University of California, Riverside - AGSM School of Business

Fall, 2023

MGT:256 - Business Analytics
Project 2 - Final

Section: 002

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Executive Summary

As a part of their annual festival, the organization engages both in ticket sales and donation campaigns to support a specific cause. Thus, the primary objective of this analysis is to extract valuable information from the data compiled in the excel file, shedding light on the effectiveness of our ticket sales and donations from various sources over a fourteen-year period. By leveraging data-driven decision-making, we aim to optimize our fundraising efforts and enhance the impact of our initiatives.

As a part of our given research, the provided excel file encompasses a comprehensive dataset spanning ticket sales and donation transactions throughout the year. This includes information such as translation dates, quantity of tickets sold, amount donated, donor details, and other various relevant metrics. Thus, as a result of utilizing our analysis from R Studio, we have found key findings that will help aid in the increase of both sales and donations from new and existing customers. Firstly, from our descriptive analysis, we see a positive correlation between the amount of sales and the amount of donations. By observation, we see that the patrons who purchased more tickets were also the same patrons who donated large sums of money. The more revenue that was generated from ticket sales, the higher the donation amount.

In addition, of the 1614 donors, there is an overall upward trend in the amount of donations per year. This same evaluation can be said for the total ticket sales between 2002 and 2015. Also, Pennsylvania (PA) showed a significantly higher amount of revenue generated compared to other states, followed by New Jersey, and then Delaware, which are all located within the same region of the country. And finally, from the analysis, we see that of those who purchased tickets, very little of these individuals donated - meaning, most patrons would rather buy additional tickets rather than give an additional donation. These top states are all very similar in terms of demographic, political party standings, and psychographics, which can help us identify and target new patrons to contribute to the organization. Likewise, according to the research below, the organization ought to be devoting more resources toward promoting increases in ticket sales rather than on donations, because sales were the more consistent, higher outcome than relying on donations from those who have already purchased tickets.

Conclusion

Thus, from the analysis of the excel file, we see valuable insights regarding the trends of our most recent revenues earned per year. By leveraging these findings, we see that the more enhanced and more notable revenue comes from those who are already purchasing numerous tickets (compared to those that are only purchasing once and donating). We also find that our most successful campaigns are those that are launched in the state of Pennsylvania. Hence, as we look into our database decision-making for this organization, it is our suggestion to continue promoting ticket sales above donations and to emphasize the following states listed, as we believe this may help increase the total revenue for this festival.

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Section 1: Descriptive Analysis

A - Donors

i.) Total Donors:

1. There are a total **1614** donors who contributed more than 0 for any year.
2. The total number of donors who contributed at least $100 - **1006**
3. The total number of donors who contributed at least $500 - **433**
4. The total number of donors who contributed at least $1000 - **243**

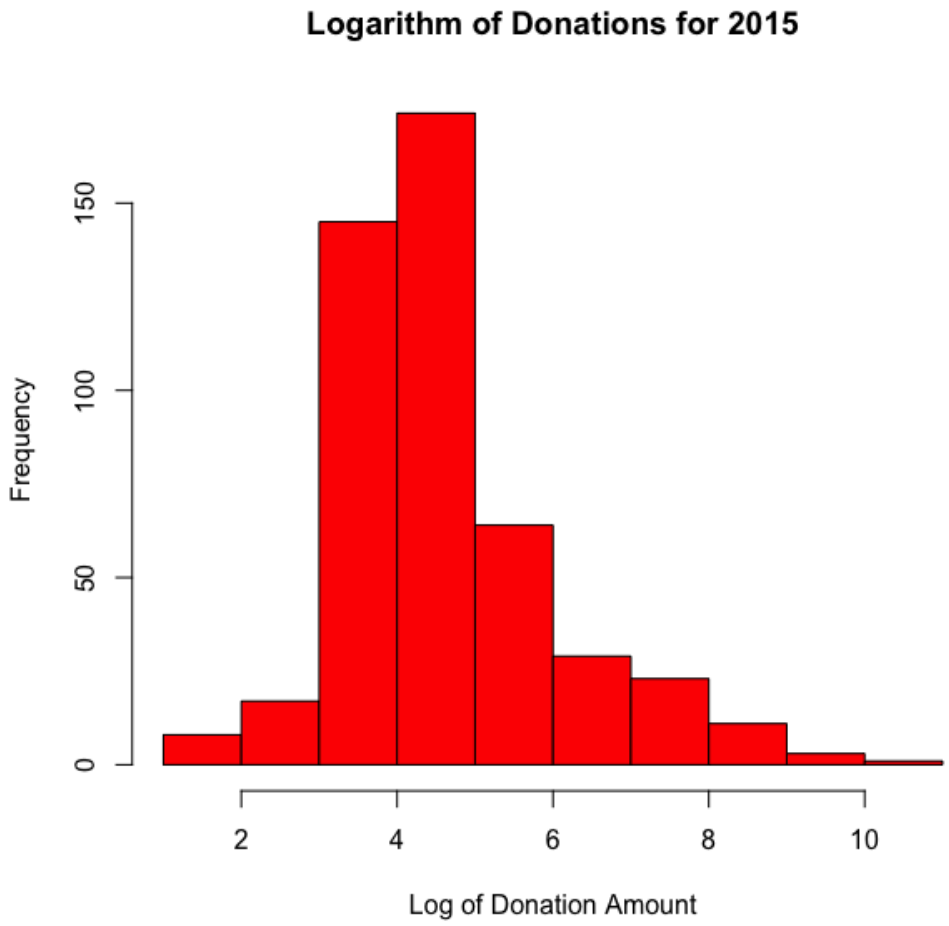
ii.) Total Donors in each year:

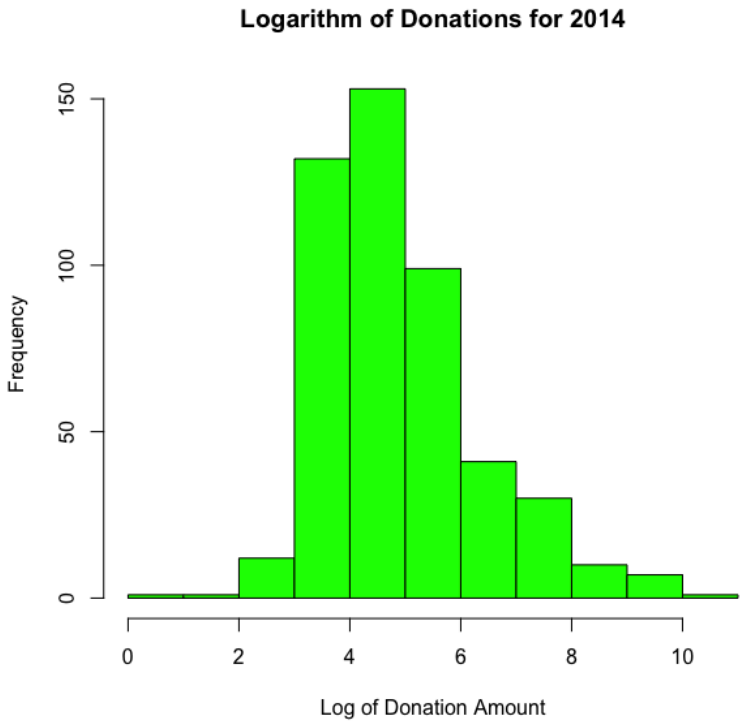
Year	Donors ($1+)	Donors ($100+)	Donors ($500+)	Donors ($1000+)
2004	380	185	34	19
2005	431	227	42	25
2006	411	204	38	21
2007	486	234	39	19
2008	441	225	40	22
2009	521	205	38	18
2010	461	207	32	14
2011	428	218	34	20
2012	413	232	42	26
2013	451	253	71	52
2014	487	314	88	60
2015	475	267	67	49

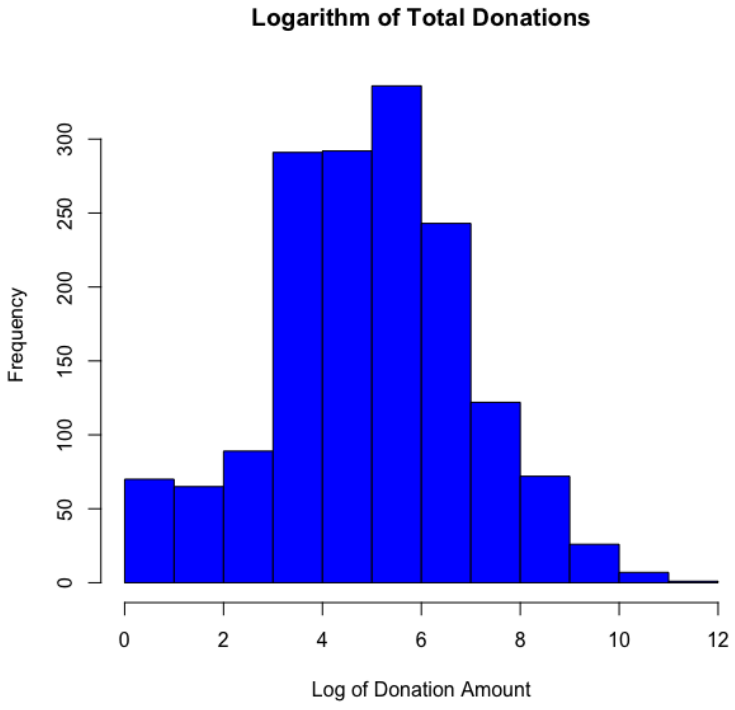
iii.) Histogram Total Donations for 2014 and 2015

The dataset provided has a wide range of donation amounts which resulted in skewed distribution. By applying a log transformation, we effectively normalize this data, reducing skewness and making the distribution more symmetrical and easier to interpret. This approach allows us to visually capture and compare the full range of donations, from the smallest to the largest, within a single, coherent framework. From the table and histogram below we can see that the most frequent donation value is between 54.6 and 148.4 in 2015.

Log Value	Corresponding Donations value (exponential of log value)
0	1.00
1	2.72
2	7.39
3	20.09
4	54.60
5	148.41
6	403.43
7	1096.63
8	2980.96
9	8103.08
10	22026.47
11	59874.14

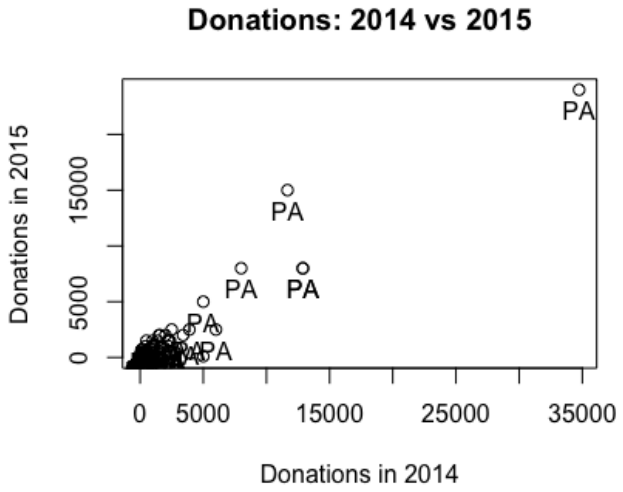

Logarithm of Donations for 2015
Frequency
0
50
100
150
2
4
6
8
10
Log of Donation Amount

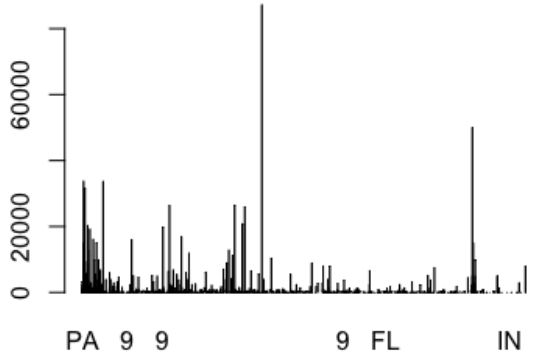

Logarithm of Donations for 2014
Frequency
0
50
100
150
0
2
4
6
8
10
Log of Donation Amount

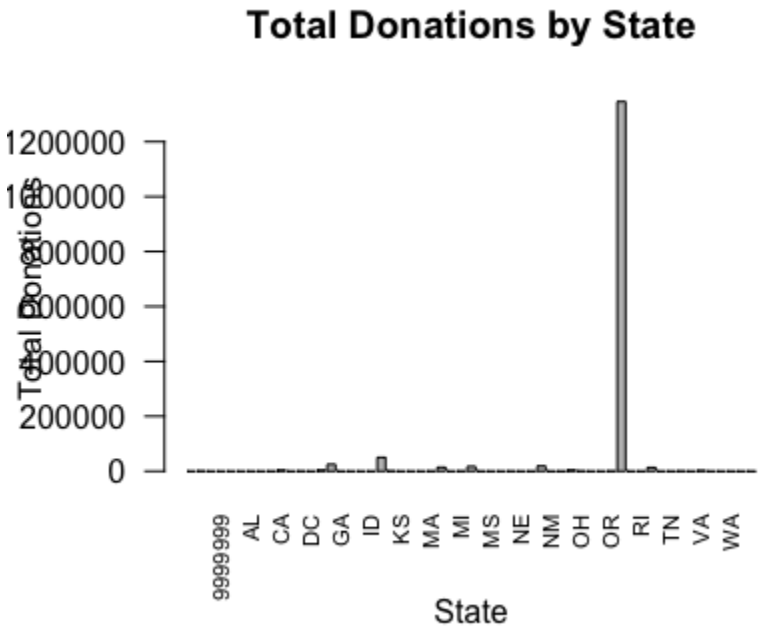

Logarithm of Total Donations
Frequency
0
50
100
150
200
250
300
0
2
4
6
8
10
12
Log of Donation Amount

iv.) Scatterplot for 2014 and 2015:

From the below scatter plot and bar charts we can see that PA has the highest single donor amount as well as the maximum total donations when grouped by states.







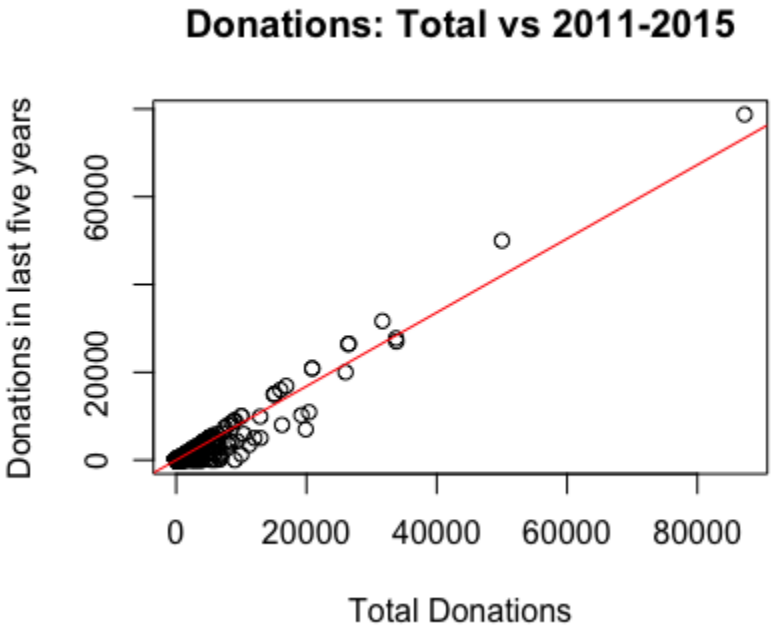
v.) How many “active” donors:
The total number of active donors from 2010 to 2015 are: 1074
The total number of donors at the end of 2010: 461
The total number of donors at the end of 2015 (Considering only 2015): 475

vi.) Donors over the past 5 years contributing more than $100.

Donors over the past 5 years donating more than $100 is 556. Check the table below. **140** people donated consistently each year from 2011 to 2015.

1	2	3	4	5
123	102	101	90	140

vii.) Plot amount donated for the past 5-years:
There is a strong positive relationship looking at the slope. That means when the total donations for every unit increase, there is a similar amount of increase in donations in last 5 years implying that last 5 years have been good in terms of donations.



B. - Ticket Holder

i.) Total number of ticket holders

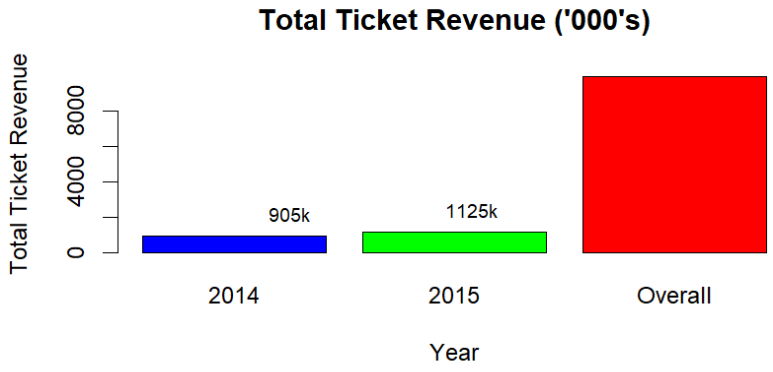
```
The total number of ticket holders are 30065
```

ii.) Total number of ticket holders for each year

```
The total number of ticket holders in Year 2002 : 4099
The total number of ticket holders in Year 2003 : 3750
```

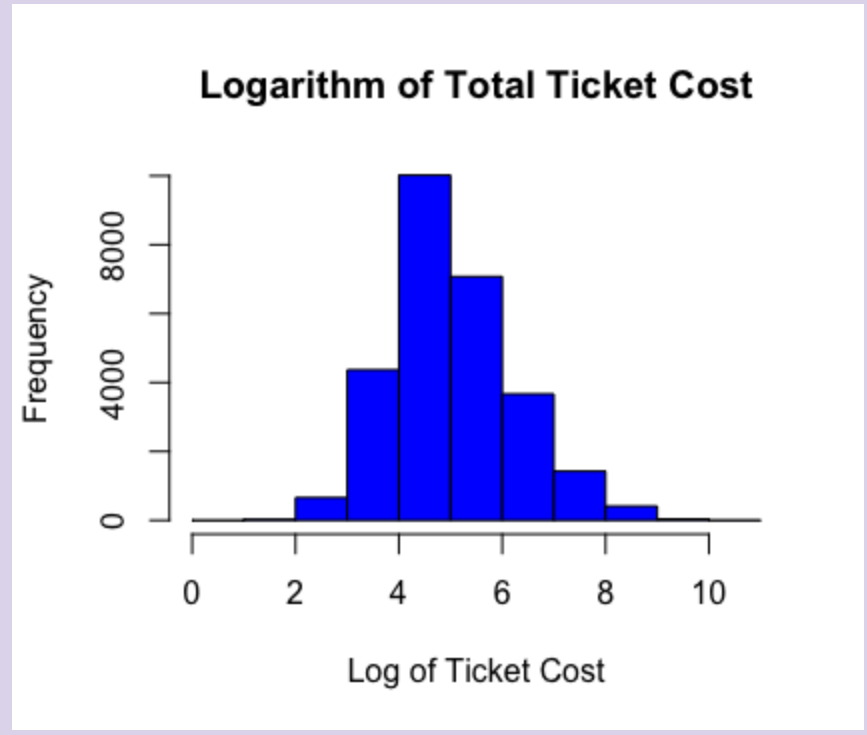
```
The total number of ticket holders in Year 2004 : 4655
The total number of ticket holders in Year 2005 : 4194
The total number of ticket holders in Year 2006 : 5083
The total number of ticket holders in Year 2007 : 5020
The total number of ticket holders in Year 2008 : 4625
The total number of ticket holders in Year 2009 : 6044
The total number of ticket holders in Year 2010 : 4836
The total number of ticket holders in Year 2011 : 6177
The total number of ticket holders in Year 2012 : 5421
The total number of ticket holders in Year 2013 : 5727
The total number of ticket holders in Year 2014 : 6281
The total number of ticket holders in Year 2015 : 6878
```

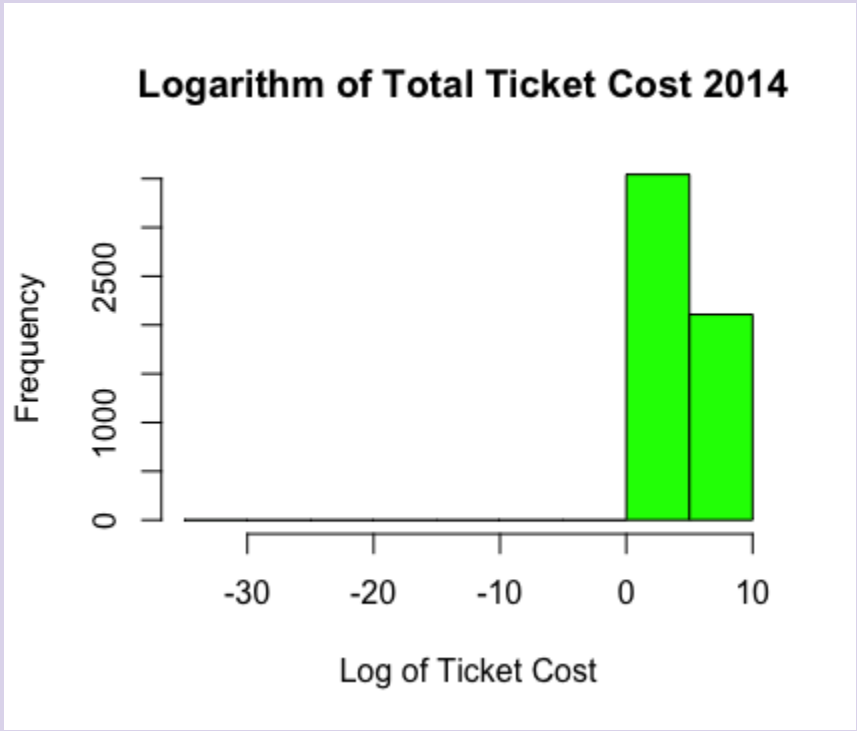
iii.) Histogram of ticket revenue

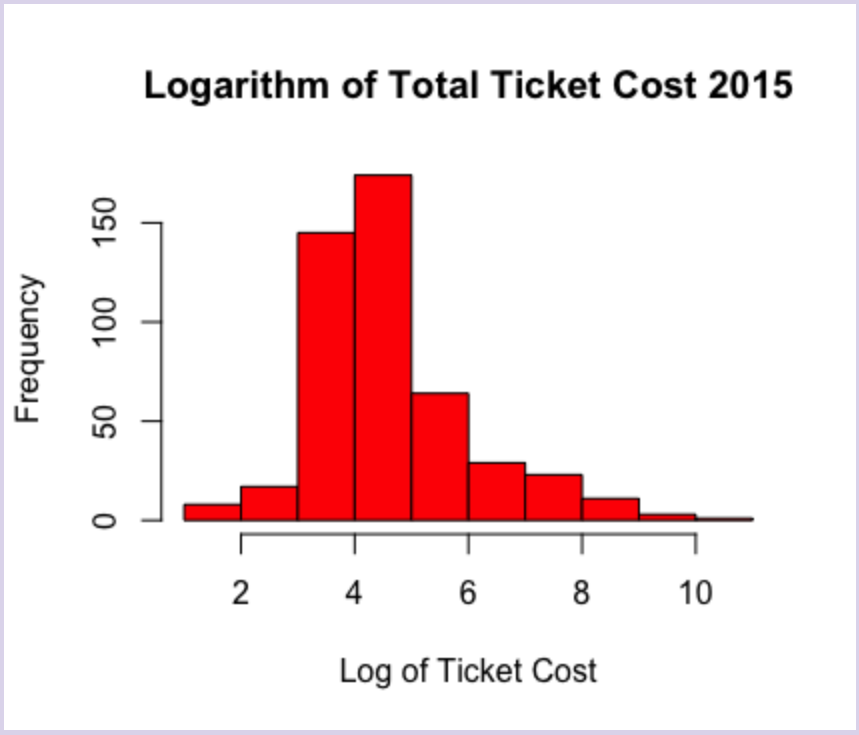


The amount of ticket revenue from 2014 and 2015 contribute to approximately a quarter of the overall ticket revenue. This indicates that 2014 and 2015 were years with high ticket purchases.

We also used normalization to eliminate the skewness in the data. We used log transformation and below are our results.

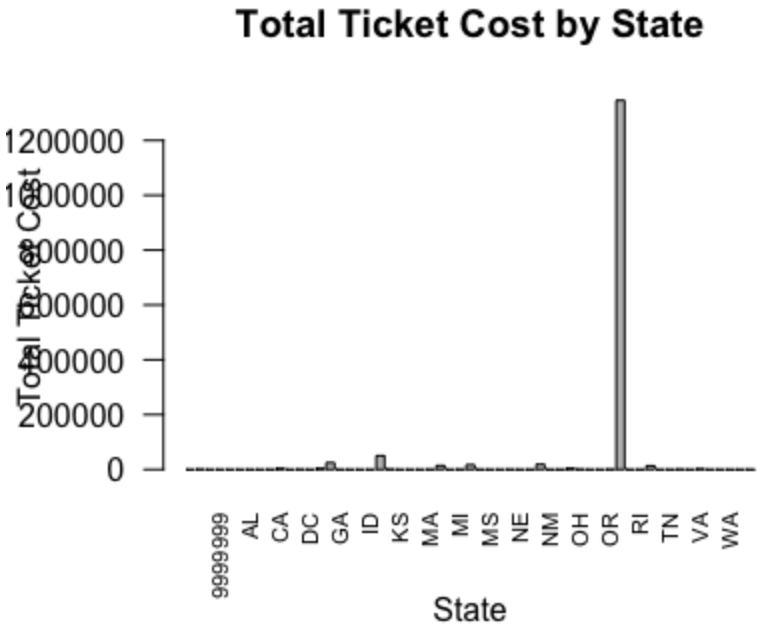

Logarithm of Total Ticket Cost
Frequency
0
4000
8000
0
2
4
6
8
10
Log of Ticket Cost

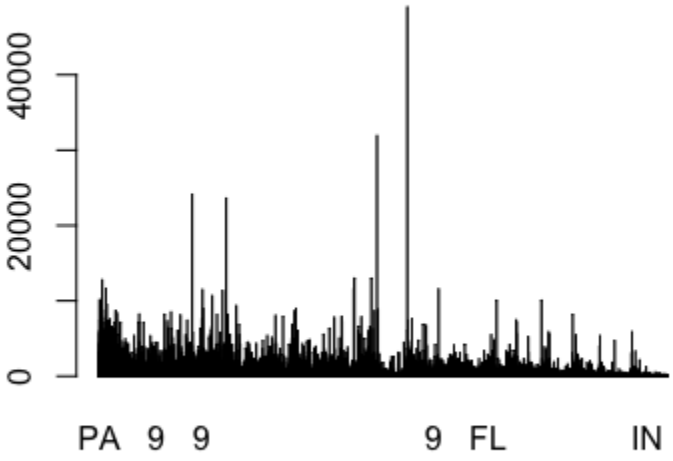

Logarithm of Total Ticket Cost 2014
Frequency
0
1000
2500
-30
-20
-10
0
10
Log of Ticket Cost

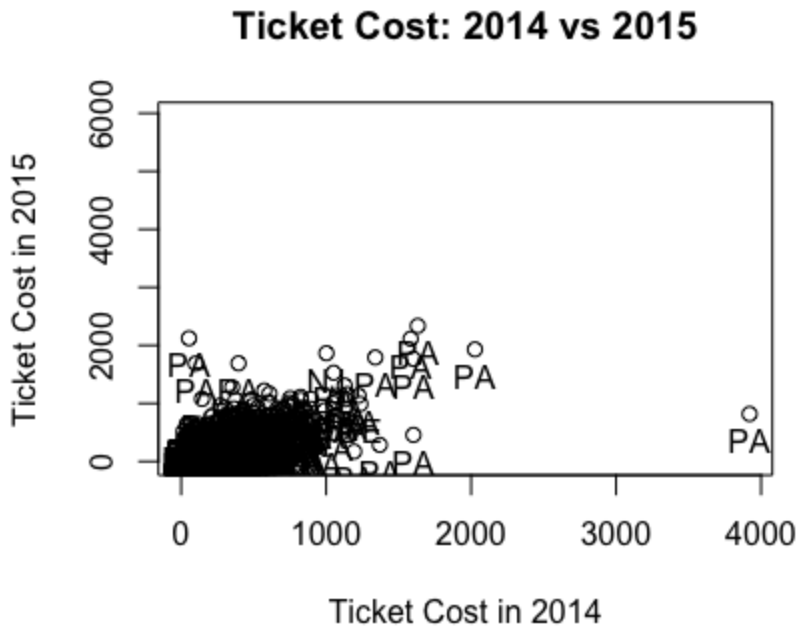


iv.) Scatterplot for tickets purchased in 2014 and 2015

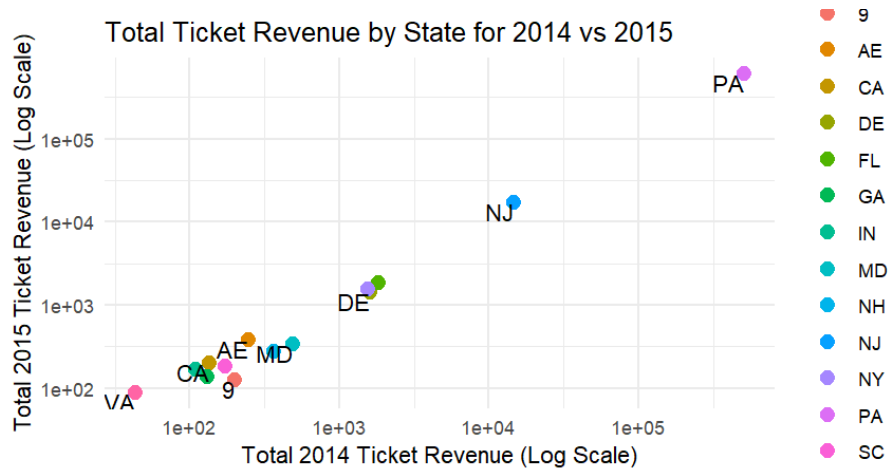
From the below scatter plot and bar charts we can see that PA has the highest single ticket purchaser as well as the maximum total ticket cost when grouped by states.


Total Ticket Cost by State
Total Ticket Cost
1200000
1000000
800000
600000
400000
200000
0
9999999
AL
CA
DC
GA
ID
KS
MA
MI
MS
NE
NM
OH
OR
RI
TN
VA
WA
State


40000
20000
0
PA
9
9
9
FL
IN



The above plot have each patron for 2014 vs 2015 and the below plot is the scatter plot for the aggregated data by state.



According to the scatterplot, the top five highest purchasing states in order from low to high are Delaware, New York, Florida, New Jersey, and Pennslyvannia. Pennsylvania and New Jersey are much higher than the others in comparison. New Jersey has approximately 10,000 for 2014 and 10,000 for 2015. Pennsylvania is the highest with approximately 600,000 for 2014 and 700,000 for 2015.

v.) Amount of "active" ticket purchasers in 2010

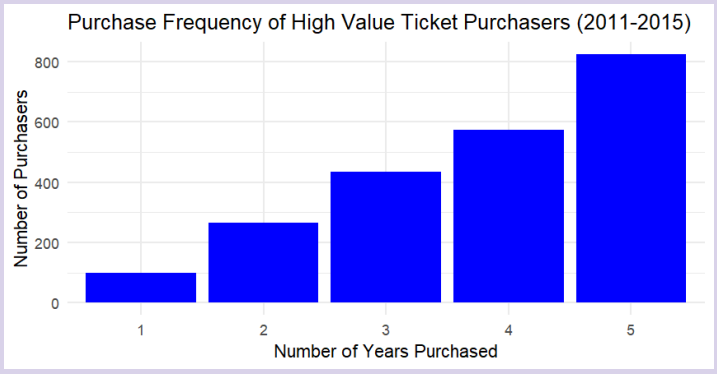
```
Number of ticket purchasers active at end of 2010: 1089
Number of active ticket purchasers from 2010 to 2015: 2635
```

It can be assumed that most of the people who donated in 2015 are people that donated in 2010.

If we assume the definition of active ticket purchasers is same as the active donors then the answer does not change and is same as active donors.

vi.) Ticket purchasers who have bought at least $500 in tickets over the past 5 years. Do they tend to buy tickets every year?

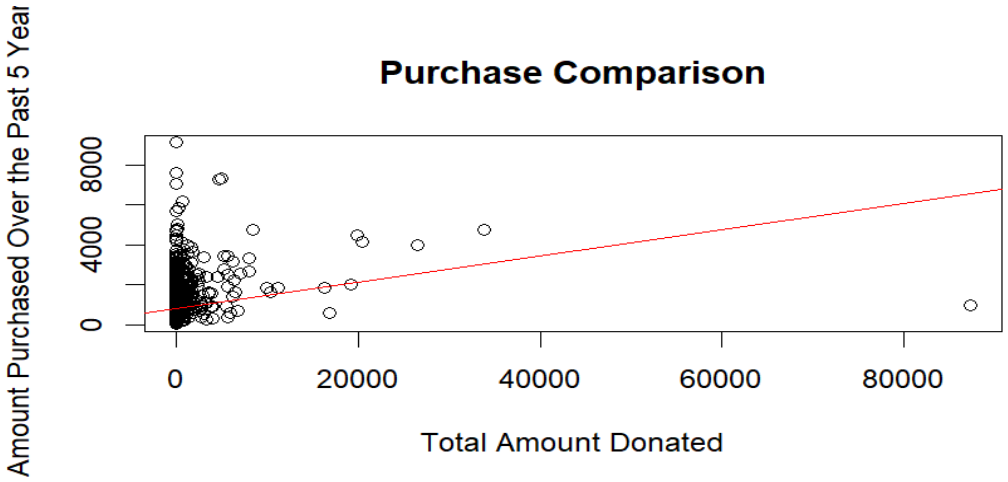
	Num_Years_Purchased	Count
	<int>	<int>
1	1	99
2	2	265
3	3	434
4	4	575
5	5	824



It can be surmised that regular ticket purchasers tend to buy every year they increase in frequency after every successive year. According to the chart, ticket purchasers usually buy every year and increase over time.

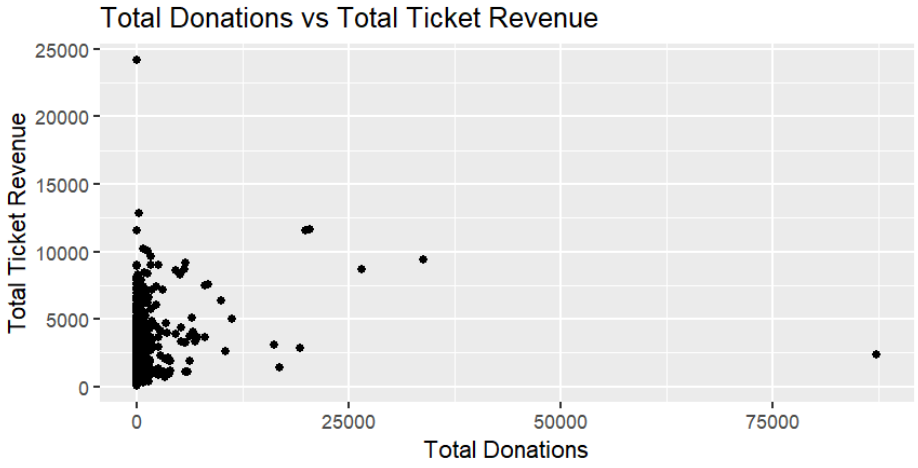
The people who bought ticket every year from 2011 to 2015 is 854

vii.) Plot amount of ticket purchases (in dollars) over the past 5 years against total amount donated



According to the chart, the vast majority of patrons buy tickets and either donate nothing or very little. The chart also has a positive correlation between those that purchased tickets the past five years and the total amount donated.

C. - Conjoint Analysis



i.)

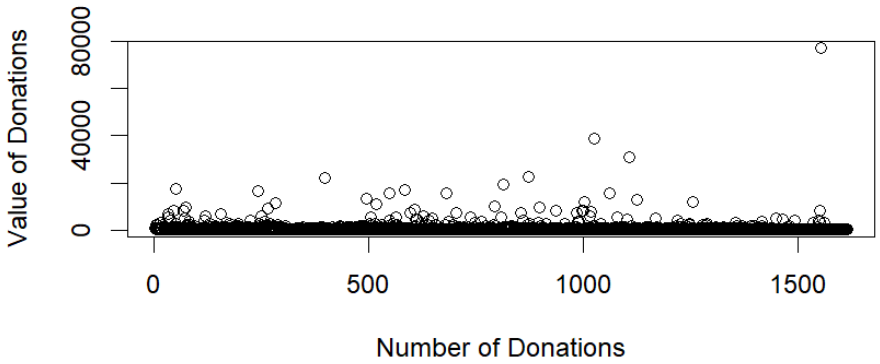
ii.) The relationship between donations and ticket revenue is slightly positive meaning when one value increases, the other tends to increase as well. As we can see by the relationship, most patrons choose to purchase tickets rather than donate large sums of money. This graph also has some resemblance to the previous plot, however, with minor differences and overall clustering and spread of the points.

Section 2: Predictive Analytics

A. Donation Patterns

i.) 2014Donations= 296.371+ 3.289(X2009.Donation)+ 0.881(X2010.Donation)+ 1.896(X2011.Donation)+ 1.707(X2012.Donation)+ 1.539(X.2013.Donation)

ii.) The correlation of the data is 0.2628359 which is between our 2015 predictions and our actual 2015 donation amounts. This correlation is a bit low but a positive correlation indicating that they both move in the same direction.



iii.)

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
296.4	296.4	325.6	931.4	624.2	77255.1

iv.)

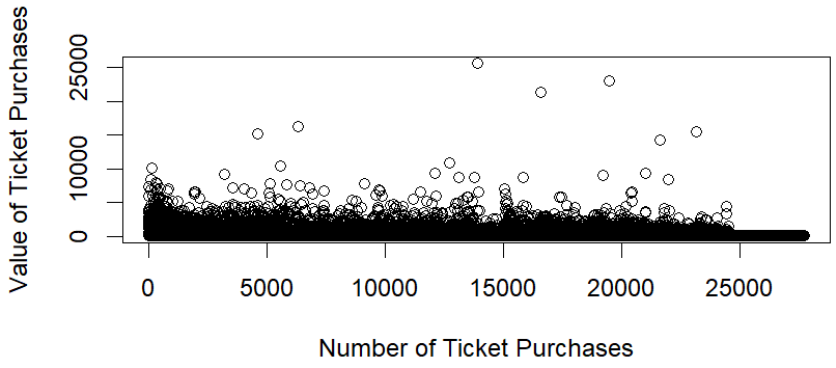
The top 10 donors for 2016 is
Patron 95514 - Predicted Donation: $77,255.13
Patron 39856 - Predicted Donation: $38,775.75
Patron 44380 - Predicted Donation: $31,079.87
Patron 30591 - Predicted Donation: $22,443.56
Patron 2187 - Predicted Donation: $22,037.75
Patron 28386 - Predicted Donation: $19,536.06
Patron 904 - Predicted Donation: $17,595.11
Patron 6088 - Predicted Donation: $16,842.50
Patron 1863 - Predicted Donation: $16,546.90
Patron 3899 - Predicted Donation: $15,688.12

B. Ticket Sales Patterns

i.) 2014TicketSales= 89.664+ 1.837(X2009.Total.Cost)+ 2.27(X2010.Total.Cost)+ 1.765(X2011.Total.Cost)+ 1.406(X2012.Total.Cost)+ 2.065(X2013.Total.Cost)

ii.) The correlation is 0.4351181 between our predicted 2015 ticket sales and our actual 2015 ticket sales. This correlation is positive and a bit higher than our donation correlation. This is good because that means both values are moving in the same direction.

iii.)



Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
89.66	89.66	135.56	358.95	343.10	25647.06

iv.)

The top 10 ticket purchasers for 2016:

Patron 50747 - Predicted Ticket Purchase: $25,647.06
Patron 80873 - Predicted Ticket Purchase: $22,995.92
Patron 73113 - Predicted Ticket Purchase: $21,402.36
Patron 30587 - Predicted Ticket Purchase: $16,303.98
Patron 91938 - Predicted Ticket Purchase: $15,451.65
Patron 23160 - Predicted Ticket Purchase: $15,161.16
Patron 87706 - Predicted Ticket Purchase: $14,339.28
Patron 47461 - Predicted Ticket Purchase: $10,897.84
Patron 29063 - Predicted Ticket Purchase: $10,361.98
Patron 1274 - Predicted Ticket Purchase: $10,181.26

Section 3: Conclusion:

Ticket Sales: As the years go by, there is an overall increase in sales which shows a positive trend, which resulted in the highest sales in 2015. This emphasizes the effective strategies that are being implemented in order to increase ticket sales in this festival season.

Donations: the correlations between ticket sales and donations is fairly low. However, from this analysis, we see that those who purchase higher quantities are also more likely to donate. Thus, this shows that donations should be more targeted towards group sales with families, school districts, and/or other organizations. These are all family-oriented transactions that occur as well - thus, as a part of their strategy, they could implement special offers for families and organizations.

Overall, this data supports our thesis on targeting families and/or student body organizations toward increasing donations and long term support. In addition, our analysis also displays that ticket sales highly differ between different states, districts, and individual groups. So, targeting these specific demographics may help increase ticket revenue as well for the coming year. Instead of focusing across various districts and states, they should promote their festival in areas with similar demographics to those that are shown from our research above.

Appendix:

Approach 1:

```
#Descriptive Analytics


#Load the csv file
Dataset=read.csv("Project2.csv")
str(Dataset)

#Question 1- How many total donors (people who contributed a positive amount any year) are there? What about donors who contributed at least $100? $500? $1000?

Total_Donors_Positive=subset(Dataset, Total.Donations>=1)
print(paste("The total number of donors are" , nrow(Total_Donors_Positive)))
```

```
Donors100=subset(Dataset, Total.Donations>=100)
print(paste("The total number of donors who contributed at least $100 are" ,
nrow(Donors100)))

Donors500=subset(Dataset, Total.Donations>=500)
print(paste("The total number of donors who contributed at least $500 are" ,
nrow(Donors500)))

Donors1000=subset(Dataset, Total.Donations>=1000)
print(paste("The total number of donors who contributed at least $1000 are" ,
nrow(Donors1000)))


#Question 2 - How many donors were there each year in the data set?
years <- 2004:2015

for (year in years) {
  total_donors_year <- sum(Dataset[paste0("X", year, ".Donation")] > 0)
  print(paste("The total number of donors who contributed at least $1 in the", year ,"are" ,
total_donors_year))
  donors_100_year <- sum(Dataset[paste0("X", year, ".Donation")] >= 100)
  print(paste("The total number of donors who contributed at least $100 in the", year ,"are" ,
donors_100_year))

  donors_500_year <- sum(Dataset[paste0("X", year, ".Donation")] >= 500)
  print(paste("The total number of donors who contributed at least $500 in the", year ,"are" ,
donors_500_year))

  donors_1000_year <- sum(Dataset[paste0("X", year, ".Donation")] >= 1000)
  print(paste("The total number of donors who contributed at least $1000 in the", year ,"are"
, donors_1000_year))
}


#Question 3- Plot the histograms of donations for the entire time period, for 2014 and for
2015. Comment

# Apply a logarithmic transformation to the donation amounts to normalize the data
Dataset$Log_Total_Donations <- log(Dataset$Total.Donations)
Dataset$Log_2014_Donation <- log(Dataset$X2014.Donation)
Dataset$Log_2015_Donation <- log(Dataset$X2015.Donation )
```

```
# Plot the histogram for the logarithm of the total donations
hist(Dataset$Log_Total_Donations, main="Logarithm of Total Donations", xlab="Log of Donation Amount", col="blue", breaks=10)

# Plot the histogram for the logarithm of 2014 donations
hist(Dataset$Log_2014_Donation, main="Logarithm of Donations for 2014", xlab="Log of Donation Amount", col="green", breaks=10)

# Plot the histogram for the logarithm of 2015 donations
hist(Dataset$Log_2015_Donation, main="Logarithm of Donations for 2015", xlab="Log of Donation Amount", col="red", breaks=10)


# Question 4- Plot a scatterplot with the donations for 2014 and 2015 (one dot = one row, removing [for this question only] instances with no donation either year). Plot the total donations and the state. Which State is having the biggest donations? Comment.

# Create a copy of the dataset to add NA to null values
NA_dataset <- Dataset
NA_dataset[NA_dataset == 0] <- NA

#Plot Scatterplot
plot(NA_dataset$X2014.Donation,NA_dataset$X2015.Donation,xlab="Donations in 2014", ylab="Donations in 2015",main="Donations: 2014 vs 2015")
text(NA_dataset$X2014.Donation, NA_dataset$X2015.Donation, labels = NA_dataset$State, pos = 1)

#identify(NA_dataset$X2014.Donation,NA_dataset$X2015.Donation,labels=NA_dataset$State)

#Plot total donations and state. Comment- If we plot all donations vs state we can see that a patron from PA has highest donation
barplot(height=NA_dataset$Total.Donations, names=NA_dataset$State)
donations_by_state <- tapply(Dataset$Total.Donations, Dataset$State, FUN=sum)
barplot(donations_by_state, main = "Total Donations by State", xlab = "State", ylab = "Total Donations", las = 2, cex.names = 0.7)

# Question 5 - How many “active” donors? The definition of “active” donors, are donors who at least donated once from year 2010 to 2015. How many were there at the end of 2010 and are there at the end of 2015?
```

```
# Check for donors who donated at least once from 2010 to 2015
Total_Active_Donors = Dataset[rowSums(Dataset[,c("X2010.Donation", "X2011.Donation",
"X2012.Donation", "X2013.Donation", "X2014.Donation", "X2015.Donation")] > 0) > 0,]
print(paste("The total number of active donors from 2010 to 2015 are:",
nrow(Total_Active_Donors)))

#Active Donors at the end of 2010
Active_Donors_At_The_End_of_2010 = subset(Dataset, X2010.Donation>=1)
print(paste("The total number of donors at the end of 2010:" ,
nrow(Active_Donors_At_The_End_of_2010)))

#Active Donors at the end of 2015
Active_Donors_At_The_End_of_2015 = subset(Dataset, X2015.Donation>=1)
print(paste("The total number of donors at the end of 2015 (Considering only 2015):" ,
nrow(Active_Donors_At_The_End_of_2015)))


# Question 6 - Consider the donors who have donated a total of more than $100 over the
past 5 years (2011 to 2015). Do they tend to donate every year? (You might want to create
a table or some other summary visuals.)

Dataset$Donations_sum_2011to2015 <- rowSums(Dataset[, c("X2011.Donation",
"X2012.Donation", "X2013.Donation", "X2014.Donation", "X2015.Donation")])


active_donors_over_100 <- unique(Dataset[Dataset$Donations_sum_2011to2015 > 100, ])


donation_table <- table(rowSums(active_donors_over_100[, c("X2011.Donation",
"X2012.Donation", "X2013.Donation", "X2014.Donation", "X2015.Donation")] > 0))

print(donation_table)

#Question 7 - Plot amount donated over the past 5 years (Y-axis) against total amount
donated (X-axis). Comment. (Hint: look on the slope of the line)

plot(Dataset$Total.Donations,Dataset$Donations_sum_2011to2015,xlab="Total Donations",
ylab="Donations in last five years",main="Donations: Total vs 2011-2015")
model <- lm(Dataset$Donations_sum_2011to2015 ~ Dataset$Total.Donations)
abline(model, col="red")
```

```
#--------------------Ticketholders----------------

#Question 1 - How many total ticketholders are there?


Total_Ticketholders=subset(Dataset,Total.Tickets>=1)
print(paste("The total number of donars are" , nrow(Total_Ticketholders)))

#Question 2 - How many ticketholders were there each year in the data set?

years <- 2002:2015

for (year in years) {
  total_ticketholders_year <- sum(Dataset[paste0("X", year, ".Qty")] > 0)
  print(paste("The total number of ticketholders in", year ,"are" , total_ticketholders_year))

}


#Question 3 - Plot the histograms of ticket revenues for the entire time period, for 2014 and
for 2015. Comment
# Apply a logarithmic transformation to the donation amounts to normalize the data
Dataset$Log_Total_Ticket_Cost <- log(Dataset$Total.Ticket.Revenue)
Dataset$Log_2014_Ticket_Cost <- log(Dataset$X2014.Total.Cost)
Dataset$Log_2015_Ticket_Cost <- log(Dataset$X2015.Total.Cost )

# Plot the histogram for the logarithm of the total donations
hist(Dataset$Log_Total_Ticket_Cost, main="Logarithm of Total Ticket Cost", xlab="Log of
Ticket Cost", col="blue", breaks=10)

# Plot the histogram for the logarithm of 2014 donations
hist(Dataset$Log_2014_Ticket_Cost, main="Logarithm of Total Ticket Cost 2014 ",
xlab="Log of Ticket Cost", col="green", breaks=10)

# Plot the histogram for the logarithm of 2015 donations
hist(Dataset$Log_2015_Donation, main="Logarithm of Total Ticket Cost 2015", xlab="Log
of Ticket Cost", col="red", breaks=10)
```

#Question 4 - Plot a scatterplot with the ticket purchases for 2014 and 2015 (one dot = one row, removing [for this question only] instances with no ticket purchase either year). Plot the total tickets purchases and the state. Which State is having more people purchasing tickets? Comment.

```
# Create a copy of the dataset to add NA to null values
NA_dataset_ticket <- Dataset
NA_dataset_ticket[NA_dataset_ticket == 0] <- NA

#Plot Scatterplot
plot(NA_dataset_ticket$X2014.Total.Cost,NA_dataset_ticket$X2015.Total.Cost,xlab="Ticket Cost in 2014", ylab="Ticket Cost in 2015",main="Ticket Cost: 2014 vs 2015")
text(NA_dataset_ticket$X2014.Total.Cost,NA_dataset_ticket$X2015.Total.Cost, labels = NA_dataset_ticket$State, pos = 1)
```

#Plot total donations and state. Comment- If we plot all donations vs state we can see that a patron from PA has highest donation

```
barplot(height=Dataset$Total.Ticket.Revenue, names=Dataset$State)
ticket_cost_by_state <- tapply(Dataset$Total.Ticket.Revenue, Dataset$State, FUN=sum)
barplot(donations_by_state, main = "Total Ticket Cost by State", xlab = "State", ylab = "Total Ticket Cost", las = 2, cex.names = 0.7)
```

#Question 5 - How many “active” ticket purchasers were there at the end of 2010? The definition of “active” ticket purchase, are donors who at least donated once from year 2010 to 2015”. How many are there at the end of 2015? Are they the same people?

#SAME AS ABOVE QUESTION 5 because the definition of active ticket purchasers is same as active ticket donors

#Question 6 - Consider the ticket purchasers who have bought at least $500 in tickets over the past 5 years (2011 to 2015). Do they tend to buy tickets every year? Do they buy tickets only a few of those years? (You might want to create a table or some other summary visuals.)

```
Dataset$Ticketholder_sum_2011to2015 <- rowSums(Dataset[, c("X2011.Total.Cost", "X2012.Total.Cost", "X2013.Total.Cost", "X2014.Total.Cost", "X2015.Total.Cost")])


active_ticketholder_500 <- unique(Dataset[Dataset$Ticketholder_sum_2011to2015 >=500, ])
```

```
ticketholder_table <- table(rowSums(active_ticketholder_500[, c("X2011.Total.Cost",
"X2012.Total.Cost", "X2013.Total.Cost", "X2014.Total.Cost", "X2015.Total.Cost")] > 0))

print(ticketholder_table)

#The people who bought ticket every year from 2011 to 2015 is 854

#Question 7- Plot amount of ticket purchases (in dollars, not number of tickets) over the
past 5 years against total amount donated. Comment.

plot(Dataset$Total.Donations,Dataset$Ticketholder_sum_2011to2015,xlab="Total
Donations", ylab="Ticket purchases in last five years",main="Total Donations vs Ticket
Purchases in last 5 years")
#model2 <- lm(Dataset$Ticketholder_sum_2011to2015 ~ Dataset$Total.Donations)
-DELETE THIS
#abline(model2, col="red")



#JOINT ANALYSIS

plot(Dataset$Total.Donations,Dataset$Total.Ticket.Revenue,xlab="Total Donations",
ylab="Ticket purchases ",main="Total Donations vs Ticket Purchases ")
#Comment- There is no visual evidence of a strong relation between total donation and total
ticket revenue.
```

Approach 2:
Refer source file in the submission