Kashyap7/4/2017 miniproject2.r

miniproject2.r *Ankit Kashyap*

*Tue* *Jul* *04* *23:32:46* *2017*

*#* *Analysis* *of* *Airline* *Ticket* *Pricing* *#* *NAME:* *ANKIT* *KASHYAP*

*#* *EMAIL:* *ankitkashyap.te15@rvce.edu.in* *#* *COLLEGE:* *R.V* *COLLEGE* *OF* *ENGINEERING*

*#######PREMIUM* *ECONOMY* *VS* *ECONOMY* *TICKET* *PRICING* *BY* *AIRLINES#######* *##setting* *the* *directory* *and* *assigning* *a* *variabel* *to* *the* *data* *frame* setwd("C:/Users/Ankit/Desktop/harvard")

*#Reading* *the* *dataset* *and* *creating* *a* *data* *frame* air.df<‐read.csv(paste("SixAirlines.csv",sep = ""))

*#Viewing* *the* *data* *frame* View(air.df)

*##Analyzing* *the* *summary* *of* *the* *data* *and* *describing* *the* *variables* library(psych)

describe(air.df)

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## vars n mean sd median trimmed mad min

## AIRLINE\* 1 462 ## AIRCRAFT 2 462 ## FLIGHT\_DURATION 3 462 ## MONTH 4 462

## INTERNATIONAL 5 462

3.02 1.65 0.33 0.47 7.55 3.54 1.67 1.05

0.91 0.28

2.00 2.90 0.00 0.28 7.75 7.54 2.00 1.71

1.00 1.00

1.48 1.00 0.00 0.00 4.82 1.25 1.48 0.00

0.00 0.00

## SEATS\_ECONOMY 6 462 200.71 77.96 185.00 193.76 85.99 17.00 ## SEATS\_PREMIUM 7 462 33.54 13.26 36.00 33.20 11.86 8.00

## PITCH\_ECONOMY ## PITCH\_PREMIUM ## WIDTH\_ECONOMY

## WIDTH\_PREMIUM

8 462 31.21 9 462 37.92 10 462 17.83

11 462 19.48

0.66 31.00 31.25 1.32 38.00 38.06 0.56 18.00 17.81

1.10 19.00 19.54

0.00 30.00 0.00 34.00 0.00 17.00

0.00 17.00

## PRICE\_ECONOMY 12 462 1317.06 989.81 1224.00 1231.30 1163.84 65.00 ## PRICE\_PREMIUM 13 462 1832.35 1289.97 1710.00 1782.94 1852.51 86.00 ## PRICE\_RELATIVE 14 462 0.49 0.45 0.38 0.43 0.42 0.02 ## N 15 462 234.25 86.88 227.00 227.69 90.44 38.00

## LAMBDA

## QUALITY

16 462 0.15 0.06

17 462 6.72 1.78

0.13 0.14

7.00 6.79

0.03 0.05

0.00 2.00

## max range skew kurtosis se

## AIRLINE\*

## AIRCRAFT

6.00 5.00 0.59

1.00 1.00 0.74

‐0.95 0.08

‐1.46 0.02

## FLIGHT\_DURATION 14.66 ## MONTH 3.00

## INTERNATIONAL 1.00

13.41 ‐0.05 3.00 ‐0.16

1.00 ‐2.93

‐1.12 0.16 ‐1.20 0.05

6.60 0.01

## SEATS\_ECONOMY

## SEATS\_PREMIUM

389.00 372.00 0.61

66.00 58.00 0.25

‐0.26 3.63

‐0.46 0.62

## PITCH\_ECONOMY ## PITCH\_PREMIUM ## WIDTH\_ECONOMY

## WIDTH\_PREMIUM

33.00 3.00 ‐0.03 40.00 6.00 ‐1.48 19.00 2.00 ‐0.03

21.00 4.00 ‐0.09

‐0.38 0.03 3.43 0.06 ‐0.12 0.03

‐0.34 0.05

## PRICE\_ECONOMY

## PRICE\_PREMIUM

3593.00 3528.00 0.52

7414.00 7328.00 0.51

‐0.88 46.05

0.41 60.01

## PRICE\_RELATIVE ## N

## LAMBDA

1.89 1.87 1.14 441.00 403.00 0.61

0.55 0.50 2.70

0.61 0.02 ‐0.44 4.04

14.02 0.00

## QUALITY 10.00 8.00 ‐0.51 1.67 0.08

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summary(air.df)

## AIRLINE AIRCRAFT FLIGHT\_DURATION MONTH

## AirFrance: 74 Min. :0.0000 Min. : 1.250 Min. :0.000

## British :175

## Delta : 46

1st Qu.:0.0000

Median :0.0000

1st Qu.: 4.250

Median : 7.750

1st Qu.:1.000

Median :2.000

## Jet : 65 Mean :0.3268 Mean : 7.549 Mean :1.671 ## Singapore: 40 3rd Qu.:1.0000 3rd Qu.:10.500 3rd Qu.:3.000 ## Virgin : 62 Max. :1.0000 Max. :14.660 Max. :3.000 ## INTERNATIONAL SEATS\_ECONOMY SEATS\_PREMIUM PITCH\_ECONOMY ## Min. :0.0000 Min. : 17.0 Min. : 8.00 Min. :30.00

## 1st Qu.:1.0000

## Median :1.0000

1st Qu.:127.0

Median :185.0

1st Qu.:21.00

Median :36.00

1st Qu.:31.00

Median :31.00

## Mean :0.9134 Mean :200.7 Mean :33.54 Mean :31.21 ## 3rd Qu.:1.0000 3rd Qu.:243.0 3rd Qu.:40.00 3rd Qu.:32.00 ## Max. :1.0000 Max. :389.0 Max. :66.00 Max. :33.00 ## PITCH\_PREMIUM WIDTH\_ECONOMY WIDTH\_PREMIUM PRICE\_ECONOMY ## Min. :34.00 Min. :17.00 Min. :17.00 Min. : 65.0

## 1st Qu.:38.00

## Median :38.00

1st Qu.:17.00

Median :18.00

1st Qu.:19.00

Median :19.00

1st Qu.: 404.8

Median :1224.0

## Mean :37.92 Mean :17.83 Mean :19.48 Mean :1317.1 ## 3rd Qu.:38.00 3rd Qu.:18.00 3rd Qu.:21.00 3rd Qu.:1903.0 ## Max. :40.00 Max. :19.00 Max. :21.00 Max. :3593.0 ## PRICE\_PREMIUM PRICE\_RELATIVE N LAMBDA

## Min. : 86 Min. :0.0200 Min. : 38.0 Min. :0.0500

## 1st Qu.: 524

## Median :1710

1st Qu.:0.1000

Median :0.3800

1st Qu.:162.0

Median :227.0

1st Qu.:0.1200

Median :0.1300

## Mean :1832 Mean :0.4926 Mean :234.2 Mean :0.1503 ## 3rd Qu.:2989 3rd Qu.:0.7475 3rd Qu.:279.0 3rd Qu.:0.1500 ## Max. :7414 Max. :1.8900 Max. :441.0 Max. :0.5500 ## QUALITY

## Min. : 2.000 ## 1st Qu.: 6.000 ## Median : 7.000 ## Mean : 6.716 ## 3rd Qu.: 7.000 ## Max. :10.000

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*##Analyzing* *data* *with* *respect* *to* *every* *airline*

by(air.df$PRICE\_ECONOMY,air.df$AIRLINE,mean)

## air.df$AIRLINE: AirFrance ## [1] 2769.784

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: British

## [1] 1293.48

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Delta

## [1] 560.9348

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Jet

## [1] 269.6769

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Singapore

## [1] 860.25

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Virgin

## [1] 1603.532

by(air.df$PRICE\_PREMIUM,air.df$AIRLINE,mean)

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## air.df$AIRLINE: AirFrance ## [1] 3065.216

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: British

## [1] 1937.029

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Delta

## [1] 684.6739

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Jet

## [1] 475.4

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Singapore

## [1] 1239.925

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Virgin

## [1] 2721.694

by(air.df$SEATS\_ECONOMY,air.df$AIRLINE,mean)

## air.df$AIRLINE: AirFrance ## [1] 214.4595

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: British

## [1] 216.5886

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Delta

## [1] 137.2174

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Jet

## [1] 132.7231

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Singapore

## [1] 243.6

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Virgin

## [1] 230.1774

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by(air.df$SEATS\_PREMIUM,air.df$AIRLINE,mean)

## air.df$AIRLINE: AirFrance ## [1] 26.7027

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: British

## [1] 43.18286

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Delta

## [1] 22.56522

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Jet

## [1] 15.98462

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Singapore

## [1] 31.2

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Virgin

## [1] 42.53226

by(air.df$WIDTH\_ECONOMY,air.df$AIRLINE,mean)

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## air.df$AIRLINE: AirFrance ## [1] 17.56757

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: British

## [1] 18

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Delta

## [1] 17.3913

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Jet

## [1] 17.10769

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Singapore

## [1] 19

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Virgin

## [1] 18

by(air.df$WIDTH\_PREMIUM,air.df$AIRLINE,mean)

## air.df$AIRLINE: AirFrance ## [1] 19

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: British

## [1] 19

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Delta

## [1] 17.78261

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Jet

## [1] 20.78462

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Singapore

## [1] 20

## ‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐‐ ## air.df$AIRLINE: Virgin

## [1] 21

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*##Drawing* *boxplots* *among* *comparable* *parameters*

*#Reading* *variables* *except* *airline* *beacause* *it's* *a* *string* air1 = air.df[,2:17]

View(air1) *##Taking* *log* air2=log(air1+1)

boxplot(air2, xlab="Value", ylab="Parameters", main="BoxPlot Presentation Of differnt Parameters")

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*##Individual* *boxplots* *for* *comparable* *parameters*

par(mfrow=c(1,2))

with(air.df, boxplot(air.df$PRICE\_ECONOMY,main="Price of Economy seats",ylab="Price in $")) with(air.df, boxplot(air.df$PRICE\_PREMIUM,main="Price of Premium seats",ylab="Price in $"))

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par(mfrow=c(1,1))

par(mfrow=c(1,2))

with(air.df, boxplot(air.df$WIDTH\_ECONOMY,main="Width of Economy seats",ylab="Width in inches")) with(air.df, boxplot(air.df$WIDTH\_PREMIUM,main="width of Premium seats",ylab="Width in inches"))

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par(mfrow=c(1,1))

par(mfrow=c(1,2))

with(air.df, boxplot(air.df$PITCH\_ECONOMY,main="Pitch of Economy seats",ylab="Pitch in inches")) with(air.df, boxplot(air.df$PITCH\_PREMIUM,main="Pitch of Premium seats",ylab="Pitch in inches"))

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par(mfrow=c(1,1))

par(mfrow=c(1,2))

with(air.df, boxplot(air.df$SEATS\_ECONOMY,main="No. of Economy seats",ylab="Count")) with(air.df, boxplot(air.df$SEATS\_PREMIUM,main="No. of Premium seats",ylab="Count"))

par(mfrow=c(1,1))

boxplot(air.df$FLIGHT\_DURATION, main="Duration of Flights",ylab="Hours")

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*##Price* *of* *seats* *varying* *with* *aircart* *company*

boxplot(air.df$PRICE\_ECONOMY~air.df$AIRCRAFT,yaxt="n", horizontal=TRUE,main="Price of Economy seats with Aircraft company",x lab="Price in $", ylab="Name of the aircraft company")

axis(side=2, at=c(1,2), labels = c("Boeing", "Airbus"))

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boxplot(air.df$PRICE\_PREMIUM~air.df$AIRCRAFT,yaxt="n", horizontal=TRUE,main="Price of Premium seats with Aircraft company",x lab="Price in $", ylab="Name of the aircraft company")

axis(side=2, at=c(1,2), labels = c("Boeing", "Airbus"))

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*##Plots*

plot(jitter(air.df$INTERNATIONAL), jitter(air.df$AIRCRAFT))

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*##PRICE* *OF* *SEAT* *VARYING* *WITH* *FLIGHT* *DURATION*

plot(air.df$FLIGHT\_DURATION~air.df$PRICE\_ECONOMY,main="Price of Economy seat with flight duration",xlab = "Flight Duration i n Hours", ylab="Price of seats in $", cex=1.1)

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library(car)

##

## Attaching package: 'car'

## The following object is masked from 'package:psych': ##

## logit

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scatterplot(air.df$PRICE\_ECONOMY,air.df$FLIGHT\_DURATION,main="Price of Economy seat with flight duration",ylab = "Flight Dur ation in Hours", xlab="Price of seats in $",cex=1.1,pch=19)

plot(air.df$FLIGHT\_DURATION~air.df$PRICE\_PREMIUM,main="Price of Premium seat with flight duration",xlab = "Flight Duration i n Hours", ylab="Price of seats in $", cex=1.1)

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scatterplot(air.df$PRICE\_PREMIUM,air.df$FLIGHT\_DURATION,main="Price of Premium seat with flight duration",ylab = "Flight Dur ation in Hours", xlab="Price of seats in $",cex=1.1,pch=19)

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plot(air.df$FLIGHT\_DURATION~air.df$PRICE\_RELATIVE,main="Relative price Vs flight duration",ylab = "Flight Duration in Hours", xlab="Ratio", cex=1.1)

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scatterplot(air.df$PRICE\_RELATIVE,air.df$FLIGHT\_DURATION,main="Relative price Vs flight duration",ylab = "Flight Duration in Hours", xlab="Ratio",cex=1.1,pch=19)

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plot(air.df$PITCH\_ECONOMY~air.df$PRICE\_RELATIVE,main="Relative price Vs flight duration",xlab = "Flight Duration in Hours", ylab="Ratio", cex=1.1)

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scatterplot(air.df$PRICE\_RELATIVE,air.df$PITCH\_ECONOMY,main="Relative price Vs flight duration",ylab = "Flight Duration in H ours", xlab="Ratio",cex=1.1,pch=19)

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library(car) scatterplotMatrix(

air.df[ ,c("FLIGHT\_DURATION","PRICE\_ECONOMY","PRICE\_PREMIUM")],

spread=FALSE, smoother.args=list(lty=2), main="Scatter Plot Matrix", diagonal = "histogram")

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*#Visualizing* *the* *data* *through* *ggvis*

library(ggvis)

## Warning: package 'ggvis' was built under R version 3.4.1

ggvis(~PRICE\_ECONOMY,~PRICE\_PREMIUM,fill=~PRICE\_RELATIVE,data=air.df)

## Guessing layer\_points()

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PRICE\_RELATIVE

7,000 0.0 1.9

6,000

5,000

4,000

PRICE\_PREMIUM

3,000

2,000

1,000

0

0 500 1,000 1,500 2,000 2,500 3,000 3,500

PRICE\_ECONOMY

ggvis(~PRICE\_ECONOMY,~PRICE\_PREMIUM,fill=~AIRLINE,data=air.df)

## Guessing layer\_points()

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AIRLINE AirFrance

7,000 British Delta

Jet

Singapore 6,000 Virgin

5,000

4,000

PRICE\_PREMIUM

3,000

2,000

1,000

0

0 500 1,000 1,500 2,000 2,500 3,000 3,500

PRICE\_ECONOMY

ggvis(~PRICE\_PREMIUM,~WIDTH\_PREMIUM,fill=~PRICE\_RELATIVE,data=air.df)

## Guessing layer\_points()

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PRICE\_RELATIVE 21.0

0.0 1.9

20.5

20.0

19.5

WIDTH\_PREMIUM

19.0

18.5

18.0

17.5

17.0

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

PRICE\_PREMIUM

*#Interaction* *between* *the* *price* *quantities*

ggvis(~PRICE\_ECONOMY,~PRICE\_RELATIVE,fill=~PRICE\_PREMIUM,data=air.df)

## Guessing layer\_points()

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PRICE\_PREMIUM

1.8 86 7,414

1.6

1.4

1.2

PRICE\_RELATIVE

1.0

0.8

0.6

0.4

0.2

0.0

0 500 1,000 1,500 2,000 2,500 3,000 3,500

PRICE\_ECONOMY

ggvis(~PRICE\_ECONOMY,~PRICE\_PREMIUM,fill=~PRICE\_RELATIVE,data=air.df)

## Guessing layer\_points()

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PRICE\_RELATIVE

7,000 0.0 1.9

6,000

5,000

4,000

PRICE\_PREMIUM

3,000

2,000

1,000

0

0 500 1,000 1,500 2,000 2,500 3,000 3,500

PRICE\_ECONOMY

*##Correlation* *tests* *to* *find* *relationship* *between* *different* *parameters* *#* *Correlation* *matrix,covariance* *matrix,* *Corrgram*

cor(air1)

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## AIRCRAFT FLIGHT\_DURATION MONTH INTERNATIONAL ## AIRCRAFT 1.000000000 ‐0.022265599 0.007377185 0.11607192 ## FLIGHT\_DURATION ‐0.022265599 1.000000000 0.042726734 0.37027250

## MONTH

## INTERNATIONAL ## SEATS\_ECONOMY ## SEATS\_PREMIUM

## PITCH\_ECONOMY

0.007377185 0.116071917 0.401466912 0.295390514

0.241596266

0.042726734 0.370272495 0.209301905 0.167707636

0.303239275

1.000000000 0.042781237 0.013665959 0.054286479

0.020511825

0.04278124 1.00000000 0.30780599 0.30898003

‐0.28733904

## PITCH\_PREMIUM ‐0.040380485 0.082007777 ‐0.008600321 0.86207721 ## WIDTH\_ECONOMY 0.292529863 0.462436824 0.034357832 0.29207630 ## WIDTH\_PREMIUM 0.036853395 0.090968063 ‐0.066095472 0.61130395

## PRICE\_ECONOMY ## PRICE\_PREMIUM ## PRICE\_RELATIVE ## N

## LAMBDA

0.037272760 0.020092754 ‐0.119890981 0.405295313

‐0.128565543

0.570604184 0.651891797 0.108224710 0.213389202

0.003494719

0.002979302 0.018930560 0.019989106 0.020544571

0.038527062

0.29906411 0.34559444 0.27746729 0.32332858

0.01812136

## QUALITY ‐0.119809583 ‐0.051829983 ‐0.014013167 0.74708385 ## SEATS\_ECONOMY SEATS\_PREMIUM PITCH\_ECONOMY PITCH\_PREMIUM

## AIRCRAFT

## FLIGHT\_DURATION ## MONTH

## INTERNATIONAL ## SEATS\_ECONOMY

## SEATS\_PREMIUM

0.401466912 0.209301905 0.013665959 0.307805993 1.000000000

0.626795608

0.2953905141 0.1677076365 0.0542864791 0.3089800311 0.6267956084

1.0000000000

0.24159627 0.30323927 0.02051183 ‐0.28733904 0.17614558

‐0.01847429

‐0.040380485 0.082007777 ‐0.008600321 0.862077210 0.082656260

‐0.008183207

## PITCH\_ECONOMY

## PITCH\_PREMIUM

0.176145581 ‐0.0184742879

0.082656260 ‐0.0081832073

1.00000000

‐0.56170832

‐0.561708319

1.000000000

## WIDTH\_ECONOMY 0.391536716 0.4618817295 0.31103746 ‐0.043627342 ## WIDTH\_PREMIUM 0.070712269 ‐0.0140721606 ‐0.54892493 0.754851871

## PRICE\_ECONOMY

## PRICE\_PREMIUM

0.148163761

0.195287760

0.1221179841

0.2249974040

0.37960497

0.23983878

0.033635434

0.071331248

## PRICE\_RELATIVE ‐0.024509143 ‐0.1072356234 ‐0.43465185 0.427823608

## N

## LAMBDA

## QUALITY

0.992908806 ‐0.399068794

‐0.004098189

0.7149790849 0.3163713970

0.0007906561

0.15523329 ‐0.17266314

‐0.78895106

0.072917300 ‐0.053841073

0.951521570

## WIDTH\_ECONOMY WIDTH\_PREMIUM PRICE\_ECONOMY PRICE\_PREMIUM

## AIRCRAFT

## FLIGHT\_DURATION ## MONTH

## INTERNATIONAL

0.29252986 0.46243682 0.03435783

0.29207630

0.03685339 0.09096806 ‐0.06609547

0.61130395

0.037272760 0.570604184 0.002979302

0.299064115

0.02009275 0.65189180 0.01893056

0.34559444

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## SEATS\_ECONOMY ## SEATS\_PREMIUM ## PITCH\_ECONOMY ## PITCH\_PREMIUM ## WIDTH\_ECONOMY ## WIDTH\_PREMIUM ## PRICE\_ECONOMY ## PRICE\_PREMIUM ## PRICE\_RELATIVE ## N

## LAMBDA ## QUALITY

##

0.39153672 0.46188173 0.31103746 ‐0.04362734 1.00000000 0.06259988 0.08196790 0.16310757 ‐0.06093642 0.42178638 0.09724877 ‐0.14803745

PRICE\_RELATIVE

0.07071227 ‐0.01407216 ‐0.54892493 0.75485187 0.06259988 1.00000000 ‐0.07018013 0.04932498 0.51167702 0.06130173 ‐0.07203714 0.76469927

N

0.148163761 0.122117984 0.379604972 0.033635434 0.081967901 ‐0.070180135 1.000000000 0.902531053 ‐0.298104314 0.151575655 ‐0.005672849 ‐0.116146580

LAMBDA

0.19528776 0.22499740 0.23983878 0.07133125 0.16310757 0.04932498 0.90253105 1.00000000 0.01757342 0.20955518 0.03550282 ‐0.03618869

QUALITY

## AIRCRAFT ‐0.11989098 0.405295313 ‐0.128565543 ‐0.1198095828

## FLIGHT\_DURATION

## MONTH

0.10822471

0.01998911

0.213389202

0.020544571

0.003494719 ‐0.0518299826

0.038527062 ‐0.0140131666

## INTERNATIONAL 0.27746729 0.323328584 0.018121358 0.7470838510 ## SEATS\_ECONOMY ‐0.02450914 0.992908806 ‐0.399068794 ‐0.0040981889 ## SEATS\_PREMIUM ‐0.10723562 0.714979085 0.316371397 0.0007906561 ## PITCH\_ECONOMY ‐0.43465185 0.155233293 ‐0.172663141 ‐0.7889510603 ## PITCH\_PREMIUM 0.42782361 0.072917300 ‐0.053841073 0.9515215700 ## WIDTH\_ECONOMY ‐0.06093642 0.421786384 0.097248771 ‐0.1480374529 ## WIDTH\_PREMIUM 0.51167702 0.061301732 ‐0.072037142 0.7646992712 ## PRICE\_ECONOMY ‐0.29810431 0.151575655 ‐0.005672849 ‐0.1161465802 ## PRICE\_PREMIUM 0.01757342 0.209555179 0.035502822 ‐0.0361886891 ## PRICE\_RELATIVE 1.00000000 ‐0.038352287 ‐0.050057215 0.4793339231 ## N ‐0.03835229 1.000000000 ‐0.309808226 ‐0.0035565934

## LAMBDA

## QUALITY

‐0.05005721 ‐0.309808226

0.47933392 ‐0.003556593

1.000000000

0.024204340

0.0242043400

1.0000000000

x<‐air.df[,c("FLIGHT\_DURATION","LAMBDA","INTERNATIONAL","N", "MONTH","QUALITY","WIDTH\_ECONOMY", "WIDTH\_PREMIUM","SEATS\_ECONO MY", "SEATS\_PREMIUM", "PITCH\_ECONOMY", "PITCH\_PREMIUM")]

y<‐air.df[,c("PRICE\_ECONOMY","PRICE\_PREMIUM","PRICE\_RELATIVE")] cor(x,y)

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## PRICE\_ECONOMY PRICE\_PREMIUM PRICE\_RELATIVE

## FLIGHT\_DURATION ## LAMBDA

## INTERNATIONAL ## N

## MONTH ## QUALITY

## WIDTH\_ECONOMY ## WIDTH\_PREMIUM ## SEATS\_ECONOMY ## SEATS\_PREMIUM ## PITCH\_ECONOMY

## PITCH\_PREMIUM

0.570604184 ‐0.005672849 0.299064115 0.151575655 0.002979302 ‐0.116146580 0.081967901 ‐0.070180135 0.148163761 0.122117984 0.379604972

0.033635434

0.65189180 0.03550282 0.34559444 0.20955518 0.01893056 ‐0.03618869 0.16310757 0.04932498 0.19528776 0.22499740 0.23983878

0.07133125

0.10822471 ‐0.05005721 0.27746729 ‐0.03835229 0.01998911 0.47933392 ‐0.06093642 0.51167702 ‐0.02450914 ‐0.10723562 ‐0.43465185

0.42782361

cov(x,y)

## PRICE\_ECONOMY PRICE\_PREMIUM PRICE\_RELATIVE

## FLIGHT\_DURATION ## LAMBDA

## INTERNATIONAL

1999.4291957 ‐0.3434499

83.3353523

2976.982377 2.801268

125.505104

0.173589562 ‐0.001387251

0.035391817

## N

## MONTH ## QUALITY

## WIDTH\_ECONOMY ## WIDTH\_PREMIUM ## SEATS\_ECONOMY ## SEATS\_PREMIUM ## PITCH\_ECONOMY

## PITCH\_PREMIUM

13035.3006451 3.1016706 ‐204.7190749 45.4751951 ‐76.5196214 11433.0342001 1602.2664451 248.7500352

44.0309604

23486.573795 25.684687 ‐83.129354 117.932783 70.089857 19639.218554 3847.355241 204.823760

121.694406

‐1.509763642 0.009525782 0.386737377 ‐0.015475111 0.255376323 ‐0.865712595 ‐0.644051047 ‐0.130376370

0.256361007

var(x,y)

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## PRICE\_ECONOMY PRICE\_PREMIUM PRICE\_RELATIVE

## FLIGHT\_DURATION ## LAMBDA

## INTERNATIONAL

1999.4291957 ‐0.3434499

83.3353523

2976.982377 2.801268

125.505104

0.173589562 ‐0.001387251

0.035391817

## N

## MONTH ## QUALITY

## WIDTH\_ECONOMY ## WIDTH\_PREMIUM ## SEATS\_ECONOMY ## SEATS\_PREMIUM ## PITCH\_ECONOMY

## PITCH\_PREMIUM

13035.3006451 3.1016706 ‐204.7190749 45.4751951 ‐76.5196214 11433.0342001 1602.2664451 248.7500352

44.0309604

23486.573795 25.684687 ‐83.129354 117.932783 70.089857 19639.218554 3847.355241 204.823760

121.694406

‐1.509763642 0.009525782 0.386737377 ‐0.015475111 0.255376323 ‐0.865712595 ‐0.644051047 ‐0.130376370

0.256361007

*#Visualizing* *relation* *through* *corrplots*

library(corrplot)

## Warning: package 'corrplot' was built under R version 3.4.1

corrplot(corr=cor(air1[,c(2,5:16)],use = "complete.obs"), method = "ellipse")

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library(gplots)

##

## Attaching package: 'gplots'

## The following object is masked from 'package:stats': ##

## lowess

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corrplot.mixed(corr=cor(air1[,c(2,5:16)],use = "complete.obs"), upper = "ellipse", tl.pos = "lt", col = colorpanel(50, "red", "gray60", "blue4"))

*#VIsualizing* *by* *corrgram*

library(corrgram)

corrgram(air1, order=TRUE, lower.panel=panel.shade, upper.panel=panel.pie, text.panel=panel.txt, main="Corrgram of Airline data intercorrelations")

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*##From* *the* *above* *cor(),corrplot* *and* *corrgram* *command* *we* *get* *to* *know* *the* *correlation* *,* *and* *can* *consider* *##* *FLIGHT\_DURATION* *as* *a* *factor* *for* *pricing* *in* *ECONOMY* *and* *PREMIUM* *seats* *and* *for*

*##* *PRICE\_RELATIVE* *factors* *such* *as* *QUALITY,PITCH\_ECONOMY,* *PITCH\_PREMIUM* *and* *WIDTH\_PREMIUM* *are* *well* *correlated*

*#Generating* *A* *Multi* *Variable* *Linear* *Regressional* *Model* *for* *Price* *of* *Economy* *Flights*

linear1.mod<‐ lm(PRICE\_ECONOMY~ PITCH\_ECONOMY + WIDTH\_ECONOMY + FLIGHT\_DURATION + QUALITY + PRICE\_RELATIVE + INTERNATIONAL, data = air.df)

summary(linear1.mod)

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##

## Call:

## lm(formula = PRICE\_ECONOMY ~ PITCH\_ECONOMY + WIDTH\_ECONOMY +

## FLIGHT\_DURATION + QUALITY + PRICE\_RELATIVE + INTERNATIONAL, ## data = air.df)

##

## Residuals:

## Min 1Q Median 3Q Max ## ‐1537.13 ‐436.22 68.69 419.27 1494.89 ##

## Coefficients:

## Estimate Std. Error t value Pr(>|t|)

## (Intercept) 18409.89 3877.90 4.747 2.76e‐06 \*\*\* ## PITCH\_ECONOMY ‐70.81 103.48 ‐0.684 0.494

## WIDTH\_ECONOMY ‐884.54 65.40 ‐13.526 < 2e‐16 \*\*\* ## FLIGHT\_DURATION 141.15 10.39 13.588 < 2e‐16 \*\*\* ## QUALITY ‐377.06 65.56 ‐5.752 1.62e‐08 \*\*\*

## PRICE\_RELATIVE ## INTERNATIONAL

## ‐‐‐

‐679.84

2946.19

73.37 ‐9.266

298.22 9.879

< 2e‐16 \*\*\*

< 2e‐16 \*\*\*

## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1 ##

## Residual standard error: 588.4 on 455 degrees of freedom ## Multiple R‐squared: 0.6512, Adjusted R‐squared: 0.6466 ## F‐statistic: 141.6 on 6 and 455 DF, p‐value: < 2.2e‐16

*#Generating* *A* *Multi* *Variable* *Linear* *Regressional* *Model* *for* *Price* *of* *Premium* *Flights*

linear2.mod<‐ lm(PRICE\_PREMIUM~ PITCH\_PREMIUM + WIDTH\_PREMIUM + FLIGHT\_DURATION + QUALITY + PRICE\_RELATIVE + INTERNATIONAL, data = air.df)

summary(linear2.mod)

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##

## Call:

## lm(formula = PRICE\_PREMIUM ~ PITCH\_PREMIUM + WIDTH\_PREMIUM +

## FLIGHT\_DURATION + QUALITY + PRICE\_RELATIVE + INTERNATIONAL, ## data = air.df)

##

## Residuals:

## Min 1Q Median 3Q Max ## ‐2152.2 ‐752.8 136.9 699.7 4295.9 ##

## Coefficients:

## Estimate Std. Error t value Pr(>|t|)

## (Intercept) ## PITCH\_PREMIUM

## WIDTH\_PREMIUM

13439.721 ‐401.935

9.289

5325.779 2.524 161.602 ‐2.487

65.400 0.142

0.0120 \* 0.0132 \*

0.8871

## FLIGHT\_DURATION ## QUALITY

## PRICE\_RELATIVE

177.065 ‐17.521

1.889

16.686 10.611 97.489 ‐0.180

120.271 0.016

< 2e‐16 \*\*\* 0.8575

0.9875

## INTERNATIONAL 2446.630 412.479 5.932 5.95e‐09 \*\*\* ## ‐‐‐

## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1 ##

## Residual standard error: 942.4 on 455 degrees of freedom ## Multiple R‐squared: 0.4732, Adjusted R‐squared: 0.4662 ## F‐statistic: 68.11 on 6 and 455 DF, p‐value: < 2.2e‐16

*##*

fit<‐lm(PRICE\_RELATIVE~.‐AIRCRAFT‐MONTH‐SEATS\_ECONOMY‐SEATS\_PREMIUM‐LAMBDA‐N‐WIDTH\_ECONOMY, data = air1) summary(fit)

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##

## Call:

## lm(formula = PRICE\_RELATIVE ~ . ‐ AIRCRAFT ‐ MONTH ‐ SEATS\_ECONOMY ‐ ## SEATS\_PREMIUM ‐ LAMBDA ‐ N ‐ WIDTH\_ECONOMY, data = air1)

##

## Residuals:

## Min 1Q Median 3Q Max ## ‐0.74081 ‐0.11639 ‐0.01705 0.09721 0.86056 ##

## Coefficients: (1 not defined because of singularities) ## Estimate Std. Error t value Pr(>|t|)

## (Intercept) ‐1.463e+01 1.437e+00 ‐10.184 < 2e‐16 \*\*\* ## FLIGHT\_DURATION 1.992e‐02 4.600e‐03 4.330 1.84e‐05 \*\*\* ## INTERNATIONAL ‐9.237e‐01 1.056e‐01 ‐8.752 < 2e‐16 \*\*\* ## PITCH\_ECONOMY 1.153e‐01 2.645e‐02 4.359 1.62e‐05 \*\*\*

## PITCH\_PREMIUM

## WIDTH\_PREMIUM

3.086e‐01

2.816e‐02

2.616e‐02 11.799

1.646e‐02 1.711

< 2e‐16 \*\*\*

0.0878 .

## PRICE\_ECONOMY ‐7.665e‐04 3.031e‐05 ‐25.291 < 2e‐16 \*\*\*

## PRICE\_PREMIUM ## QUALITY

## ‐‐‐

5.331e‐04

NA

2.414e‐05 22.083

NA NA

< 2e‐16 \*\*\*

NA

## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1 ##

## Residual standard error: 0.237 on 454 degrees of freedom ## Multiple R‐squared: 0.7306, Adjusted R‐squared: 0.7265 ## F‐statistic: 175.9 on 7 and 454 DF, p‐value: < 2.2e‐16

t.test(PRICE\_PREMIUM ~ AIRCRAFT,alternative= "less",data=air.df)

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##

## Welch Two Sample t‐test ##

## data: PRICE\_PREMIUM by AIRCRAFT

## t = ‐0.43785, df = 309.53, p‐value = 0.3309

## alternative hypothesis: true difference in means is less than 0 ## 95 percent confidence interval:

## ‐Inf 152.7841 ## sample estimates:

## mean in group 0 mean in group 1 ## 1814.305 1869.503

t.test(PRICE\_ECONOMY ~ AIRCRAFT,alternative= "less",data=air.df)

##

## Welch Two Sample t‐test ##

## data: PRICE\_ECONOMY by AIRCRAFT

## t = ‐0.79106, df = 288.69, p‐value = 0.2148

## alternative hypothesis: true difference in means is less than 0 ## 95 percent confidence interval:

## ‐Inf 85.32482 ## sample estimates:

## mean in group 0 mean in group 1 ## 1291.386 1369.954

t.test(PRICE\_PREMIUM ~ INTERNATIONAL,alternative= "less",data=air.df)

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##

## Welch Two Sample t‐test ##

## data: PRICE\_PREMIUM by INTERNATIONAL

## t = ‐24.295, df = 457.34, p‐value < 2.2e‐16

## alternative hypothesis: true difference in means is less than 0 ## 95 percent confidence interval:

## ‐Inf ‐1476.119 ## sample estimates:

## mean in group 0 mean in group 1 ## 385.90 1969.45

t.test(PRICE\_ECONOMY ~ AIRCRAFT,alternative= "less",data=air.df)

##

## Welch Two Sample t‐test ##

## data: PRICE\_ECONOMY by INTERNATIONAL

## t = -20.174, df = 436.68, p‐value = 2.2e-16

## alternative hypothesis: true difference in means is less than 0 ## 95 percent confidence interval:

## ‐Inf -965.5563 ## sample estimates:

## mean in group 0 mean in group 1 ## 356.6250 1408.102

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