## 9               Lled     MG9696 Cambridge   101662    42928     6608
## 10            Ovonel     RQ8547 Kitchener    90592    61989     6671
```

Interpretation

as.factor(variable): used to change data type into factor value.
From above change of char variables to factor variables.
Character type (chr) changed to –> (fctr)

4. What are the dimensions of the dataset (rows and columns)?

```
dim(data_DVH)

## [1] 90000     6
```

Interpretation

In order to find number of rows and column in dataset, dim() function is used.
There are 90000 row and 6 column are present in table.

2. Summarizing Data

1. Means and Standard Deviations

a. Calculate the mean and standard deviation for Server Message Blocks Received.

```
mean_SMBR_DVH <- mean(data_DVH$SMBR_DVH)
print(paste0("Mean Of Server Message Blocks Received: ",mean_SMBR_DVH))

## [1] "Mean Of Server Message Blocks Received: 100017.478544444"

sd_SMBR_DVH <- sd(data_DVH$SMBR_DVH)
print(paste0("Standard Deviation Of Server Message Blocks Received: 
",sd_SMBR_DVH))
```

```
## [1] "Standard Deviation Of Server Message Blocks Received:
10002.4583223398"
```

Interpretation
mean() function is used to calculate average of values.
sd() function is used to calculate standard deviation of values.
MEAN of SMBR: 100017.18
SD of SMBR: 10002.46

b. Use the results above to calculate the coefficient of variation (rounded to 3 decimal places).

```
cv_SMBR_DVH <- sd_SMBR_DVH/mean_SMBR_DVH
cv_SMBR_DVH <- round(cv_SMBR_DVH,3)
print(paste0("coefficient of Variation Of Server Message Blocks Received:
",cv_SMBR_DVH))

## [1] "coefficient of Variation Of Server Message Blocks Received: 0.1"
```

Interpretation
Coefficient Variation is calculated by dividing mean of SMBR from standard deviation of SMBR.Value of mean and sd is taken from previous answer.
round() function returns floating point number is rounded to desire number. Here answer is rounded with 3 as per instruction.
CV of SMBR: 0.1

c. Calculate the mean and standard deviation for Serve Message Blocks Transmitted.

```
mean_SMBT_DVH <- mean(data_DVH$SMBT_DVH)
print(paste0("Mean Of Server Message Blocks Trasmitted: ",mean_SMBT_DVH))

## [1] "Mean Of Server Message Blocks Trasmitted: 49966.0049333333"

sd_SMBT_DVH <- sd(data_DVH$SMBT_DVH)
print(paste0("Standard Deviation Of Server Message Blocks Transmitted:
",sd_SMBT_DVH))

## [1] "Standard Deviation Of Server Message Blocks Transmitted:
10024.435354702"
```

Interpretation
MEAN of SMBT: 49966.0049
SD of SMBT: 10024.4353

d. Also calculate the coefficient of variation (rounded to 3 decimal places).

```
cv_SMBT_DVH <- round(sd_SMBT_DVH/mean_SMBT_DVH,3)
print(paste0("coefficient of Variation Of Server Message Blocks Transmitted:
",cv_SMBT_DVH))

## [1] "coefficient of Variation Of Server Message Blocks Transmitted: 0.201"
```

Interpretation
CV of SMBT: 0.201

e. Does the SMBT or SMBR have more variation?

Interpretation
Yes, SMBT(0.201) has more variation compared to SMBR(0.1). from the above results of SMBT and SMBR.

2. Calculate the 45th percentile of the number of Server Message Blocks Transmitted. This calculation should be rounded to the nearest whole number (no decimal places).

```
percentile45_smbt_DVH <- quantile(data_DVH$SMBT_DVH, 0.45)
print(paste0("The 45th percentile of the number of Server Message Blocks
Transmitted: ",round(percentile45_smbt_DVH)))

## [1] "The 45th percentile of the number of Server Message Blocks
Transmitted: 48741"
```

Interpretation
quantile() is used to find 45th percentile of smbt.
The 45th percentile of the number of Server Message Blocks Transmitted: 48741

####2. Organizing Data ######1. Summary Table
a. Create a table showing the average Server Message Blocks Transmitted by Manufacturer. This should be rounded to two decimal places.

```
ServerManufacture_DVH <- aggregate(data_DVH$SMBT_DVH,
                        by=list(data_DVH$Manufacturer_DVH),
                        FUN=mean,
                        na.rm=TRUE)
colnames(ServerManufacture_DVH) <- c("Manufacture","Average SMBT")
ServerManufacture_DVH

##         Manufacture Average SMBT
## 1 Highway-Passenger     49916.14
## 2              Lled     50008.12
## 3            Ovonel     49973.76
```

Interpretation
aggregate() function is used with appropriate arguments to find average smbt by manufacture. where, fun=mean represents average of smbt, by=list(data_DVH$Manufacturer_DVH) represents average by manufacture.

b. Which Manufacturer's Servers have, on average, transmitted the most server message blocks? Which manufacturer is it?

Interpretation
From the previous result, Lled has most transmitted server message which is 50008.12.

2. Cross Tabulation

a. Create a table counting all Servers by Data Centre

```
ServerDC_DVH <- table(data_DVH$Server_DVH,data_DVH$DC_DVH)
ServerDC_DVH

##
##          Bridgeport Cambridge Elmira Kitchener Waterloo
##   DF6726       2971      4385   5869      7363     8827
##   DJ3756         60        87    118       157      163
##   MB3406       2188      3433   4534      5634     6882
##   MG9696        719      1128   1435      1810     2237
##   RQ8547       2082      3184   4161      5248     6421
##   RX8838        925      1365   1734      2191     2689
```

b. Change the table to show the percentage of each Server in each Data Centre . This should be rounded to three decimal places.

Note: 1 is set as margin parameter
1 –> value divide by row sum 2 –> Value divide by Column sum

```
Percent_ServerDC_DVH <- round(prop.table(ServerDC_DVH,2),3)
Percent_ServerDC_DVH

##
##          Bridgeport Cambridge Elmira Kitchener Waterloo
##   DF6726      0.332     0.323  0.329     0.329    0.324
##   DJ3756      0.007     0.006  0.007     0.007    0.006
##   MB3406      0.245     0.253  0.254     0.251    0.253
##   MG9696      0.080     0.083  0.080     0.081    0.082
##   RQ8547      0.233     0.234  0.233     0.234    0.236
##   RX8838      0.103     0.101  0.097     0.098    0.099
```

c. What percentage of servers at Elmira are MG9696?

```
Percent_ServerDC_DVH[,'Elmira']['MG9696']

## MG9696
##   0.08
```

Interpretation
Percentage of Server MG9696 at Elmira is 8%.

3. Bar Plot

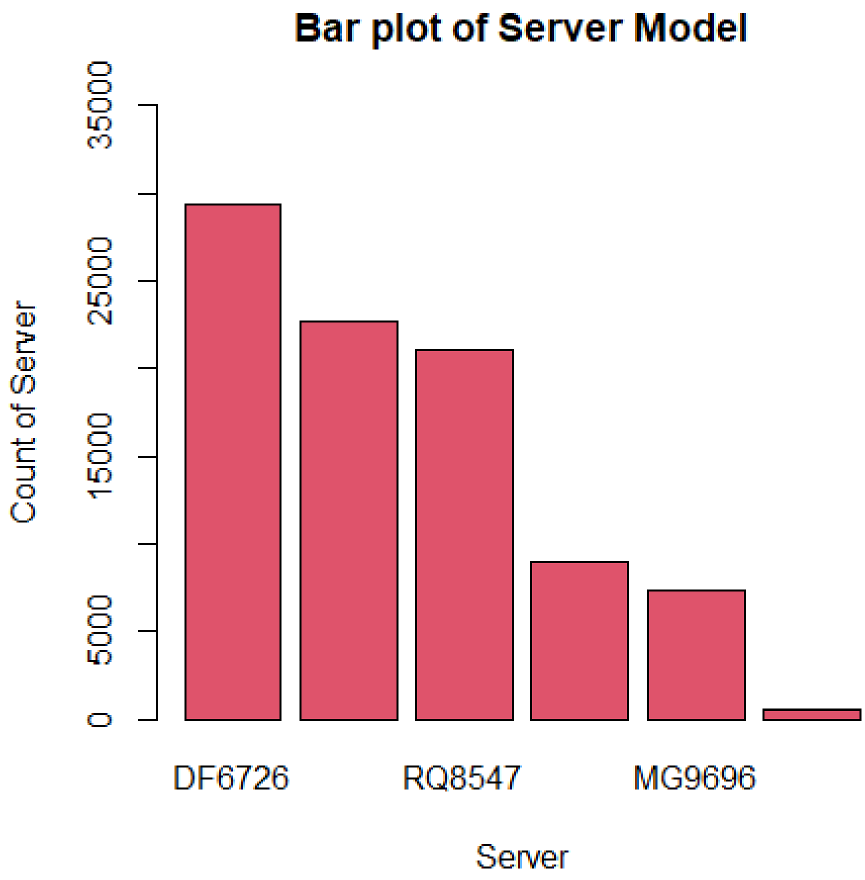
a. Create a bar plot of count of Servers Models.

b. The plot should be:
   i. Rank ordered by highest count of Server Model.

   ii. Properly labeled (title, x-axis, etc)

iii. The bars should have a different colour than the one shown in class.

```
Server_DVH <- table(data_DVH$Server_DVH)
Server_DVH <- Server_DVH[order(Server_DVH,decreasing = TRUE)]
barplot(Server_DVH,
        main="Bar plot of Server Model",
        ylab="Count of Server",
        xlab = "Server",
        col = 2,
        ylim =c(0,35000)
        )
```



Interpretation
From above Bar chart, count of server varies from 0 to 35000. All the server are displayed as ascending order. There are total 6 servers available in bar char with Red color.

c. Based on the bar plot, (approximately) how many of Server RX8838 are there?

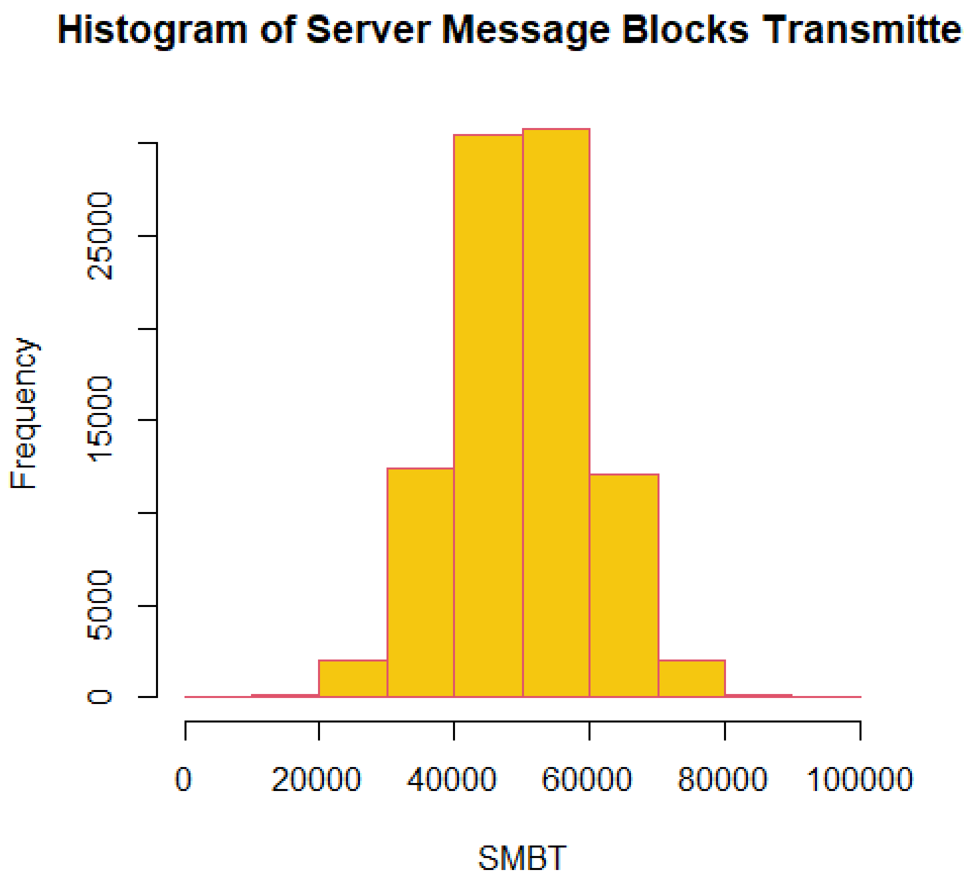
Interpretation
Based on the Bar Plot, there are around 9000 RX8838 server shown.

4. Histogram

a. Create a histogram of Server Message Blocks Transmitted.

b. The plot should be properly labeled and a unique colour and have 10 breaks.

```
hist(data_DVH$SMBT_DVH,
     col=7,
     border = 2,
     main="Histogram of Server Message Blocks Transmitted",
     xlab = "SMBT",
     breaks = 10
          )
```



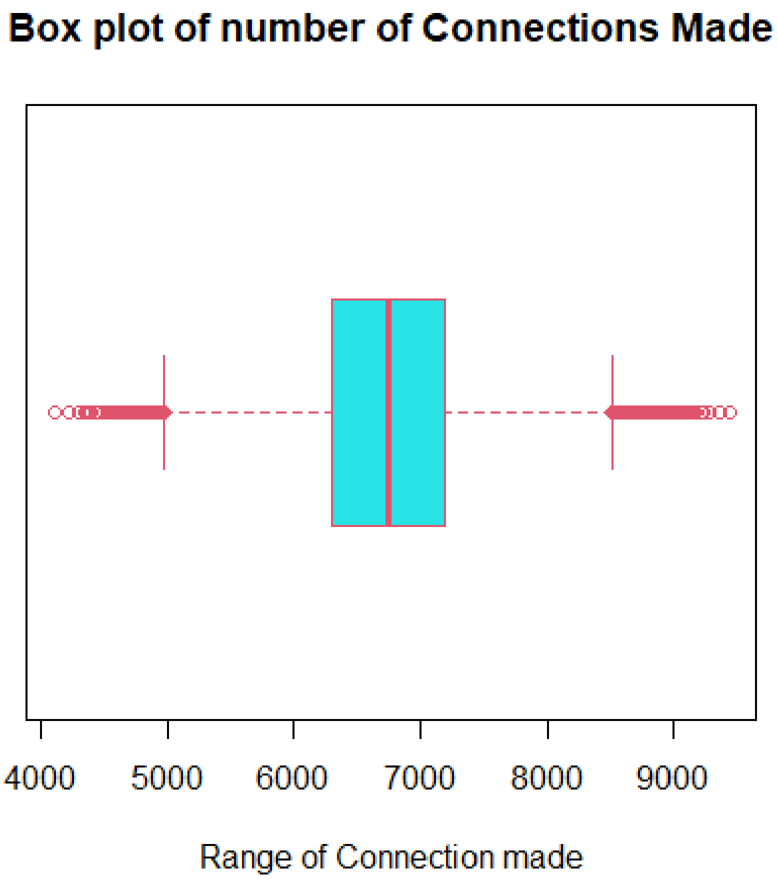
c. Which range of SMBT is the most common?
Ans. From the above graph, most common range of SMBT is between 40000 to 60000.

5. Box Plot

a. Create a horizontal box plot of number of Connections Made.

b. The plot should be properly labeled and a unique colour.

```
boxplot(data_DVH$Conn_DVH,
        col=5,
        border = 2,
        horizontal = TRUE,
        main = "Box plot of number of Connections Made",
        xlab = "Range of Connection made"
        )
```



c. Based on the box plot, approximately how many servers made fewer than 6160 connections?

```
sum(data_DVH$Conn_DVH < 6160)

## [1] 16437
```

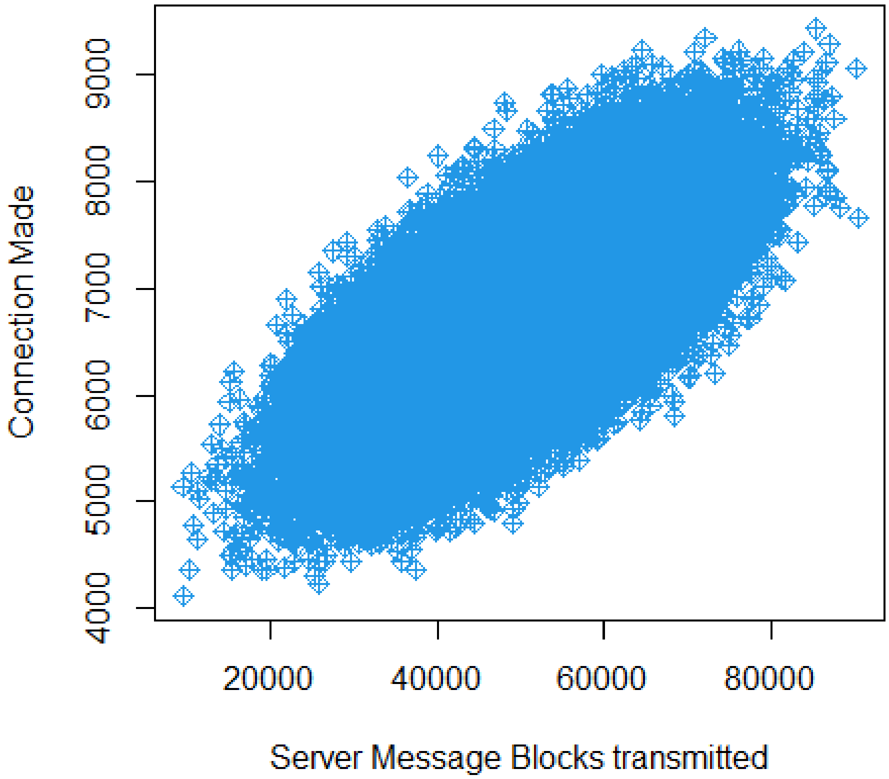
Interpretation
Number of Server fewer than 6160 is 16437.

6. Scatter Plot x

a. Create a scatter plot comparing Server Message Blocks Transmitted and Connections Made.

b. The plot should be properly labeled with a marker type different than the one demonstrated in class.

```
plot(data_DVH$SMBT_DVH,data_DVH$Conn_DVH,
    pch=9,
    xlab = "Server Message Blocks transmitted",
    ylab = "Connection Made",
    col=4
    )
```



c. Does there appear to be an association between Server Message Blocks Transmitted and Connections Made?

Interpretation
As from plot, SMBT are positively increasing with connection made. There is a association between SMBT and connection made.