

```

1. setwd("C:/Users/Rafaela Becerra/Desktop/UC3M/R Programming")
2. data=read.csv("SP1.csv")
3.
4. library(dplyr)
5. library(readxl)
6. library(reshape2)
7. library(lubridate)
8.
9. ##### Data tables #####
10. read_sheets <- function(filename, tibble = FALSE) {
11.   sheets <- readxl::excel_sheets(filename)
12.   x <- lapply(sheets, function(X) readxl::read_excel(filename, sheet = X))
13.   if(!tibble) x <- lapply(x, as.data.frame)
14.   names(x) <- sheets
15.   x
16. }
17. vars<-read_sheets("VARS.xlsx")
18. #data$Jornada=rep(1:38, each=10)
19.
20. ##### PER DATE #####
21. #data$Jornada=rep(1:38, each=10) por jornada
22. data$Date=as.Date(data$Date, format="%d/%m/%y")
23. data$month=format(data$Date, format="%m-%y")
24.
25. data$season=0
26. data[data$month=="08-17"|data$month=="09-17"| data$month=="10-17" | data$month=="11-17"& !is.na(data$month),match("season",names(data))]= "ago-nov"
27. data[data$month=="12-17"|data$month=="01-18"| data$month=="02-18" & !is.na(data$month),match("season",names(data))]= "dic-feb"
28. data[data$month=="03-18"|data$month=="04-18"| data$month=="05-18" & !is.na(data$month),match("season",names(data))]= "mar-may"
29.
30. #####
31.
32. home=data[, match(vars$VAR_HOME[,1],names(data))]
33. away=data[, match(vars$VAR_AWAY[,1],names(data))]
34. results=data[, match(vars$RESULTS[,1],names(data))]
35.
36. rm(vars)
37.
38. results$HomeTeam=as.character(results$HomeTeam)
39. results$AwayTeam=as.character(results$AwayTeam)
40.
41. results1=dcast(select(results,-HTR), Date+HomeTeam+AwayTeam~ FTR)
42. resultsh=dcast(results, HomeTeam~ FTR, value.var = "FTR" )
43. resultsa=dcast(results, AwayTeam~ FTR, value.var = "FTR" )
44.
45. names(resultsh)[1:4]<-c("Team", "Lose_home", "Draw_home", "Win_home")
46. names(resultsa)[1:4]<-c("Team", "Win_away", "Draw_away", "Lose_away")
47. total_results1=left_join(resultsh,resultsa)
48.
49. results2=dcast(select(results,-FTR), Date+HomeTeam+AwayTeam~ HTR)
50. resultsh2=dcast(results, HomeTeam~ HTR, value.var = "HTR" )
51. resultsa2=dcast(results, AwayTeam~ HTR, value.var = "HTR" )
52.
53. names(resultsh2)[1:4]<-c("Team", "H_Lose_home", "H_Draw_home", "H_Win_home")
54. names(resultsa2)[1:4]<-c("Team", "H_Win_away", "H_Draw_away", "H_Lose_away")
55. total_results2=left_join(resultsh2,resultsa2)
56.
57. total_results=left_join(total_results1, total_results2)
58.
59. total_results=mutate(total_results,Win=Win_home+Win_away, Lose=Lose_away+Lose_home, Draw=Draw_away+Draw_home, Total_games=Win+Draw+Lose, Total_points=Win*3+Draw*1,

```

```

60.             H_Win=H_Win_home+H_Win_away, H_Lose=H_Lose_away+H_Lose_ho
me, H_Draw=H_Draw_away+H_Draw_home)
61.
62. home1<-home%>%group_by(HomeTeam)%>%summarise_all(sum)
63. away1<-away%>%group_by(AwayTeam)%>%summarise_all(sum)
64.
65. colnames=names(home1)
66. away2=away1
67. colnames(away2)=colnames
68.
69. total_play=rbind(home1,away2)
70. total_play<-total_play%>%group_by(HomeTeam)%>%summarise_all(sum)
71.
72. names(total_play)=c("Team", "Goals", "H_Goals", "Shots", "Shots_t", "Fouls", "
Corners","Yellow", "Red")
73.
74. names(home1)[1]="Team"
75. names(away1)[1]="Team"
76.
77. total=left_join(total_results, total_play)
78.
79. ##### Date #####
#####
80. total_season=select(data,-season, -Div, -Date, -HomeTeam, -AwayTeam, -HTR,-
FTR)%>%group_by(month)%>%summarise_all(sum)%>%mutate(Shots=HS+AS, Goals=FTHG+F
TAG, Fouls=HF+AF, Yellow=HY+AY, Red=HR+AR )
81.
82. ##### Per season #####
#####
83. total_sum=select(total, -Team)%>%summarise_all(sum)
84.
85. ##### F vs Half time Wins #####
#####
86. total_h=ungroup(data)%>%group_by(HomeTeam, FTR, HTR)%>%summarise(Count=n())
87. total_a=ungroup(data)%>%group_by(AwayTeam, FTR, HTR)%>%summarise(Count=n())
88.
89. total_h_w=filter(as.data.frame(total_h), FTR=="H")
90. total_h_w$HTR=gsub('H', "Win", total_h_w$HTR)
91. total_h_w$HTR=gsub('A', "Lose", total_h_w$HTR)
92. total_h_w$HTR=gsub('D', "Draw", total_h_w$HTR)
93.
94. total_a_w=filter(as.data.frame(total_a), FTR=="A")
95. total_a_w$HTR=gsub('H', "Lose", total_a_w$HTR)
96. total_a_w$HTR=gsub('A', "Win", total_a_w$HTR)
97. total_a_w$HTR=gsub('D', "Draw", total_a_w$HTR)
98.
99. names(total_h_w)[1]="Team"
100. names(total_a_w)[1]="Team"
101. total_w=rbind(total_a_w, total_h_w)
102. total_w=select(total_w,-
FTR)%>%group_by(Team,HTR)%>%summarise(Count=sum(Count))
103.
104. ##### F vs Half time Wins home/away
#####
105. total_wha=rbind(total_a_w, total_h_w)
106. total_whatotal_wha=total_wha%>%group_by(Team,HTR,FTR)%>%summarise(Count
=sum(Count))
107.
108. ##### Graphs #####
109. #With totals
110. library(ggplot2)
111. library(treemap)
112. library(RColorBrewer)
113. library(ggwordcloud)
114. library(ggplot2)
115.

```

```

116. ##### Plot Word cloud #####
117. plot5=ggplot(
118.   total,
119.   aes(
120.     label = Team, size = Total_points,
121.     x = Team, color = Team
122.   )
123. ) +
124.   geom_text_wordcloud_area(shape = "circle") +
125.   scale_size_area(max_size = 35) +
126.   scale_x_discrete(breaks = NULL) +
127.   theme_minimal()
128.
129. ##### Ranking
130. total <- arrange(total, desc(Total_points)) %>%
131.   mutate(Ranking = 1:nrow(total))
132.
133. ##### Plot Winning percentage #####
134. table7=select(total, Team, Win_away, Win_home, Total_points)
135. table7=mutate(table7, Pr_Win_away=Win_away/19, Pr_Win_home=Win_home/19,
136.   Diff=Pr_Win_home-Pr_Win_away)
137.
138. library(ggrepel)
139.
140. plot7=ggplot(table7, aes(x=Pr_Win_away, y=Pr_Win_home, color = Team)) +
141.   geom_point(aes(size=Total_points)) +
142.   geom_label_repel(aes(label = Team), box.padding = 0.35, show.legend =
143.     FALSE, size=6)+
144.   xlim(0, 0.65)+ylim(0.15, 0.85)+
145.   xlab("Winning percentage away")+
146.   ylab("Winning percentage home")+
147.   theme(legend.position = "none",
148.     panel.background = element_rect(fill = "#BFD5E3", colour = "#6D
149.     9EC1", size = 2, linetype = "solid"),
150.     axis.text=element_text(size=15),
151.     axis.title.x=element_text(size=15),
152.     axis.title.y=element_text(size=15))
153. ##### Plot Goals favor and against #####
154. table2h=select(data, HomeTeam, FTHG, FTAG)
155. table2a=select(data, AwayTeam, FTHG, FTAG)
156.
157. names(table2h)=c("Team", "Goals", "Goals_against")
158. names(table2a)=c("Team", "Goals_against", "Goals")
159.
160. table2=rbind(table2h, select_(table2a, .dots=names(table2h)))
161.
162. plot2=ggplot(table2, aes(x=Goals, y=Goals_against, color = Team))+geom_
163.   jitter()
164.
165. table2v=table2v=table2%>%group_by(Team)%>%summarise_all(sum)
166. table2v=mutate(table2v, Goals_against=Goals_against*-1)
167. table2v=melt(table2v)
168. table2v=left_join(table2v, select(table7, Team, Total_points))
169.
170. table2vtable2v=table2v[order(table2v$variable, table2v$value),]
171. plot2v=ggplot(table2v, aes(x=reorder(Team, Total_points), y=value, fill
172.   =Total_points))+
173.   geom_bar(stat="identity", position="identity")+
174.   geom_text(aes(label=value, vjust = ifelse(value >= 0, 0, 1))
175.     , colour="skyblue4", size=5)+
176.   xlab("Team")+ylab("Goals")+

```

```

174.         geom_hline(yintercept = 0) +
175.         annotate("text", 2, 50, vjust = -
176. 1, label = "Goals For", color="Lightblue", size=8)+
177.         annotate("text", 2, -95, vjust = -
178. 0.3, hjust=0.4, label = "Goals Against", color="Lightblue", size=8)+
179.         theme(panel.grid.major = element_blank(), panel.grid.minor =
180. element_blank(),
181.               panel.background = element_blank(), panel.grid = eleme
182. nt_blank(),
183.               axis.text.y=element_blank(), axis.ticks=element_blank(
184. ),
185.               axis.text.x = element_text(size=15, angle = 90, color=
186. "skyblue4"),
187.               axis.title.x=element_text(size=15),
188.               axis.title.y=element_text(size=15))
189.
190. ##### Plot Accumulate points #####
191. #Accumulate victories
192. table11h=select(data,Date,HomeTeam, FTR, FTHG)
193. table11a=select(data,Date,AwayTeam, FTR, FTAG)
194.
195. table11h$Points=0
196. table11h[table11h$FTR=="H",match("Points",names(table11h)) ]=3
197. table11h[table11h$FTR=="D",match("Points",names(table11h)) ]=1
198.
199. table11a$Points=0
200. table11a[table11a$FTR=="A",match("Points",names(table11a)) ]=3
201. table11a[table11a$FTR=="D",match("Points",names(table11a)) ]=1
202.
203. colnames=names(table11h)
204. colnames(table11a)=colnames
205. table11=rbind(table11h,table11a)
206. names(table11)[2]="Team"
207. table11=left_join(table11, select(table7, Team, Total_points))
208. table11$Team=table11[order(table11$Team,table11$Date),]
209.
210.
211.
212.
213. table11$Team=table11[order(table11$Team,table11$Date),]
214.
215. table11=table11%>%group_by(Team)%>%mutate(CSuma_Points=cumsum(Po
216. ints))
217. library(data.table)
218. table11=as.data.table(table11)
219. table11$Team=table11[, APoints:=c(NA, CSuma_Points[-.N]), by=Team]
220.
221.
222.
223. table11_betsh=select(data, Date,HomeTeam,B365H, BWH,IWH,PSH, WHH,VCH )
224.
225. table11_betsh$Type="H"
226. table11_betsa=select(data, Date,AwayTeam,B365A, BWA,IWA,PSA, WHA,VCA )
227.
228. table11_betsa$Type="A"
229.
230.
231.
232. colnames=names(table11_betsh)
233. names(table11_betsa)=colnames
234.
235.
236.
237. table11_bets=rbind(table11_betsh,table11_betsa)
238. table11_bets$Mean=rowMeans(table11_bets[,3:8])
239. names(table11_bets)[2]="Team"
240.
241.
242.
243. table11=left_join(table11, table11_bets)
244.
245.
246.
247. table11$Team=table11[!is.na(table11$APoints),]
248.
249.
250.
251. table11_acum_p=select(as.data.frame(table11_acum), Team,APoints, Mean,
252. Total_points, Type)

```

```

230.
231.     plot11g=ggplot(table11_acum_p, aes(x=Mean, y=APoints, color = Total_poi
nts)) +
232.         geom_point(size=5)+
233.         xlab("Mean bet value")+
234.         ylab("Accumulate points till the date")
235.
236.     ranking=select(total, Team, Ranking)
237.     table11_acum_p=left_join(table11_acum_p,ranking)
238.     table11_acum_5=filter(table11_acum_p, Ranking<=5) #without outliers
239.
240.     table11_acum_5$Team=factor(table11_acum_5$Team, levels=c("Barcelona","A
th Madrid","Real Madrid", "Valencia", "Villarreal"))
241.     plot11=ggplot(table11_acum_5, aes(x=Mean, y=APoints, color =Team , alph
a=Type)) +
242.         geom_point(size=5)+geom_path()+facet_grid(. ~Team,scales = "free")+
243.         xlab("Mean bet value")+
244.         ylab("Accumulate points till the date")+scale_alpha_discrete(range =
c(0.5,1))+
245.         theme(panel.background = element_rect(fill = "#BFD5E3", colour = "#6D
9EC1",size = 2, linetype = "solid"),
246.               axis.text=element_text(size=10),
247.               axis.title.x=element_text(size=14),
248.               axis.title.y=element_text(size=14),
249.               strip.background = element_rect(color="#6D9EC1", fill="navy", s
ize=1.5, linetype="solid"),
250.               strip.text.x = element_text(size = 12, color = "white"))
251.
252.
253.     ##### Plot Resume statistics #####
254.     library(tidyr)
255.     total_sum1=select(total_sum, Win_home, Draw, Lose_home, Goals, Fouls, S
hots, Shots_t, Corners, Yellow)
256.     total_sum1=gather(total_sum1)
257.     total_sum1=mutate(total_sum1, Mean=(value/380))
258.
259.     total_sum1[4:9,3]=round(total_sum1[4:9,3])
260.     total_sum1[9,1]="Yellow cards"
261.     total_sum1[7,1]="Shots to target"
262.
263.     plot9a=ggplot(total_sum1[4:9,], aes(x=key, y=value))+geom_col(aes(fill
= key), width = 0.7)+
264.         coord_flip()+
265.         geom_label(aes(label = value, color=key), size=8)+
266.         geom_text(aes(label = paste("Mean:",Mean), color=key,hjust = 0.5,vjus
t=4), size = 5)+
267.         theme(axis.text=element_text(size=15),
268.               axis.text.x = element_blank(),
269.               legend.title = element_blank(),
270.               panel.background = element_blank(),
271.               panel.grid.major = element_blank(),
272.               panel.grid.minor = element_blank(),
273.               axis.ticks.x=element_blank(),
274.               legend.position = "none",
275.               axis.title.x=element_blank(),
276.               axis.title.y=element_blank())
277.
278.     library(waffle)
279.     plot9b=waffle(
280.         c('Home win (179 games)= 47%' = 47, 'Draw (86 games)= 23%' = 23, 'Awa
y win (115 games)= 30%' = 30), rows = 10, ccolors = c("navy", "dodgerblue", "gr
een2"),
281.         legend_pos="left"
282.     )+theme(legend.text =element_text(size=20))
283.
284.

```

```

285. ##### Plot total points #####
286. plot1=ggplot(total, aes(x=Team, y=Total_points, fill=Total_points)) +
287.   geom_bar( stat="identity") +
288.   scale_fill_gradient(low="deepskyblue4", high="white", limits=c(0,100)
289. ) +
290.   theme(axis.title.y=element_text(angle=0))+
291.   coord_polar() + aes(x=reorder(Team, Total_points)) +
292.   theme(axis.text.x = element_text(angle=-
293. 20, size=15, colour="deepskyblue4"),
294.   panel.background = element_blank(),
295.   panel.grid.major = element_blank(),
296.   panel.grid.minor = element_blank(),
297.   axis.text.y=element_blank(),
298.   axis.title.x=element_blank(),
299.   axis.title.y=element_blank())
300. ##### Plot percentage of goals #####
301. table19=mutate(total, Percentage_goals=Goals/sum(total$Goals))
302.
303. plot19=ggplot(table19, aes(x="", y=Percentage_goals, fill=reorder(Team, G
304. oals)))+
305.   geom_bar(stat="identity", width=1)+
306.   geom_text(aes(label = paste0(round(Percentage_goals*100), "%")), posi
307. tion = position_stack(vjust = 0.5), size=4.3)+
308.   coord_polar("y")+
309.   labs(x = NULL, y="Percentage of score goals", fill = "Team")+
310.   theme(axis.title.y=element_text(size=15),
311.   axis.text.y=element_text(size=15),
312.   axis.text.x = element_text(size=15, color="skyblue4"),
313.   legend.text = element_text(size=15, colour="deepskyblue4"),
314.   legend.title = element_text(size=15),
315.   panel.background = element_rect(fill = "#BFD5E3", colour = "#6D
316. 9EC1",size = 2, linetype = "solid"))
317. ##### Plot first 5 ranking #####
318.
319. library(scales)
320. principal=total[1:5,]
321. principal_select=select(principal, Team,Win,Lose,Draw,Total_points,Goal
322. s,Shots,Shots_t,Fouls, Yellow)
323. principal_select=mutate(principal_select, `Mean fouls`=round(Fouls/38),
324. `Mean yellow cards`=round(Yellow/38), `Percentage goals from shots`=Goals/Shot
325. s_t*100, `Percentage Shots on target`=Shots_t/Shots*100)
326.
327. principal_select=select(principal_select, Team,Win,Lose,Draw,Total_poin
328. ts,`Mean fouls`, `Mean yellow cards`, `Percentage goals from shots`, `Percentage
329. Shots on target`)
330.
331. library(tidyr)
332. principal_selec1t=gather(principal_select,key=Variable, value=Count, -
333. 1)
334. principal_selec1t$Team=factor(principal_selec1t$Team, levels=c("Barcelo
335. na","Ath Madrid","Real Madrid", "Valencia", "Villarreal"))
336.
337. dat_text <- data.frame(
338.   label = c("79", "93", "76", "73", "61"),
339.   Team = c("Ath Madrid", "Barcelona", "Real Madrid", "Valencia", "Vil
340. larreal"))
341.
342. plot4=ggplot(principal_selec1t, aes(x=reorder(Variable,Count), y=Count,
343. color =Team)) +
344.   geom_point(size=5)+geom_segment( aes(x=Variable,y=0,yend=Count, xend=
345. Variable), size=2)+
346.   coord_flip()+facet_grid(. ~Team,scales = "free")+coord_flip()+

```

```

335.     geom_label(aes(label = round(Count), color=Team, hjust = -
1,vjust=0), size=4)+
336.     geom_text(data= dat_text,mapping = aes(x = -Inf, y = -
Inf, labellabel = label),
337.         hjust = -0.7,vjust = -47)+
338.     theme(panel.background = element_rect(fill = "#BFD5E3", colour = "#6D
9EC1",size = 2, linetype = "solid"),
339.         axis.title.x=element_blank(),
340.         axis.title.y=element_blank(),
341.         strip.background = element_rect(color="#6D9EC1", fill="navy", s
ize=1.5, linetype="solid"),
342.         strip.text.x = element_text(size = 12, color = "white"),
343.         legend.title=element_blank(),
344.         legend.text=element_blank(),
345.         legend.position = "none",
346.         axis.text=element_text(size=12),
347.         panel.grid.major = element_blank(),
348.         axis.text.y=element_blank(),
349.         axis.text.x=element_blank())
350.
351. ##### Plot half time ranking 5 #####
352. total_w=left_join(total_w, select(total, Team, Win))
353. total_w=mutate(total_w,`Percentage of HTR of games won`=Count/Win)
354. table16=total_w[total_w$Team%in%dat_text[,2],]
355. table161=spread(as.data.frame(table16), HTR, `Percentage of HTR of game
s won`)
356.
357. table16$Team=factor(table16$Team, levels=c("Barcelona","Ath Madrid","Re
al Madrid", "Valencia", "Villarreal"))
358. ggplot(table16, aes(x = HTR, y = `Percentage of HTR of games won`, col
= Team, group = Team)) + geom_polygon(fill = NA) +geom_point()+ coord_polar()
359.
360. plot16=ggplot(as.data.frame(table16),aes(x=Team, y=`Percentage of HTR o
f games won`, fill=HTR))+
361.     geom_bar(stat="identity", alpha=0.5)+
362.     geom_text(aes(label = paste0(round(`Percentage of HTR of games won`*1
00),"%"), fill=HTR),position = position_stack(vjust = 0.5))+
363.     scale_fill_brewer('Darkblue')+
364.     guides(fill=guide_legend(title="HTR result"))+
365.     coord_polar(start = 0)+
366.     theme(strip.background = element_blank(),
367.         axis.title.x=element_blank(),
368.         panel.background =element_blank(),
369.         axis.text.x=element_text(size=15),
370.         axis.text.y=element_blank(),
371.         axis.title.y=element_blank(),
372.         axis.ticks=element_blank())
373.
374. ##### Plot half time ranking 5 #####
375. total_w=left_join(total_w, select(total, Team, Win))
376. total_w=mutate(total_w,`Percentage of HTR of games won`=Count/Win)
377. table16=total_w[total_w$Team%in%dat_text[,2],]
378. table161=spread(as.data.frame(table16), HTR, `Percentage of HTR of game
s won`)
379.
380. table16$Team=factor(table16$Team, levels=c("Barcelona","Ath Madrid","Re
al Madrid", "Valencia", "Villarreal"))
381. ggplot(table16, aes(x = HTR, y = `Percentage of HTR of games won`, col
= Team, group = Team)) + geom_polygon(fill = NA) +geom_point()+ coord_polar()
382.
383. plot16=ggplot(as.data.frame(table16),aes(x=Team, y=`Percentage of HTR o
f games won`, fill=HTR))+
384.     geom_bar(stat="identity", alpha=0.5)+

```



```

385.     geom_text(aes(label = paste0(round(`Percentage of HTR of games won`*1
00),"%"), fill=HTR),position = position_stack(vjust = 0.5))+
386.     scale_fill_brewer('Darkblue')+
387.     guides(fill=guide_legend(title="HTR result"))+
388.     coord_polar(start = 0)+
389.     theme(strip.background = element_blank(),
390.           axis.title.x=element_blank(),
391.           panel.background =element_blank(),
392.           axis.text.x=element_text(size=15),
393.           axis.text.y=element_blank(),
394.           axis.title.y=element_blank(),
395.           axis.ticks=element_blank())
396.
397. ##### Plot map #####
398. library(gtable)
399. library(grid)
400. library(maps)
401. library(viridis)
402. library(tidyverse)
403. library(ggmap)
404.
405. setwd("C:/Users/Rafaela Becerra/Desktop/UC3M/R Programming")
406. library(readxl)
407. data1 <- read_excel("Map.xlsx")
408.
409. spain <- map_data("world","Spain")
410. ggplot(spain, aes(x = long, y = lat))+geom_polygon(aes( groupgroup = gr
oup, fill = subregion))+
411.   geom_jitter(data=data1, aes(x = lng, y = lat, color=Team))+
412.   geom_label_repel(data=data1,(aes(x = lng, y = lat, color=Team,label =
paste0(Team,"\n", "City: ",City,"\n", "Stadium: ",Stadium,"\n", "$: ",`Highest p
rice`))),box.padding = 1.8,show.legend = FALSE,size=3)+
413.   theme(panel.background = element_blank(),
414.         legend.position = "none",
415.         axis.title.y=element_blank(),
416.         axis.title.x=element_blank(),
417.         axis.ticks=element_blank(),
418.         axis.text.x=element_blank(),
419.         axis.text.y=element_blank()
420.   )
421.
422. ##### Plot correlation #####
423. data1=left_join(data1, total)
424. data1=select(as.data.frame(data1),`Highest price`,Capacity,Spectators,
Total_points,Win,Shots_t, Goals)
425.
426. cormatrix <- round(cor(data1),2)
427.
428. data2=melt(cormatrix)
429. ggplot(data = data2, aes(x=Var1, y=Var2, fill=value)) +
430.   geom_tile()+
431.   guides(fill=guide_legend(title="Correlation"))+
432.   scale_fill_gradient(low = "steelblue1", high = "midnightblue")+
433.   theme(axis.title.y=element_blank(),
434.         axis.title.x=element_blank(),
435.         axis.text.x=element_text(size=15),
436.         axis.text.y=element_text(size=15),
437.         legend.text = element_text(size=15),
438.         legend.title = element_text(size=15))
439.
440. ##### Plot Probabilities #####
441. ##### Probability winning home and away #####
442. datadata2=data
443. HomeWins_HomeBets <- select(data2, HomeTeam, FTR, B365H, BWH, IWH, PSH,
WHH, VCH)

```



```

444.     AwayWins_AwayBets <- select(data2, AwayTeam, FTR, B365A, BWA, IWA, PSA,
    WHA, VCA)
445.     HomeWins_HomeBets_Filter <- filter(as.data.frame(HomeWins_HomeBets), FTR
    R=="H")
446.     AwayWins_AwayBets_Filter <- filter(as.data.frame(AwayWins_AwayBets), FTR
    R=="A")
447.     HomeWins_HomeBets_Filter[,3:8]= HomeWins_HomeBets_Filter[,3:8]>% mutat
    e_if(is.factor, funs(as.numeric(as.character(.))))
448.
449.     #Convert my list in numeric type for operating
450.     AwayWins_AwayBets_Filter[,3:8]=AwayWins_AwayBets_Filter[,3:8] >% mutat
    e_if(is.factor, funs(as.numeric(as.character(.))))
451.     Prob_HomeWins <- mutate(1/(HomeWins_HomeBets_Filter[,3:8]))
452.     Prob_AwayWins <- mutate(1/(AwayWins_AwayBets_Filter[,3:8]))
453.     Teams_Results_HomeWins <- select(HomeWins_HomeBets_Filter, HomeTeam, FT
    R)
454.     Prob_HomeWins_BetsHome <- cbind(Teams_Results_HomeWins, Prob_HomeWins)
455.     Teams_Results_AwayWins <- select(AwayWins_AwayBets_Filter, AwayTeam, FT
    R)
456.     Prob_AwayWins_BetsAway <- cbind(Teams_Results_AwayWins, Prob_AwayWins)
457.     Prob_HomeWins_BetsHome_t <- Prob_HomeWins_BetsHome >% group_by(HomeTea
    m,B365H,BWH,IWH,PSH,WHH,VCH) >% summarise(count=n())
458.     Prob_AwayWins_BetsAway_t <- Prob_AwayWins_BetsAway >% group_by(AwayTea
    m,B365A,BWA,IWA,PSA,WHA,VCA) >% summarise(count=n())
459.     Prob_HomeWins_BetsHome_mean <- Prob_HomeWins_BetsHome_t >% group_by(Ho
    meTeam) >% summarise_all(mean) >% select(-count)
460.     Prob_HomeWins_BetsHome_mean$Prob_HomeWins_mean=rowMeans(Prob_HomeWins_B
    etsHome_mean[,2:7])
461.     Prob_HomeWins_mean_t <- select(Prob_HomeWins_BetsHome_mean, HomeTeam, P
    rob_HomeWins_mean)
462.     Prob_AwayWins_BetsAway_mean <- Prob_AwayWins_BetsAway_t >% group_by(Aw
    ayTeam) >% summarise_all(mean) >% select(-count)
463.     Prob_AwayWins_BetsAway_mean$Prob_AwayWins_mean=rowMeans(Prob_AwayWins_B
    etsAway_mean[,2:7])
464.     Prob_AwayWins_mean_t <- select(Prob_AwayWins_BetsAway_mean, AwayTeam, P
    rob_AwayWins_mean)
465.     Results <- select(data, HomeTeam, AwayTeam, FTR)
466.     N_HomeWins <- filter(as.data.frame(Results), FTR=="H")
467.     N_AwayWins <- filter(as.data.frame(Results), FTR=="A")
468.     N_HomeWins_Team <- N_HomeWins >% group_by(HomeTeam) >% summarise(coun
    t=n())
469.     names(N_HomeWins_Team)[2]=c("N_HomeWins")
470.     N_AwayWins_Team <- N_AwayWins >% group_by(AwayTeam) >% summarise(coun
    t=n())
471.     names(N_AwayWins_Team)[2]=c("N_AwayWins")
472.
473.     #Resume
474.     Total_Data_Prob <- cbind(Prob_HomeWins_mean_t, Prob_AwayWins_mean_t)
475.     Total_Data_Prob2 <- select(Total_Data_Prob, -AwayTeam)
476.     names(Total_Data_Prob2)[2]=c('Mean Prob of HomeWins')
477.     names(Total_Data_Prob2)[3]=c('Mean Prob of AwayWins')
478.     names(Total_Data_Prob2)[1]=c("Team")
479.     Total_Data_Prob2_Long <- melt(Total_Data_Prob2)
480.     names(Total_Data_Prob2_Long)[2]=c("Probs")
481.     names(Total_Data_Prob2_Long)[3]=c("Value1")
482.
483.     Total_Data_N <- cbind(N_HomeWins_Team, N_AwayWins_Team)
484.     Total_Data_N2 <- select(Total_Data_N, -AwayTeam)
485.     names(Total_Data_N2)[1]=c("Team2")
486.     names(Total_Data_N2)[2]=c("N of Home Wins")
487.     names(Total_Data_N2)[3]=c("N of Away Wins")
488.     Total_Data_N2_Long <- melt(Total_Data_N2)
489.     names(Total_Data_N2_Long)[2]=c("Quantity")
490.     names(Total_Data_N2_Long)[3]=c("Value2")

```

```

491.
492.   Total_Data_VF1 <- cbind(Total_Data_Prob2_Long, Total_Data_N2_Long)
493.   Total_Data_VF1 <- select(Total_Data_VF1, -Team2)
494.
495.   names(Total_Data_VF1)
496.
497.   ##### Plot home/away all teams #####
498.   library(gtable)
499.   library(grid)
500.
501.   ggplot(Total_Data_VF1) +
502.     geom_bar(aes(x=Team, y=Value1*15, fill = Probs), alpha=0.7, stat="ide
ntity", position = "dodge") +
503.     geom_line(aes(x= Team, y = Value2, colour = Quantity, group = Quantit
y)) +
504.     scale_fill_manual(values=c('steelblue1', 'skyblue4')) +
505.     scale_color_manual(values=c('red4', 'salmon')) +
506.     scale_y_continuous(sec.axis = sec_axis(~./15, name= "Probability of W
in (Home/Away)")) +
507.     xlab("Teams") + ylab("N of Wins (Home/Away)") +
508.     theme(axis.text.x = element_text(size=15, angle = 90, color="skyblue
4"),
509.           panel.background = element_rect(fill = "#BFD5E3", colour = "#6D9EC1
", size = 2, linetype = "solid"),
510.           legend.text=element_text(size=15),
511.           legend.title=element_text(size=15)
512.     )
513.
514.   ##### Prbability of winning considering all teams #####
515.   colnames=names(Prob_HomeWins_BetsHome_t)
516.   colnames(Prob_AwayWins_BetsAway_t)=colnames
517.   Prob_Wins_Match <- rbind(Prob_HomeWins_BetsHome_t, Prob_AwayWins_BetsAw
ay_t)
518.   Prob_Wins_Match <- select(Prob_Wins_Match, -count)
519.   Prob_Wins_Match$Prob_Wins_Match_mean= (rowMeans(Prob_Wins_Match[,2:7])*
100)
520.   Prob_Wins_Team <- cbind(Prob_Wins_Match[1], Prob_Wins_Match[8])
521.   names(Prob_Wins_Team)[1]=c("Team")
522.   Total_Data_VF2 <- Prob_Wins_Team
523.
524.   ggplot(Total_Data_VF2) +
525.     geom_boxplot(aes(x=Team, y=Prob_Wins_Match_mean, color=Team))+
526.     theme (axis.text.x = element_text(size=15, angle = 90, color="skyblue4
"),
527.           panel.background = element_rect(fill = "#BFD5E3", colour = "#
6D9EC1", size = 2, linetype = "solid"),
528.           legend.text=element_text(size=15),
529.           legend.title=element_text(size=15),
530.           panel.grid.major = element_blank(), panel.grid.minor = element_
blank())
531.
532.
533.   ##### Benefit of bookmakers #####
534.   Date_and_bets <- select(data2, HomeTeam, Date, B365H, B365A, B365D, BWH
, BWA, BWD, IWH, IWA, IWD, PSH, PSA, PSD, WHH, WHA, WHD, VCH, VCA, VCD)
535.   Date_and_bets[,3:20]=Date_and_bets[,3:20] %>% mutate_if(is.factor, funs
(as.numeric(as.character(.))))
536.   Date_and_bets[,3] <- (1/(Date_and_bets[,3]))
537.   Date_and_bets[,4] <- (1/(Date_and_bets[,4]))
538.   Date_and_bets[,5] <- (1/(Date_and_bets[,5]))
539.   Date_and_bets[,6] <- (1/(Date_and_bets[,6]))
540.   Date_and_bets[,7] <- (1/(Date_and_bets[,7]))
541.   Date_and_bets[,8] <- (1/(Date_and_bets[,8]))
542.   Date_and_bets[,9] <- (1/(Date_and_bets[,9]))
543.   Date_and_bets[,10] <- (1/(Date_and_bets[,10]))

```

```

544.     Date_and_bets[,11] <- (1/(Date_and_bets[,11]))
545.     Date_and_bets[,12] <- (1/(Date_and_bets[,12]))
546.     Date_and_bets[,13] <- (1/(Date_and_bets[,13]))
547.     Date_and_bets[,14] <- (1/(Date_and_bets[,14]))
548.     Date_and_bets[,15] <- (1/(Date_and_bets[,15]))
549.     Date_and_bets[,16] <- (1/(Date_and_bets[,16]))
550.     Date_and_bets[,17] <- (1/(Date_and_bets[,17]))
551.     Date_and_bets[,18] <- (1/(Date_and_bets[,18]))
552.     Date_and_bets[,19] <- (1/(Date_and_bets[,19]))
553.     Date_and_bets[,20] <- (1/(Date_and_bets[,20]))
554.
555.
556.     #Lo calculo en %
557.     Date_and_bets[,21] <- (1-(rowSums(Date_and_bets[,3:5])))
558.     Date_and_bets[,22] <- Date_and_bets[,21]*-100
559.     Date_and_bets[,23] <- (1-(rowSums(Date_and_bets[,6:8])))
560.     Date_and_bets[,24] <- Date_and_bets[,23]*-100
561.     Date_and_bets[,25] <- (1-(rowSums(Date_and_bets[,9:11])))
562.     Date_and_bets[,26] <- Date_and_bets[,25]*-100
563.     Date_and_bets[,27] <- (1-(rowSums(Date_and_bets[,12:14])))
564.     Date_and_bets[,28] <- Date_and_bets[,27]*-100
565.     Date_and_bets[,29] <- (1-(rowSums(Date_and_bets[,15:17])))
566.     Date_and_bets[,30] <- Date_and_bets[,29]*-100
567.     Date_and_bets[,31] <- (1-(rowSums(Date_and_bets[,18:20])))
568.     Date_and_bets[,32] <- Date_and_bets[,31]*-100
569.
570.
571.     names(Date_and_bets)[22]=c("PBenB365")
572.     names(Date_and_bets)[24]=c("PBenBW")
573.     names(Date_and_bets)[26]=c("PBenIW")
574.     names(Date_and_bets)[28]=c("PBenPS")
575.     names(Date_and_bets)[30]=c("PBenWH")
576.     names(Date_and_bets)[32]=c("PBenVC")
577.
578.     Date_and_bets[,2] = format(as.Date(Date_and_bets[,2]), "%d-%m-%y")
579.
580.     Date_and_bets$Month = format(as.Date(Date_and_bets[,2]), "%m-%y")
581.
582.     BrandBenefit_date <- select(Date_and_bets, PBenB365, PBenBW, PBenIW, PBenPS, PBenWH, PBenVC, Month)
583.
584.     BrandBenefit_mean <- BrandBenefit_date %>% group_by(Month) %>% summarise_all(mean)
585.
586.     BrandBenefit_mean_Long <- melt(BrandBenefit_mean)
587.
588.     Total_BrandBenefit_mean <- BrandBenefit_mean_Long %>% group_by(variable) %>% summarise_all(mean)
589.
590.     Total_Data_VF3 <- select(Total_BrandBenefit_mean, -Month)
591.
592.     names(Total_Data_VF3)[1]=c("BetBrand")
593.     names(Total_Data_VF3)[2]=c("PBen")
594.
595.     ##### Plot benefit #####
596.     ggplot(Total_Data_VF3, aes(x = "", y = PBen, fill = reorder(BetBrand, PBen))) +
597.       geom_bar(width = 1, stat = "identity", color = "white") +
598.       coord_polar("y", start = 0) +
599.       geom_text(aes(label = scales::percent(round(PBen/100,3))), position = position_stack(vjust = 0.5)) +
600.       labs(x = NULL, y = NULL, fill = NULL) +
601.       theme(axis.text.x= element_blank(),
602.             axis.ticks=element_blank(),
603.             panel.background = element_blank(),
604.             legend.text=element_text(size=15),

```

```

605.         axis.text=element_text(size=15),
606.     )
607.
608.
609.     ##### Fouls, goals and shots per season #####
610.     #####
611.     Matches_and_FGS <- select(data2, HomeTeam, Date, FTHG, FTAG, HS, AS, HF,
612.     AF)
613.
614.     Matches_and_FGS[,3:6]=Matches_and_FGS[,3:6] %>% mutate_if(is.factor, funs
615.     (as.numeric(as.character(.))))
616.
617.     Matches_and_FGS[,2] = format(as.Date(Matches_and_FGS[,2]), "%d-%m-%y")
618.
619.     Matches_and_FGS$Month = format(as.Date(Matches_and_FGS[,2]), "%m-%y")
620.
621.     Matches_and_FGS$Total_Fouls <- (Matches_and_FGS[,7]) + (Matches_and_FGS[,8
622.     ])
623.
624.     Matches_and_FGS$Total_Shots <- (Matches_and_FGS[,5]) + (Matches_and_FGS[,6
625.     ])
626.
627.     Matches_and_FGS$Total_Goals <- (Matches_and_FGS[,3]) + (Matches_and_FGS[,4
628.     ])
629.
630.     Matches_and_TotalFGS <- select(Matches_and_FGS, HomeTeam, Month, Total_Fo
631.     uls, Total_Goals, Total_Shots)
632.
633.     Matches_and_TotalFGS_Month <- select(Matches_and_TotalFGS, Month, Total_F
634.     ouls, Total_Goals, Total_Shots)
635.
636.     TotalF_Month <- aggregate(Matches_and_TotalFGS_Month$Total_Fouls, by=lis
637.     t(Category=Matches_and_TotalFGS_Month$Month), FUN=sum)
638.     names(TotalF_Month)[1]=c("Month")
639.     names(TotalF_Month)[2]=c("Total_Fouls")
640.
641.     TotalS_Month <- aggregate(Matches_and_TotalFGS_Month$Total_Shots, by=lis
642.     t(Category=Matches_and_TotalFGS_Month$Month), FUN=sum)
643.     names(TotalS_Month)[1]=c("Month3")
644.     names(TotalS_Month)[2]=c("Total_Shots")
645.
646.     TotalG_Month <- aggregate(Matches_and_TotalFGS_Month$Total_Goals, by=lis
647.     t(Category=Matches_and_TotalFGS_Month$Month), FUN=sum)
648.     names(TotalG_Month)[1]=c("Month2")
649.     names(TotalG_Month)[2]=c("Total_Goals")
650.
651.     TotalFGS_Month <- cbind(TotalF_Month, TotalG_Month, TotalS_Month)
652.     TotalFGS_Month <- select(TotalFGS_Month, -Month2, -Month3)
653.
654.     #Calculo del mean por partido
655.     TotalFGS_Month[1,5] <- (TotalFGS_Month[1,2]/40)
656.     TotalFGS_Month[1,6] <- (TotalFGS_Month[1,3]/40)
657.     TotalFGS_Month[1,7] <- (TotalFGS_Month[1,4]/40)
658.     TotalFGS_Month[2,5] <- (TotalFGS_Month[2,2]/48)
659.     TotalFGS_Month[2,6] <- (TotalFGS_Month[2,3]/48)
660.     TotalFGS_Month[2,7] <- (TotalFGS_Month[2,4]/48)
661.     TotalFGS_Month[3,5] <- (TotalFGS_Month[3,2]/37)
662.     TotalFGS_Month[3,6] <- (TotalFGS_Month[3,3]/37)
663.     TotalFGS_Month[3,7] <- (TotalFGS_Month[3,4]/37)
664.     TotalFGS_Month[4,5] <- (TotalFGS_Month[4,2]/54)
665.     TotalFGS_Month[4,6] <- (TotalFGS_Month[4,3]/54)
666.     TotalFGS_Month[4,7] <- (TotalFGS_Month[4,4]/54)
667.     TotalFGS_Month[5,5] <- (TotalFGS_Month[5,2]/32)
668.     TotalFGS_Month[5,6] <- (TotalFGS_Month[5,3]/32)

```

```

660. TotalFGS_Month[5,7] <- (TotalFGS_Month[5,4]/32)
661. TotalFGS_Month[6,5] <- (TotalFGS_Month[6,2]/20)
662. TotalFGS_Month[6,6] <- (TotalFGS_Month[6,3]/20)
663. TotalFGS_Month[6,7] <- (TotalFGS_Month[6,4]/20)
664. TotalFGS_Month[7,5] <- (TotalFGS_Month[7,2]/45)
665. TotalFGS_Month[7,6] <- (TotalFGS_Month[7,3]/45)
666. TotalFGS_Month[7,7] <- (TotalFGS_Month[7,4]/45)
667. TotalFGS_Month[8,5] <- (TotalFGS_Month[8,2]/35)
668. TotalFGS_Month[8,6] <- (TotalFGS_Month[8,3]/35)
669. TotalFGS_Month[8,7] <- (TotalFGS_Month[8,4]/35)
670. TotalFGS_Month[9,5] <- (TotalFGS_Month[9,2]/30)
671. TotalFGS_Month[9,6] <- (TotalFGS_Month[9,3]/30)
672. TotalFGS_Month[9,7] <- (TotalFGS_Month[9,4]/30)
673. TotalFGS_Month[10,5] <- (TotalFGS_Month[10,2]/39)
674. TotalFGS_Month[10,6] <- (TotalFGS_Month[10,3]/39)
675. TotalFGS_Month[10,7] <- (TotalFGS_Month[10,4]/30)
676.
677.
678. TotalFGS_Month_mean <- select(TotalFGS_Month,Month, V5,V6,V7)
679. names(TotalFGS_Month_mean)[2]=c("Total_Fouls")
680. names(TotalFGS_Month_mean)[3]=c("Total_Goals")
681. names(TotalFGS_Month_mean)[4]=c("Total_Shots")
682.
683. Total_Data_VF4 <- melt(TotalFGS_Month_mean)
684.
685. Total_Data_VF4$Month <- as.Date(paste("01-
",Total_Data_VF4$Month,sep=""), "%d-%m-%y")
686.
687. ##### Plot goals season #####
688. ggplot(Total_Data_VF4, aes(x=Month, y=value, group=variable, color=variable)) +
689.   geom_line() +
690.   scale_color_manual(values=c('navyblue', 'steelblue1', "red4")) +
691.   xlab("Month") + ylab("Mean") +
692.   theme(panel.background = element_rect(fill = "#BFD5E3", colour = "#6D
9EC1",size = 2, linetype = "solid"),
693.         legend.text=element_text(size=15)
694.   )
695. ##### Plot pr for winning away and home for each team #####
696. Wins_vs_HT <- select(data2, HomeTeam, AwayTeam, FTR, HTR)
697. Wins_vs_HT_Home <- select(Wins_vs_HT, HomeTeam, FTR, HTR)
698. Wins_vs_HT_Away <- select(Wins_vs_HT, AwayTeam, FTR, HTR)
699.
700. #Count del Win-Win
701. Wins_vs_HT_WWH <- filter(as.data.frame(Wins_vs_HT_Home), FTR=="H", HTR
== "H")
702. Total_vs_HT_WWH <- Wins_vs_HT_WWH %>% group_by(HomeTeam) %>% summarise(
count=n())
703. names(Total_vs_HT_WWH)[1]=c("Team")
704. names(Total_vs_HT_WWH)[2]=c("WWH")
705.
706. Wins_vs_HT_WWA <- filter(as.data.frame(Wins_vs_HT_Away), FTR=="A", HTR
== "A")
707. Total_vs_HT_WWA <- Wins_vs_HT_WWA %>% group_by(AwayTeam) %>% summarise(
count=n())
708. names(Total_vs_HT_WWA)[1]=c("Team")
709. names(Total_vs_HT_WWA)[2]=c("WWA")
710.
711. #lo unimos y calculamos total
712. Total_Wins_vs_HT_WW <- left_join(Total_vs_HT_WWH , Total_vs_HT_WWA)
713.
714. Total_Wins_vs_HT_WW[,2:3]=Total_Wins_vs_HT_WW[,2:3] %>% mutate_if(is.factor,
fun(as.numeric(as.character(.))))
715.

```

```

716.     Total_Wins_vs_HT_WW$Total_WW <- (Total_Wins_vs_HT_WW[,2]) + (Total_Wins
_vs_HT_WW[,3])
717.
718.     Total_WW_Team <- select(Total_Wins_vs_HT_WW, Team, Total_WW)
719.
720.
721.     #Count del Draw-Win
722.     Wins_vs_HT_DWH <- filter(as.data.frame(Wins_vs_HT_Home), FTR=="H", HTR
== "D")
723.     Total_vs_HT_DWH <- Wins_vs_HT_DWH %>% group_by(HomeTeam) %>% summarise(
count=n())
724.     names(Total_vs_HT_DWH)[1]=c("Team")
725.     names(Total_vs_HT_DWH)[2]=c("DWH")
726.
727.     Wins_vs_HT_DWA <- filter(as.data.frame(Wins_vs_HT_Away), FTR=="A", HTR
== "D")
728.     Total_vs_HT_DWA <- Wins_vs_HT_DWA %>% group_by(AwayTeam) %>% summarise(
count=n())
729.     names(Total_vs_HT_DWA)[1]=c("Team")
730.     names(Total_vs_HT_DWA)[2]=c("DWA")
731.
732.     Total_Wins_vs_HT_DW <- left_join(Total_vs_HT_DWH , Total_vs_HT_DWA) %>%
733.     mutate(DWA = ifelse(is.na(DWA), 0, DWA))
734.     Total_Wins_vs_HT_DW$Total_DW <- (Total_Wins_vs_HT_DW[,2]) + (Total_Wins
_vs_HT_DW[,3])
735.     Total_DW_Team <- select(Total_Wins_vs_HT_DW, Team, Total_DW)
736.
737.     #Calculo del Win-Loss
738.     Wins_vs_HT_LWH <- filter(as.data.frame(Wins_vs_HT_Home), FTR=="H", HTR
== "A")
739.     Total_vs_HT_LWH <- Wins_vs_HT_LWH %>% group_by(HomeTeam) %>% summarise(
count=n())
740.     names(Total_vs_HT_LWH)[1]=c("Team")
741.     names(Total_vs_HT_LWH)[2]=c("LWH")
742.
743.     Wins_vs_HT_LWA <- filter(as.data.frame(Wins_vs_HT_Away), FTR=="A", HTR
== "H")
744.     Total_vs_HT_LWA <- Wins_vs_HT_LWA %>% group_by(AwayTeam) %>% summarise(
count=n())
745.     names(Total_vs_HT_LWA)[1]=c("Team")
746.     names(Total_vs_HT_LWA)[2]=c("LWA")
747.
748.     Total_Wins_vs_HT_LW <- left_join(Total_vs_HT_LWH , Total_vs_HT_LWA) %>%
749.     mutate(LWA = ifelse(is.na(LWA), 0, LWA))
750.
751.     Total_Wins_vs_HT_LW$Total_LW <- (Total_Wins_vs_HT_LW[,2]) + (Total_Wins
_vs_HT_LW[,3])
752.
753.     Total_LW_Team <- select(Total_Wins_vs_HT_LW, Team, Total_LW)
754.     Total_WW_DW_Team <- left_join(Total_WW_Team, Total_DW_Team) %>%
755.     mutate(Total_DW = ifelse(is.na(Total_DW$DWH), 0, Total_DW$DWH))
756.
757.     Total_WW_DW_LW_Team <- left_join(Total_WW_Team, left_join(Total_DW_Team
, Total_LW_Team)) %>%
758.     mutate(Total_DW = ifelse(is.na(Total_DW$DWH), 0, Total_DW$DWH),
759.           Total_LW = ifelse(is.na(Total_LW$LWH), 0, Total_LW$LWH),
760.           Total_WW = ifelse(is.na(Total_WW$WWH), 0, Total_WW$WWH)) %>%
761.     data.frame()
762.
763.     colnames(Total_WW_DW_LW_Team)
764.
765.     Total_Data_VF5 <-melt(Total_WW_DW_LW_Team)
766.

```

```

767.     ggplot(Total_Data_VF5, aes(x=Team, y=value, fill=variable)) +
768.       geom_bar(stat="identity", position="stack") +
769.       scale_fill_manual(values=c('navyblue', 'steelblue1', "skyblue4")) +
770.       xlab("Team") + ylab("N of Wins") +
771.       theme(panel.background = element_rect(fill = "#BFD5E3", colour = "#6D
9EC1",size = 2, linetype = "solid"),
772.             axis.text=element_text(size=15),
773.             axis.text.x = element_text(size=15,angle = 90, color="skyblue4"
),
774.             axis.title.y=element_text(size=15),
775.             legend.text=element_text(size=15),
776.             legend.title=element_text(size=15))
777.
778.
779.     #####Save
780.     setwd("C:/Users/Rafaela Becerra/Desktop/UC3M/R Programming/Project 1")
781.     save=function(x){
782.       a=paste("C:/Users/Rafaela Becerra/Desktop/UC3M/R Programming/Project
1/", "x", ".png")
783.       png(file.path(a))
784.       x
785.       dev.off()
786.     }
787.     save(plot2)

```