

```

> ##Importing Data and initial analyses
> #Importing csv file from a location
> attr<- read.csv(file="MVA/Attrition Dataset.csv", header=TRUE, sep=",")
> attr <- as.data.frame(attr)
> glimpse(attr)

Observations: 1,470
Variables: 35
$ Age <int> 41, 49, 37, 33, 27, 32, 59, 30, 38, 36, 35,
29, 31, 34, 28, 29, 32, 22, 5...
$ Attrition <fct> Yes, No, Yes, No, No, No, No, No, No, No, No,
, No, No, No, Yes, No, No, No...
$ BusinessTravel <fct> Travel_Rarely, Travel_Frequently, Travel_Rar
ely, Travel_Frequently, Trave...
$ DailyRate <int> 1102, 279, 1373, 1392, 591, 1005, 1324, 1358
, 216, 1299, 809, 153, 670, 1...
$ Department <fct> Sales, Research & Development, Research & De
velopment, Research & Develop...
$ DistanceFromHome <int> 1, 8, 2, 3, 2, 2, 3, 24, 23, 27, 16, 15, 26,
19, 24, 21, 5, 16, 2, 2, 11,...
$ Education <int> 2, 1, 2, 4, 1, 2, 3, 1, 3, 3, 3, 2, 1, 2, 3,
4, 2, 2, 4, 3, 2, 4, 4, 2, 1...
$ EducationField <fct> Life Sciences, Life Sciences, Other, Life Sc
iences, Medical, Life Science...
$ EmployeeCount <int> 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1, 1, 1, 1, 1, 1, 1...
$ EmployeeNumber <int> 1, 2, 4, 5, 7, 8, 10, 11, 12, 13, 14, 15, 16
, 18, 19, 20, 21, 22, 23, 24,...
$ EnvironmentSatisfaction <int> 2, 3, 4, 4, 1, 4, 3, 4, 4, 3, 1, 4, 1, 2, 3,
2, 1, 4, 1, 4, 1, 3, 1, 3, 2...
$ Gender <fct> Female, Male, Male, Female, Male, Male, Fema
le, Male, Male, Male, Male, F...
$ HourlyRate <int> 94, 61, 92, 56, 40, 79, 81, 67, 44, 94, 84,
49, 31, 93, 50, 51, 80, 96, 7...
$ JobInvolvement <int> 3, 2, 2, 3, 3, 3, 4, 3, 2, 3, 4, 2, 3, 3, 2,
4, 4, 4, 2, 3, 4, 2, 3, 3, 3...
$ JobLevel <int> 2, 2, 1, 1, 1, 1, 1, 1, 3, 2, 1, 2, 1, 1, 1,
3, 1, 1, 4, 1, 2, 1, 3, 1, 1...
$ JobRole <fct> Sales Executive, Research Scientist, Laborat
ory Technician, Research Scie...
$ JobSatisfaction <int> 4, 2, 3, 3, 2, 4, 1, 3, 3, 3, 2, 3, 3, 4, 3,
1, 2, 4, 4, 4, 3, 1, 2, 4, 1...
$ MaritalStatus <fct> Single, Married, Single, Married, Married, S
ingle, Married, Divorced, Sin...
$ MonthlyIncome <int> 5993, 5130, 2090, 2909, 3468, 3068, 2670, 26
93, 9526, 5237, 2426, 4193, 2...
$ MonthlyRate <int> 19479, 24907, 2396, 23159, 16632, 11864, 996
4, 13335, 8787, 16577, 16479,...
$ NumCompaniesWorked <int> 8, 1, 6, 1, 9, 0, 4, 1, 0, 6, 0, 0, 1, 0, 5,
1, 0, 1, 2, 5, 0, 7, 0, 1, 2...
$ Over18 <fct> Y, Y, Y, Y, Y, Y, Y, Y, Y, Y, Y, Y, Y, Y, Y,
Y, Y, Y, Y, Y, Y, Y, Y, Y...
$ OverTime <fct> Yes, No, Yes, Yes, No, No, Yes, No, No, No,
No, Yes, No, No, Yes, No, Yes...
$ PercentSalaryHike <int> 11, 23, 15, 11, 12, 13, 20, 22, 21, 13, 13,
12, 17, 11, 14, 11, 12, 13, 1...
$ PerformanceRating <int> 3, 4, 3, 3, 3, 3, 4, 4, 4, 3, 3, 3, 3, 3, 3,
3, 3, 3, 3, 3, 3, 4, 3, 3, 3...
$ RelationshipSatisfaction <int> 1, 4, 2, 3, 4, 3, 1, 2, 2, 2, 3, 4, 4, 3, 2,
3, 4, 2, 3, 3, 4, 2, 3, 4, 3...
$ StandardHours <int> 80, 80, 80, 80, 80, 80, 80, 80, 80, 80, 80, 80,
80, 80, 80, 80, 80, 80, 8...
$ StockOptionLevel <int> 0, 1, 0, 0, 1, 0, 3, 1, 0, 2, 1, 0, 1, 1, 0,
1, 2, 2, 0, 0, 1, 0, 0, 0, 0...

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$ TotalWorkingYears      <int> 8, 10, 7, 8, 6, 8, 12, 1, 10, 17, 6, 10, 5,
3, 6, 10, 7, 1, 31, 6, 5, 10,...
$ TrainingTimesLastYear  <int> 0, 3, 3, 3, 3, 2, 3, 2, 2, 3, 5, 3, 1, 2, 4,
1, 5, 2, 3, 3, 5, 4, 4, 6, 2...
$ WorkLifeBalance        <int> 1, 3, 3, 3, 3, 2, 2, 3, 3, 2, 3, 3, 2, 3, 3,
3, 2, 2, 3, 3, 2, 3, 3, 3, 3...
$ YearsAtCompany         <int> 6, 10, 0, 8, 2, 7, 1, 1, 9, 7, 5, 9, 5, 2, 4
, 10, 6, 1, 25, 3, 4, 5, 12, ...
$ YearsInCurrentRole     <int> 4, 7, 0, 7, 2, 7, 0, 0, 7, 7, 4, 5, 2, 2, 2,
9, 2, 0, 8, 2, 2, 3, 6, 0, 2...
$ YearsSinceLastPromotion <int> 0, 1, 0, 3, 2, 3, 0, 0, 1, 7, 0, 0, 4, 1, 0,
8, 0, 0, 3, 1, 1, 0, 2, 0, 1...
$ YearswithCurrManager   <int> 5, 7, 0, 0, 2, 6, 0, 0, 8, 7, 3, 8, 3, 2, 3,
8, 5, 0, 7, 2, 3, 3, 11, 0, ...

```

```
> #Dimension of the dataset
```

```
> dim(attr)
```

```
[1] 1470    35
```

```
> #View the first 5 rows of the dataset
```

```
> head(attr)
```

	Age	Attrition	BusinessTravel	DailyRate	Department	DistanceFromHome	Education	EducationField
1	41	Yes	Travel_Rarely	1102	Sales			
1	2	Life Sciences						
2	49	No	Travel_Frequently	279	Research & Development			
8	1	Life Sciences						
3	37	Yes	Travel_Rarely	1373	Research & Development			
2	2	Other						
4	33	No	Travel_Frequently	1392	Research & Development			
3	4	Life Sciences						
5	27	No	Travel_Rarely	591	Research & Development			
2	1	Medical						
6	32	No	Travel_Frequently	1005	Research & Development			
2	2	Life Sciences						
	EmployeeCount	EmployeeNumber	Environmentsatisfaction	Gender	HourlyRate	JobInvolvement	JobLevel	
1	1	1	2	Female	94			
3	2	1	3	Male	61			
2	2	1	4	Male	92			
3	1	1	5	Female	56			
4	1	1	7	Male	40			
5	1	1	8	Male	79			
6	1							
3	1							
	JobRole	Jobsatisfaction	MaritalStatus	MonthlyIncome	MonthlyRate	NumCompaniesWorked	Over18	
1	Sales Executive	4	Single	5993	194			
79		8	Y					
2	Research Scientist	2	Married	5130	249			
07		1	Y					
3	Laboratory Technician	3	Single	2090	23			
96		6	Y					
4	Research Scientist	3	Married	2909	231			
59		1	Y					
5	Laboratory Technician	2	Married	3468	166			
32		9	Y					
6	Laboratory Technician	4	Single	3068	118			
64		0	Y					

	OverTime	PercentSalaryHike	PerformanceRating	RelationshipSatisfaction	StandardHours
1	Yes	11	3	1	
80		0			
2	No	23	4	4	
80		1			
3	Yes	15	3	2	
80		0			
4	Yes	11	3	3	
80		0			
5	No	12	3	4	
80		1			
6	No	13	3	3	
80		0			

	TotalWorkingYears	TrainingTimesLastYear	WorkLifeBalance	YearsAtCompany	YearsInCurrentRole
1	8	0	1	6	
4					
2	10	3	3	10	
7					
3	7	3	3	0	
0					
4	8	3	3	8	
7					
5	6	3	3	2	
2					
6	8	2	2	7	
7					

	YearsSinceLastPromotion	YearsWithCurrManager
1	0	5
2	1	7
3	0	0
4	3	0
5	2	2
6	3	6

> summary(attr)

	Age	Attrition	BusinessTravel	DailyRate
Department				
Min. :18.00	No :1233	Non-Travel : 150	Min. : 102.0	Human Resources
1st Qu.:30.00	Yes: 237	Travel_Frequently: 277	1st Qu.: 465.0	Research & Development
Median :36.00		Travel_Rarely :1043	Median : 802.0	Sales
Mean :36.92			Mean : 802.5	
3rd Qu.:43.00			3rd Qu.:1157.0	
Max. :60.00			Max. :1499.0	

	DistanceFromHome	Education	EducationField	EmployeeCount	EmployeeNumber
Min. : 1.000	Min. :1.000	Human Resources : 27	Min. :1	Min.	
1st Qu.: 2.000	1st Qu.:2.000	Life Sciences :606	1st Qu.:1	1st Q	
Median : 7.000	Median :3.000	Marketing :159	Median :1	Media	
Mean : 9.193	Mean :2.913	Medical :464	Mean :1	Mean	
3rd Qu.:14.000	3rd Qu.:4.000	Other : 82	3rd Qu.:1	3rd Q	
Max. :29.000	Max. :5.000	Technical Degree:132	Max. :1	Max.	

EnvironmentSatisfaction	Gender	HourlyRate	JobInvolvement	JobL
Min. :1.000	Female:588	Min. : 30.00	Min. :1.00	Min.
1st Qu.:2.000	Male :882	1st Qu.: 48.00	1st Qu.:2.00	1st Qu.
Median :3.000		Median : 66.00	Median :3.00	Median
Mean :2.722		Mean : 65.89	Mean :2.73	Mean
3rd Qu.:4.000		3rd Qu.: 83.75	3rd Qu.:3.00	3rd Qu.
Max. :4.000		Max. :100.00	Max. :4.00	Max.

MonthlyRate	JobRole	JobSatisfaction	MaritalStatus	MonthlyIncome
Sales Executive	:326	Min. :1.000	Divorced:327	Min. : 1009
Research Scientist	:292	1st Qu.:2.000	Married :673	1st Qu.: 2911
Laboratory Technician	:259	Median :3.000	Single :470	Median : 4919
Manufacturing Director	:145	Mean :2.729		Mean : 6503
Healthcare Representative	:131	3rd Qu.:4.000		3rd Qu.: 8379
Manager	:102	Max. :4.000		Max. :19999
(Other)	:215			

NumCompaniesWorked	Over18	OverTime	PercentsSalaryHike	PerformanceRating	R
Min. :0.000	Y:1470	No :1054	Min. :11.00	Min. :3.000	M
1st Qu.:1.000		Yes: 416	1st Qu.:12.00	1st Qu.:3.000	1
Median :2.000			Median :14.00	Median :3.000	M
Mean :2.693			Mean :15.21	Mean :3.154	M
3rd Qu.:4.000			3rd Qu.:18.00	3rd Qu.:3.000	3
Max. :9.000			Max. :25.00	Max. :4.000	M

StandardHours	StockOptionLevel	TotalWorkingYears	TrainingTimesLastYear	workL
Min. :80	Min. :0.0000	Min. : 0.00	Min. :0.000	Min.
1st Qu.:80	1st Qu.:0.0000	1st Qu.: 6.00	1st Qu.:2.000	1st Q
Median :80	Median :1.0000	Median :10.00	Median :3.000	Media
Mean :80	Mean :0.7939	Mean :11.28	Mean :2.799	Mean
3rd Qu.:80	3rd Qu.:1.0000	3rd Qu.:15.00	3rd Qu.:3.000	3rd Q
Max. :80	Max. :3.0000	Max. :40.00	Max. :6.000	Max.

YearsInCurrentRole	YearsSinceLastPromotion	YearswithCurrManager
Min. : 0.000	Min. : 0.000	Min. : 0.000
1st Qu.: 2.000	1st Qu.: 0.000	1st Qu.: 2.000
Median : 3.000	Median : 1.000	Median : 3.000

Mean	: 4.229	Mean	: 2.188	Mean	: 4.123
3rd Qu.:	7.000	3rd Qu.:	3.000	3rd Qu.:	7.000
Max.	:18.000	Max.	:15.000	Max.	:17.000

```

> #Rename the Age column
> colnames(attr)[1] <- "Age"
> #Calculating the number of null values in each of the columns
> colSums(sapply(attr,is.na))

```

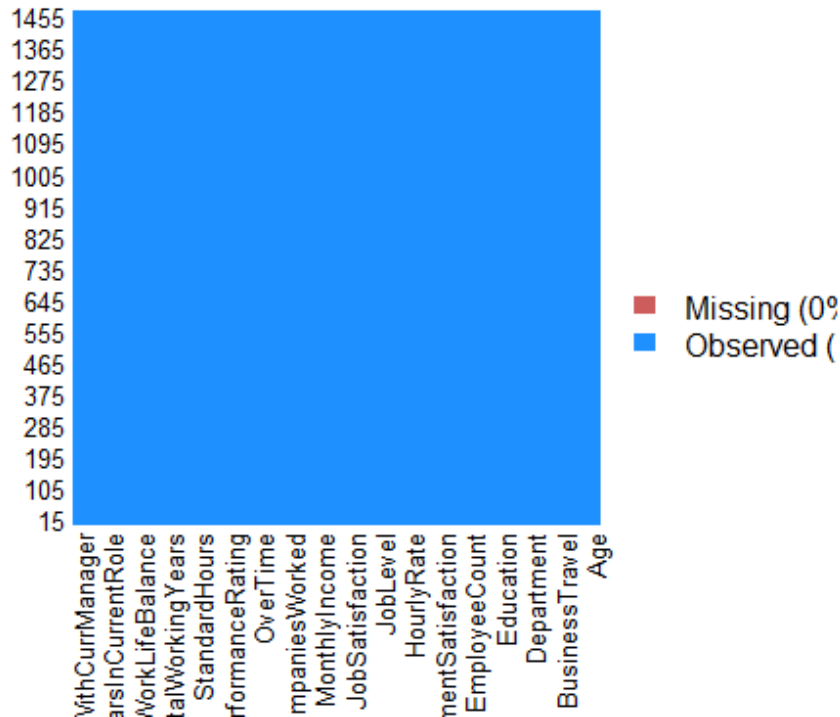
	Age	Attrition	BusinessTravel
DailyRate	0	0	0
0			
EducationField	Department	DistanceFromHome	Education
0	0	0	0
Gender	EmployeeCount	EmployeeNumber	Environmentsatisfaction
0	0	0	0
JobRole	HourlyRate	JobInvolvement	JobLevel
0	0	0	0
MonthlyRate	JobSatisfaction	MaritalStatus	MonthlyIncome
0	0	0	0
PercentSalaryHike	NumCompaniesWorked	Over18	OverTime
0	0	0	0
StockOptionLevel	PerformanceRating	RelationshipSatisfaction	StandardHours
0	0	0	0
YearsAtCompany	TotalWorkingYears	TrainingTimesLastYear	workLifeBalance
0	0	0	0
	YearsInCurrentRole	YearsSinceLastPromotion	YearswithCurrManager
	0	0	0

```

> missmap(attr,main="Missing values vs Observed")

```

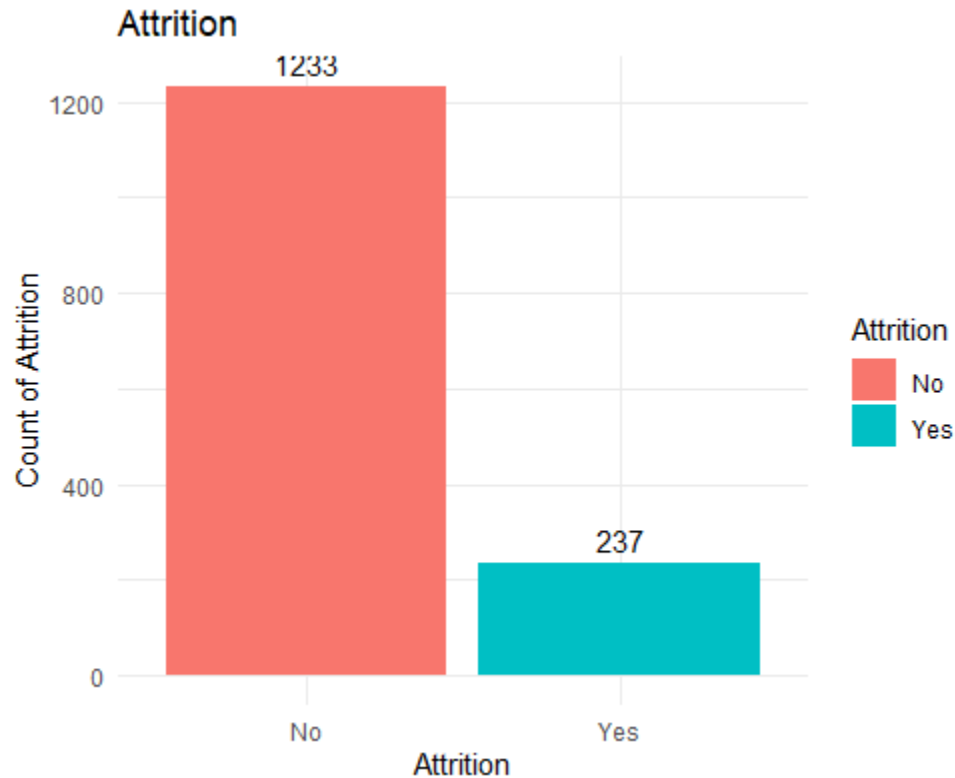
Missing Values VS Observed



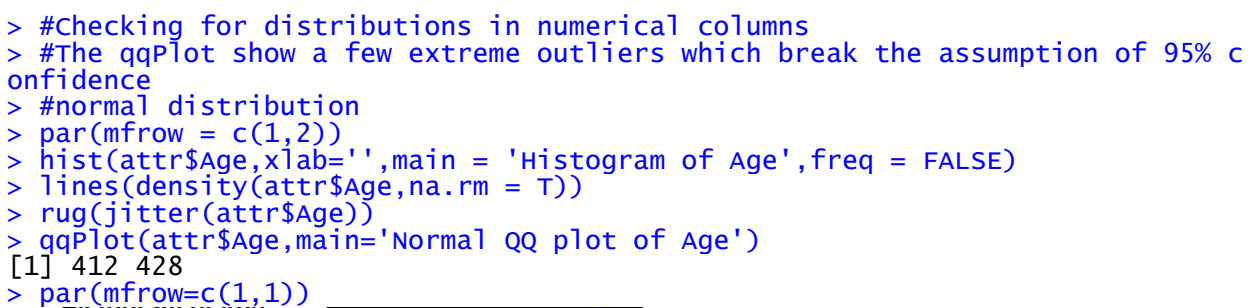
```
> #Removing redundant columns
> attr$EmployeeNumber<- NULL
> attr$StandardHours <- NULL
> attr$Over18 <- NULL
> attr$EmployeeCount <- NULL
> #Converting data type of categorical column
> attr$Education <- factor(attr$Education)
> attr$EnvironmentSatisfaction <- factor(attr$EnvironmentSatisfaction)
> attr$JobInvolvement <- factor(attr$JobInvolvement)
> attr$JobLevel <- factor(attr$JobLevel)
> attr$JobSatisfaction <- factor(attr$JobSatisfaction)
> attr$PerformanceRating <- factor(attr$PerformanceRating)
> attr$RelationshipSatisfaction <- factor(attr$RelationshipSatisfaction)
> attr$StockOptionLevel <- factor(attr$StockOptionLevel)
> attr$WorkLifeBalance <- factor(attr$WorkLifeBalance)
> #Assigning categorical and numerical variable to temporary variable
> catvar<-c('BusinessTravel','Department','Education','EducationField','EnvironmentSatisfaction','Gender',
+           'JobRole','JobInvolvement','JobLevel','JobSatisfaction',
+           'MaritalStatus','PerformanceRating','RelationshipSatisfaction','StockOptionLevel','WorkLifeBalance')
> numvar<-c('Age','DailyRate','DistanceFromHome','HourlyRate',
+           'MonthlyIncome','MonthlyRate','NumCompaniesWorked','PercentsSalaryHike','TotalWorkingYears',
+           'TrainingTimesLastYear','YearsAtCompany',
+           'YearsInCurrentRole','YearsSinceLastPromotion','YearsWithCurrManager')

> ##Exploratory Data Analysis
>
> #Vizualization of Attrition
> attr %>%
+   group_by(Attrition) %>%
```

```
+ tally() %>%
+ ggplot(aes(x =Attrition,y = n,fill=Attrition)) +
+ geom_bar(stat = "identity") +
+ theme_minimal()+
+ labs(x="Attrition", y="Count of Attrition")+
+ ggtitle("Attrition")+
+ geom_text(aes(label = n), vjust = -0.5, position = position_dodge(0.9))
```



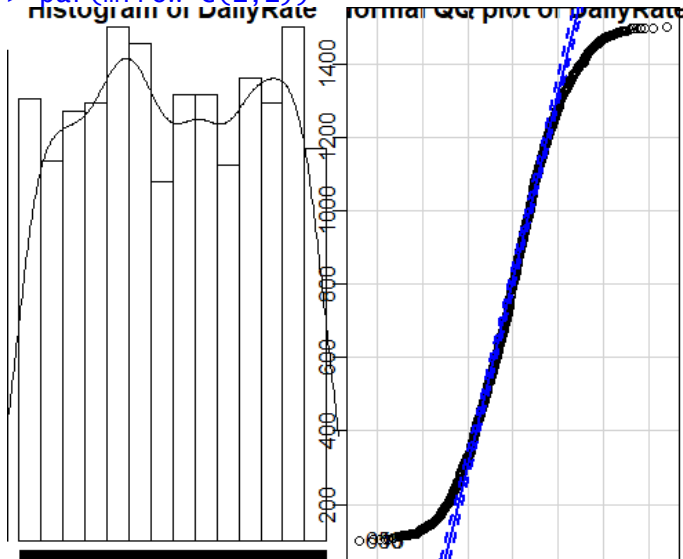
```
#Influence of features on Attrition
> ggplot(data=attr, aes(attr$Age)) +
+   geom_histogram(breaks=seq(20, 50, by=2),
+                 col="red",
+                 aes(fill=..count..))+
+   labs(x="Age", y="Count")+
+   scale_fill_gradient("Count", low="yellow", high="dark red")
```




```

> par(mfrow = c(1,2))
> hist(attr$DailyRate,xlab='',main = 'Histogram of DailyRate',freq = FALSE)
> lines(density(attr$DailyRate,na.rm = T))
> rug(jitter(attr$DailyRate))
> qqPlot(attr$DailyRate,main='Normal QQ plot of DailyRate')
[1] 650 15
> par(mfrow=c(1,1))

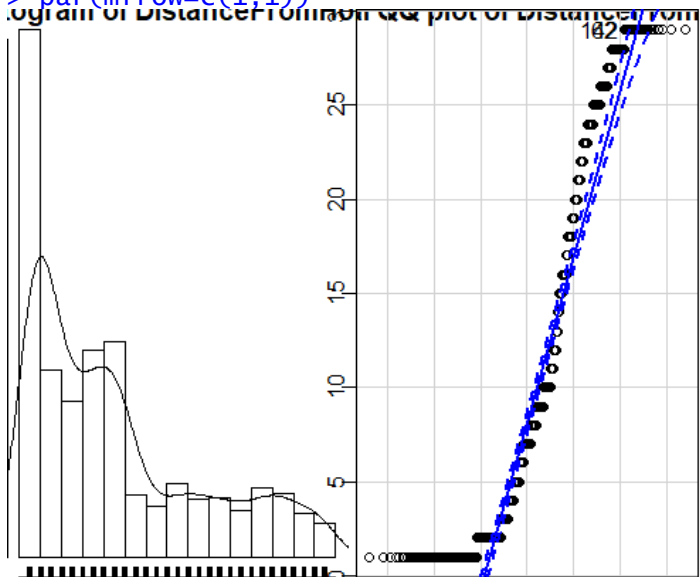
```



```

> par(mfrow = c(1,2))
> hist(attr$DistanceFromHome,xlab='',main = 'Histogram of DistanceFromHome',freq = FALSE)
> lines(density(attr$DistanceFromHome,na.rm = T))
> rug(jitter(attr$DistanceFromHome))
> qqPlot(attr$DistanceFromHome,main='Normal QQ plot of DistanceFromHome')
[1] 62 142
> par(mfrow=c(1,1))

```

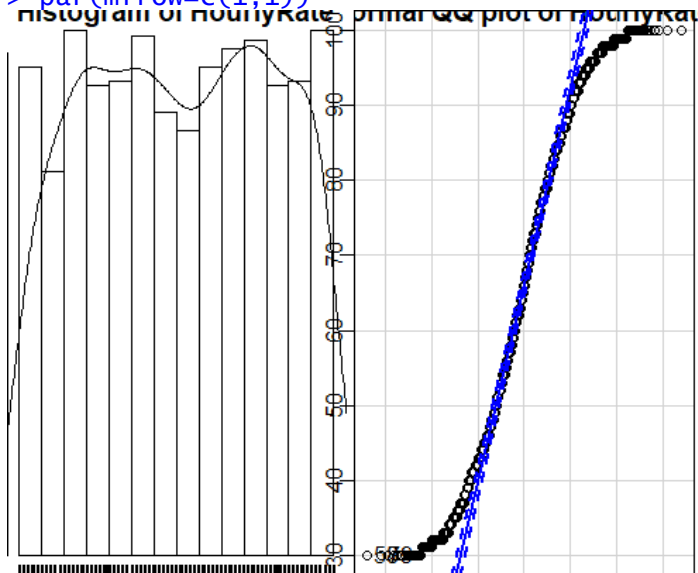


```

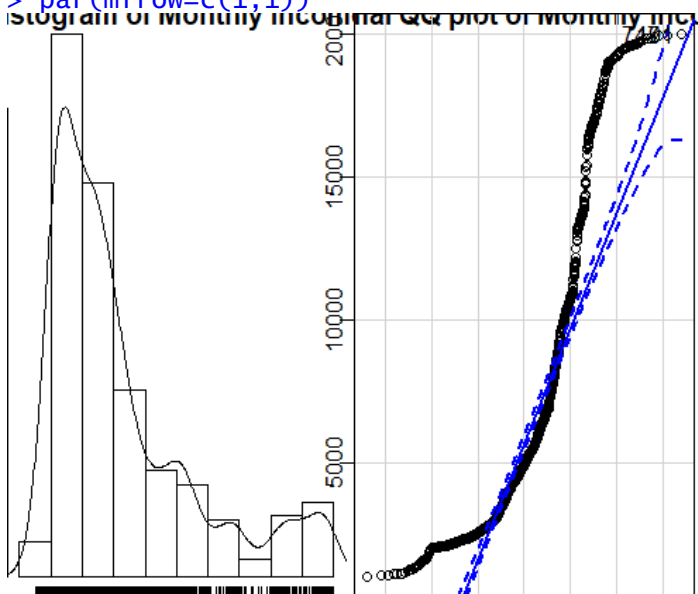
> par(mfrow = c(1,2))
> hist(attr$HourlyRate,xlab='',main = 'Histogram of HourlyRate',freq = FALSE)
> lines(density(attr$HourlyRate,na.rm = T))

```

```
> rug(jitter(attr$HourlyRate))
> qqPlot(attr$HourlyRate,main='Normal QQ plot of HourlyRate')
[1] 58 79
> par(mfrow=c(1,1))
```



```
> par(mfrow = c(1,2))
> hist(attr$MonthlyIncome,xlab='',main = 'Histogram of Monthly Income',freq =
FALSE)
> lines(density(attr$MonthlyIncome,na.rm = T))
> rug(jitter(attr$MonthlyIncome))
> qqPlot(attr$MonthlyIncome,main='Normal QQ plot of Monthly Income')
[1] 191 747
> par(mfrow=c(1,1))
```

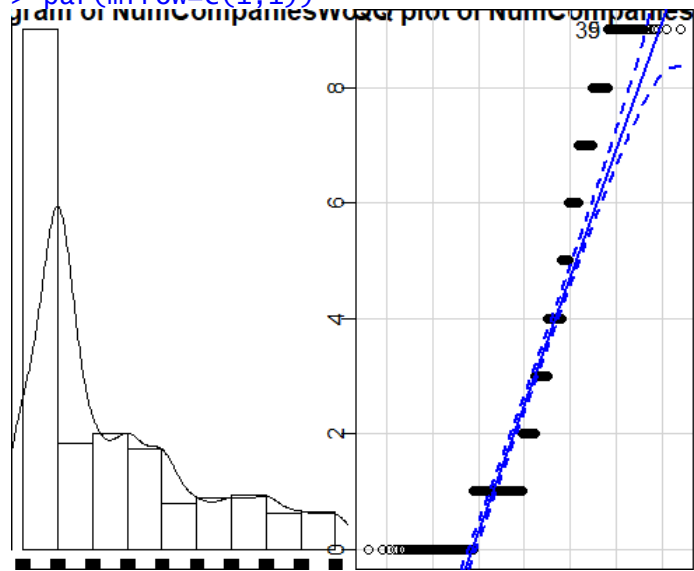


```
> par(mfrow = c(1,2))
> hist(attr$NumCompaniesworked,xlab='',main = 'Histogram of NumCompaniesworke
d',freq = FALSE)
> lines(density(attr$NumCompaniesworked,na.rm = T))
> rug(jitter(attr$NumCompaniesworked))
```

```
> qqPlot(attr$NumCompaniesWorked,main='Normal QQ plot of NumCompaniesWorked')
```

```
[1] 5 39
```

```
> par(mfrow=c(1,1))
```



```
> par(mfrow = c(1,2))
```

```
> hist(attr$PercentSalaryHike,xlab='',main = 'Histogram of PercentSalaryHike',freq = FALSE)
```

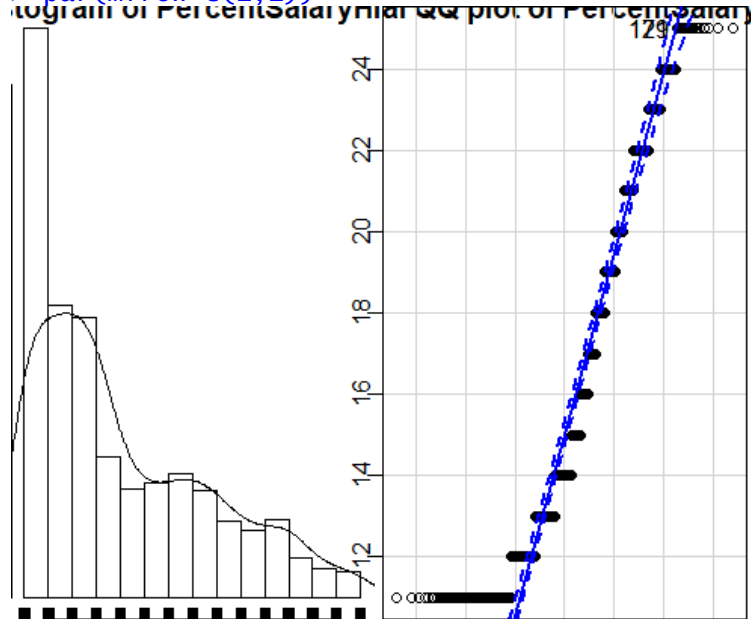
```
> lines(density(attr$PercentSalaryHike,na.rm = T))
```

```
> rug(jitter(attr$PercentSalaryHike))
```

```
> qqPlot(attr$PercentSalaryHike,main='Normal QQ plot of PercentSalaryHike')
```

```
[1] 121 179
```

```
> par(mfrow=c(1,1))
```



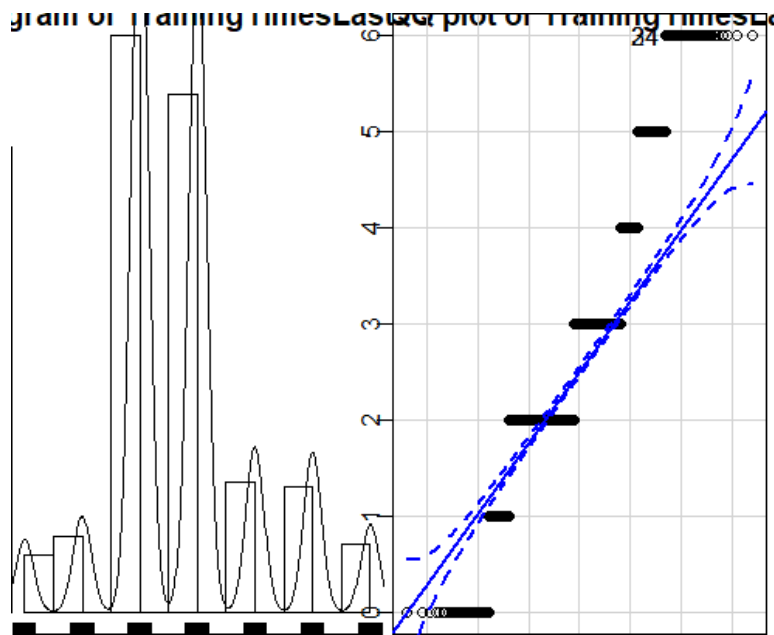
```
> par(mfrow = c(1,2))
```

```
> hist(attr$TrainingTimesLastYear,xlab='',main = 'Histogram of TrainingTimesLastYear',freq = FALSE)
```

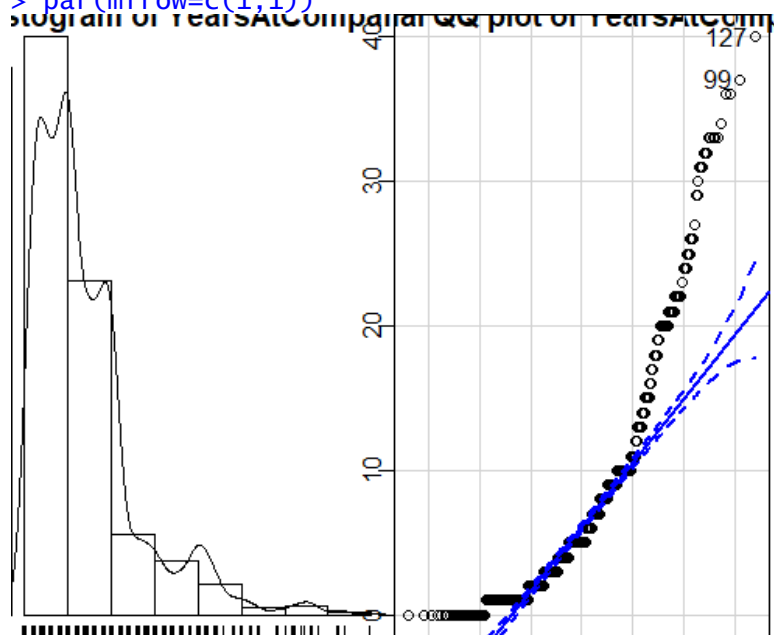
```
> lines(density(attr$TrainingTimesLastYear,na.rm = T))
```

```
> rug(jitter(attr$TrainingTimesLastYear))
```

```
> qqPlot(attr$TrainingTimesLastYear,main='Normal QQ plot of TrainingTimesLast
Year')
[1] 24 34
> par(mfrow=c(1,1))
```



```
> par(mfrow = c(1,2))
> hist(attr$YearsAtCompany,xlab='',main = 'Histogram of YearsAtCompany',freq
= FALSE)
> lines(density(attr$YearsAtCompany,na.rm = T))
> rug(jitter(attr$YearsAtCompany))
> qqPlot(attr$YearsAtCompany,main='Normal QQ plot of YearsAtCompany')
[1] 127 99
> par(mfrow=c(1,1))
```

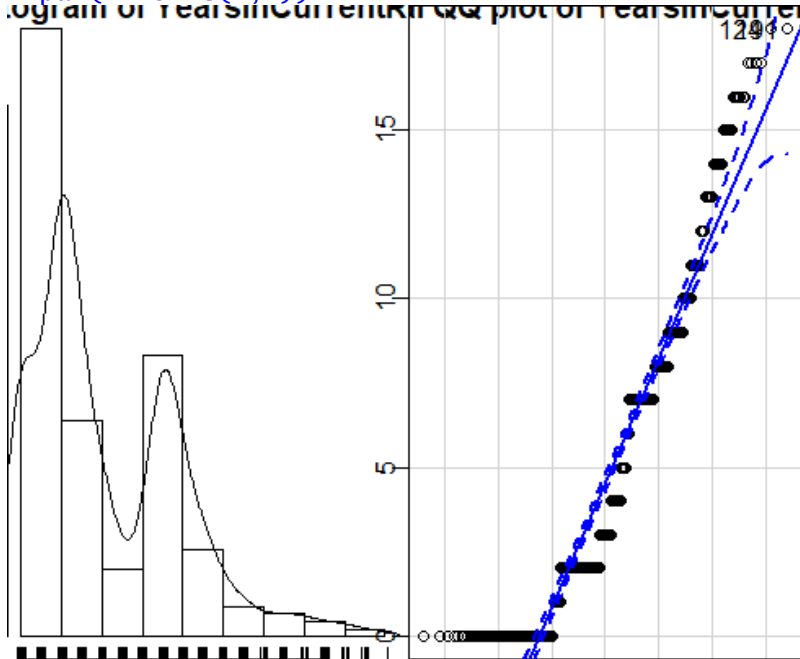


```
> par(mfrow = c(1,2))
```

```

> hist(attr$YearsInCurrentRole,xlab='',main = 'Histogram of YearsInCurrentRole',freq = FALSE)
> lines(density(attr$YearsInCurrentRole,na.rm = T))
> rug(jitter(attr$YearsInCurrentRole))
> qqPlot(attr$YearsInCurrentRole,main='Normal QQ plot of YearsInCurrentRole')
[1] 124 191
> par(mfrow=c(1,1))

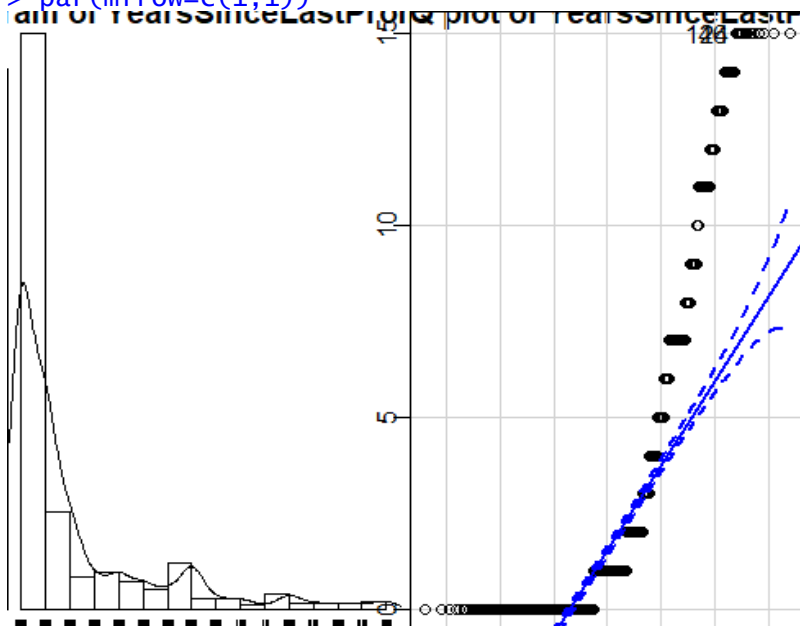
```



```

> par(mfrow = c(1,2))
> hist(attr$YearsSinceLastPromotion,xlab='',main = 'Histogram of YearsSinceLastPromotion',freq = FALSE)
> lines(density(attr$YearsSinceLastPromotion,na.rm = T))
> rug(jitter(attr$YearsSinceLastPromotion))
> qqPlot(attr$YearsSinceLastPromotion,main='Normal QQ plot of YearsSinceLastPromotion')
[1] 46 124
> par(mfrow=c(1,1))

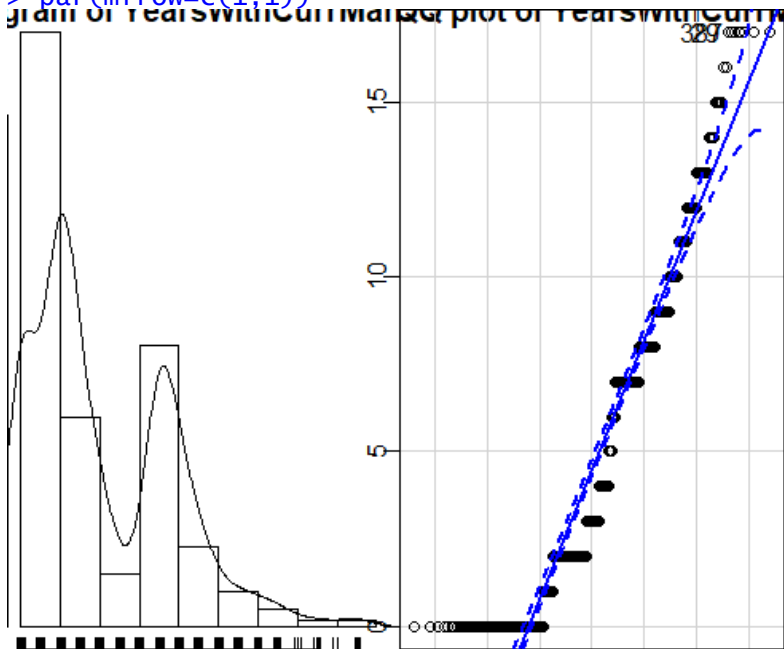
```



```

> par(mfrow = c(1,2))
> hist(attr$YearsWithCurrManager,xlab='',main = 'Histogram of YearsWithCurrMa
nager',freq = FALSE)
> lines(density(attr$YearsWithCurrManager,na.rm = T))
> rug(jitter(attr$YearsWithCurrManager))
> qqPlot(attr$YearsWithCurrManager,main='Normal QQ plot of YearsWithCurrManag
er')
[1] 29 387
> par(mfrow=c(1,1))

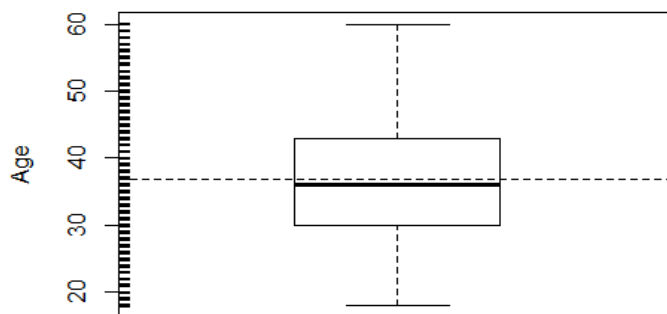
```



```

> #Boxplot distributions for our numeric columns
> #The dashed line shows the mean and the dark center line shows the median
> #Difference between these two lines depict the deviation from the central limit theorem
> #Boxplot distributions for Age
> boxplot(attr$Age, ylab = "Age")
> rug(jitter(attr$Age), side = 2)
> abline(h = mean(attr$Age, na.rm = T), lty = 2)

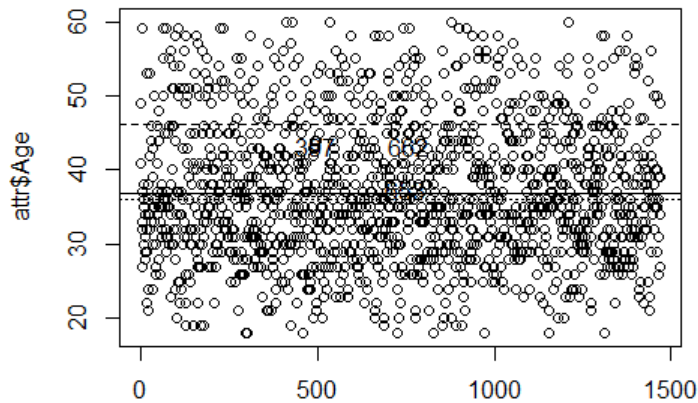
```



```

> #Plotting the Age with 3 lines for mean, median and mean+std
> plot(attr$Age, xlab = "")
> abline(h = mean(attr$Age, na.rm = T), lty = 1)
> abline(h = mean(attr$Age, na.rm = T) + sd(attr$Age, na.rm = T), lty = 2)
> abline(h = median(attr$Age, na.rm = T), lty = 3)
> identify(attr$Age)
[1] 286 696 709 720 1174 1323

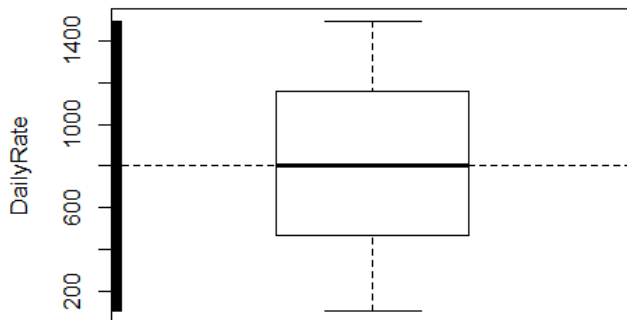
```



```

> #Boxplot distributions for Daily rate
> boxplot(attr$DailyRate, ylab = "DailyRate", outline = TRUE)
> rug(jitter(attr$DailyRate), side = 2)
> abline(h = mean(attr$DailyRate, na.rm = T), lty = 2)

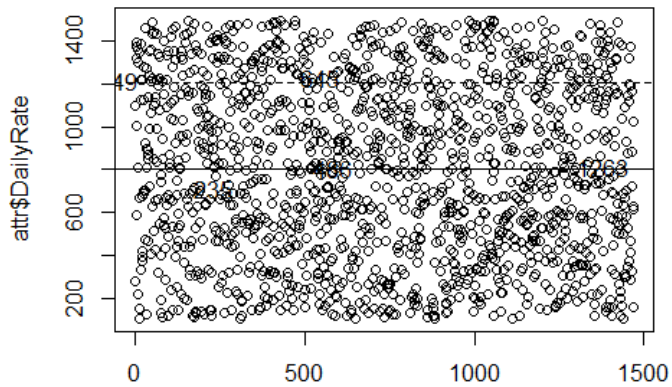
```



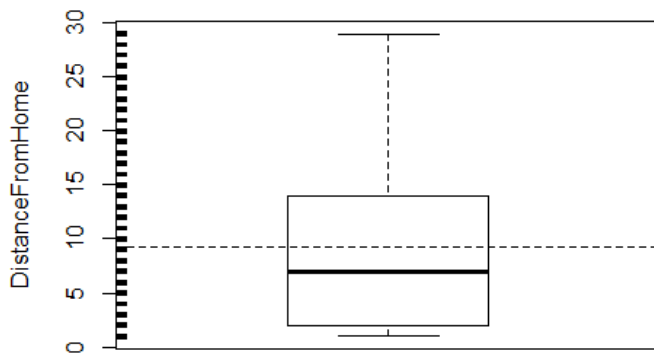
```

> #Plotting the DailyRate with 3 lines for mean, median and mean+std
> plot(attr$DailyRate, xlab = "")
> abline(h = mean(attr$DailyRate, na.rm = T), lty = 1)
> abline(h = mean(attr$DailyRate, na.rm = T) + sd(attr$DailyRate, na.rm = T),
lty = 2)
> abline(h = median(attr$DailyRate, na.rm = T), lty = 3)
> identify(attr$DailyRate)
[1] 49 235 486 645 1263

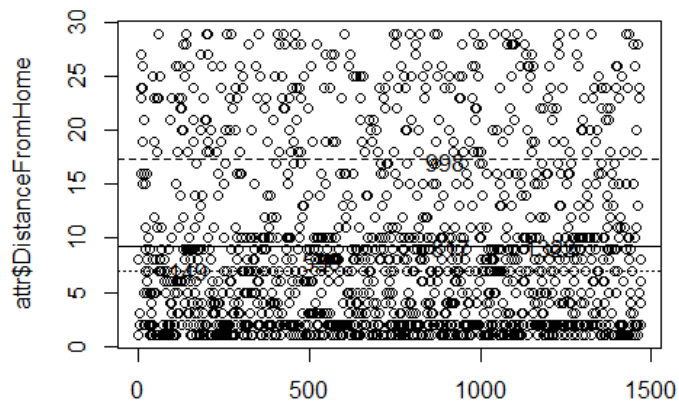
```



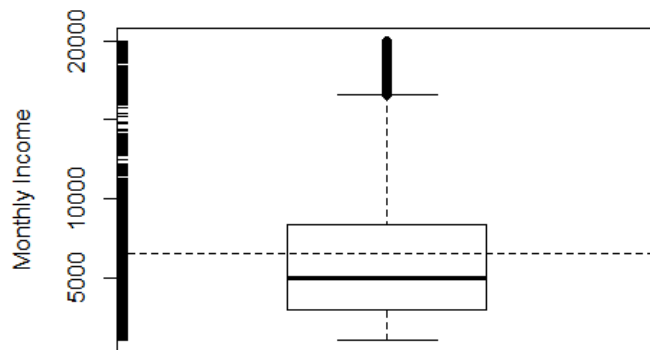
```
> #Boxplot distributions for Distance from home
> boxplot(attr$DistanceFromHome, ylab = "DistanceFromHome",outline = TRUE)
> rug(jitter(attr$DistanceFromHome), side = 2)
> abline(h = mean(attr$DistanceFromHome, na.rm = T), lty = 2)
```



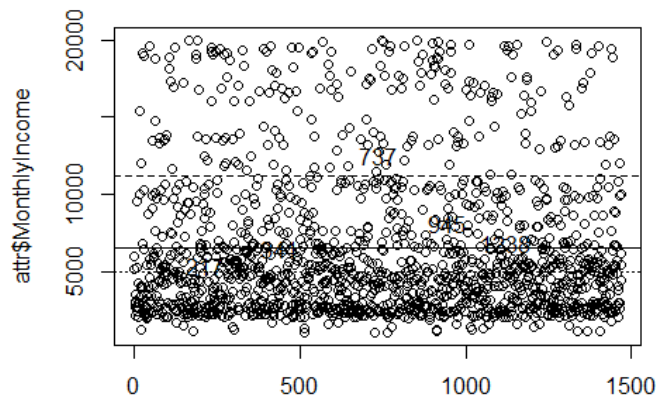
```
> plot(attr$DistanceFromHome, xlab = "")
> abline(h = mean(attr$DistanceFromHome, na.rm = T), lty = 1)
> abline(h = mean(attr$DistanceFromHome, na.rm = T) + sd(attr$DistanceFromHome, na.rm = T), lty = 2)
> abline(h = median(attr$DistanceFromHome, na.rm = T), lty = 3)
> identify(attr$DistanceFromHome)
[1] 149 538 817 998 1322
```

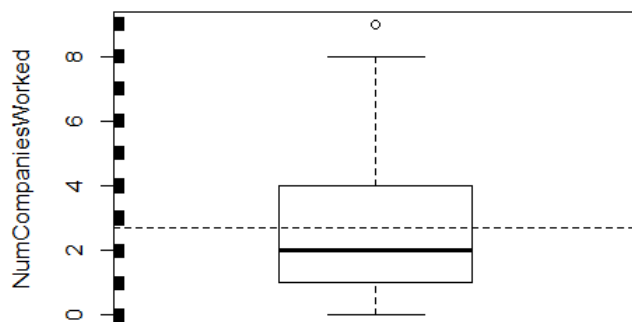
```
> #Boxplot distributions for Monthly Income
> boxplot(attr$MonthlyIncome, ylab = "Monthly Income")
> rug(jitter(attr$MonthlyIncome), side = 2)
> abline(h = mean(attr$MonthlyIncome, na.rm = T), lty = 2)
```



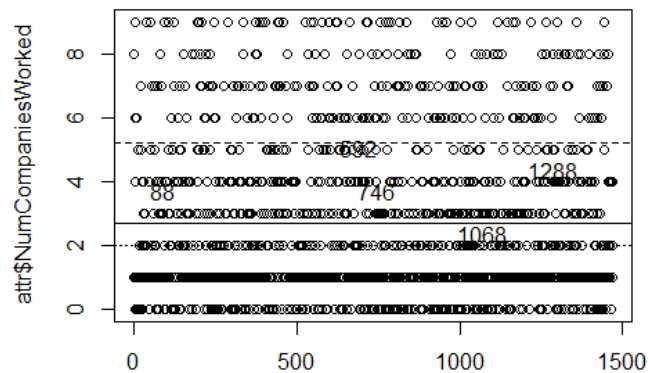
```
> #Plotting the Monthly Income and Age with 3 lines for mean, median and mean+std
> plot(attr$MonthlyIncome, xlab = "")
> abline(h = mean(attr$MonthlyIncome, na.rm = T), lty = 1)
> abline(h = mean(attr$MonthlyIncome, na.rm = T) + sd(attr$MonthlyIncome, na.rm = T), lty = 2)
> abline(h = median(attr$MonthlyIncome, na.rm = T), lty = 3)
> identify(attr$MonthlyIncome)
[1] 217 341 737 945 1238
```



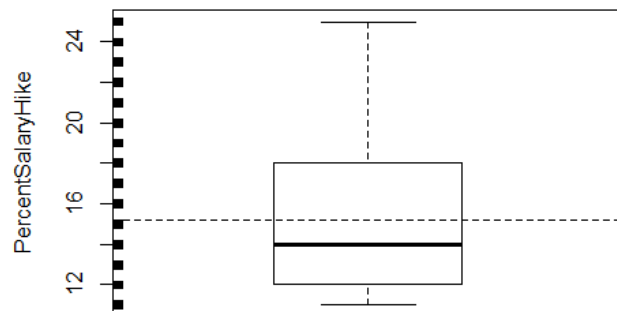
```
> #Boxplot distributions for NumCompaniesWorked
> boxplot(attr$NumCompaniesWorked, ylab = "NumCompaniesWorked")
> rug(jitter(attr$NumCompaniesWorked), side = 2)
> abline(h = mean(attr$NumCompaniesWorked, na.rm = T), lty = 2)
```



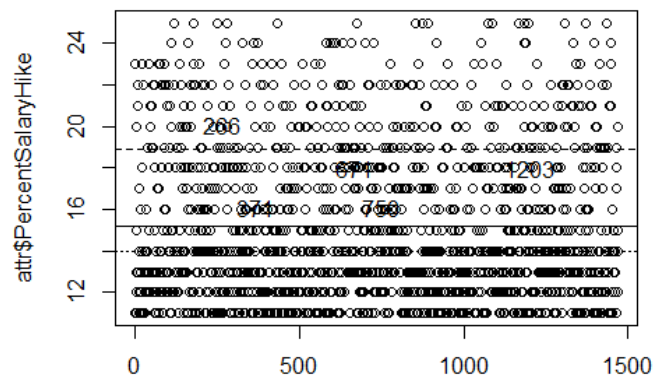
```
> #Plotting the NumCompaniesWorked with 3 lines for mean, median and mean+std
> plot(attr$NumCompaniesWorked, xlab = "")
> abline(h = mean(attr$NumCompaniesWorked, na.rm = T), lty = 1)
> abline(h = mean(attr$NumCompaniesWorked, na.rm = T) + sd(attr$NumCompaniesw
orked, na.rm = T), lty = 2)
> abline(h = median(attr$NumCompaniesWorked, na.rm = T), lty = 3)
> identify(attr$NumCompaniesWorked)
[1] 88 592 746 1068 1288
```



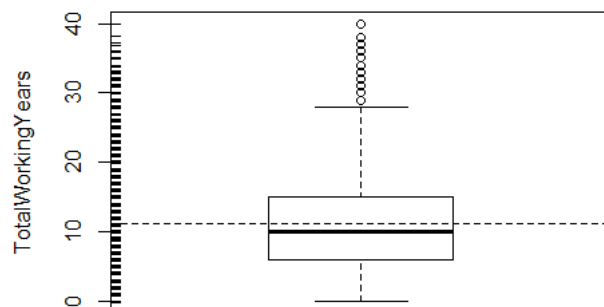
```
> #Boxplot distributions for PercentsSalaryHike
> boxplot(attr$PercentsSalaryHike, ylab = "PercentsSalaryHike")
> rug(jitter(attr$PercentsSalaryHike), side = 2)
> abline(h = mean(attr$PercentsSalaryHike, na.rm = T), lty = 2)
```



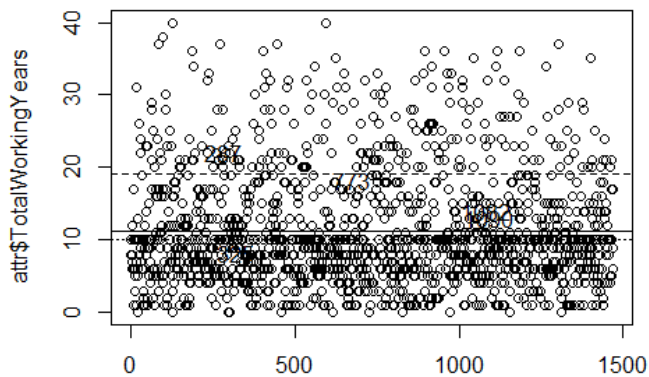
```
> #Plotting the PercentsSalaryHike with 3 lines for mean, median and mean+std
> plot(attr$PercentsSalaryHike, xlab = "")
> abline(h = mean(attr$PercentsSalaryHike, na.rm = T), lty = 1)
> abline(h = mean(attr$PercentsSalaryHike, na.rm = T) + sd(attr$PercentsSalaryHike, na.rm = T), lty = 2)
> abline(h = median(attr$PercentsSalaryHike, na.rm = T), lty = 3)
> identify(attr$PercentsSalaryHike)
[1] 266 371 671 750 1203
```



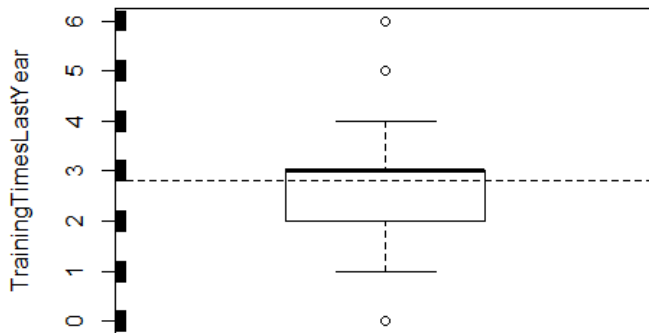
```
> #Boxplot distributions for TotalWorkingYears
> boxplot(attr$TotalWorkingYears, ylab = "TotalWorkingYears")
> rug(jitter(attr$TotalWorkingYears), side = 2)
> abline(h = mean(attr$TotalWorkingYears, na.rm = T), lty = 2)
```



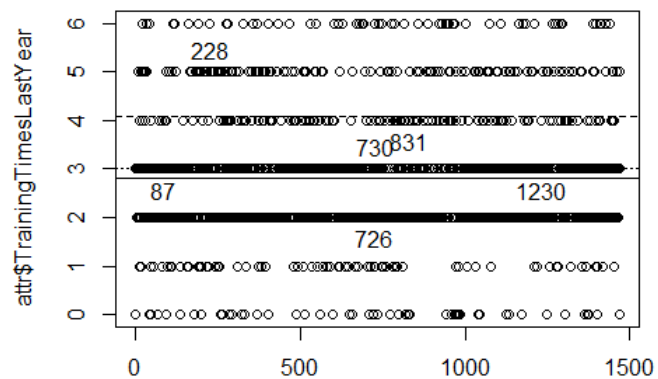
```
> #Plotting the TotalWorkingYears with 3 lines for mean, median and mean+std
> plot(attr$TotalWorkingYears, xlab = "")
> abline(h = mean(attr$TotalWorkingYears, na.rm = T), lty = 1)
> abline(h = mean(attr$TotalWorkingYears, na.rm = T) + sd(attr$TotalWorkingYears, na.rm = T), lty = 2)
> abline(h = median(attr$TotalWorkingYears, na.rm = T), lty = 3)
> identify(attr$TotalWorkingYears)
[1] 287 325 773 1082 1090
```



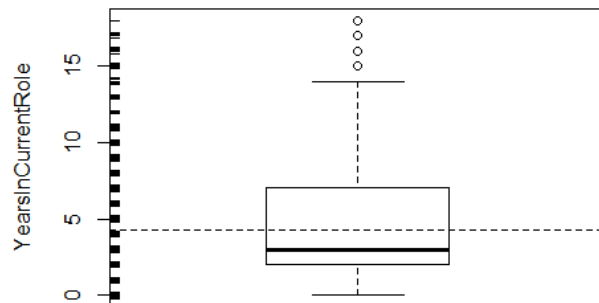
```
> #Boxplot distributions for TrainingTimesLastYear
> boxplot(attr$TrainingTimesLastYear, ylab = "TrainingTimesLastYear")
> rug(jitter(attr$TrainingTimesLastYear), side = 2)
> abline(h = mean(attr$TrainingTimesLastYear, na.rm = T), lty = 2)
```



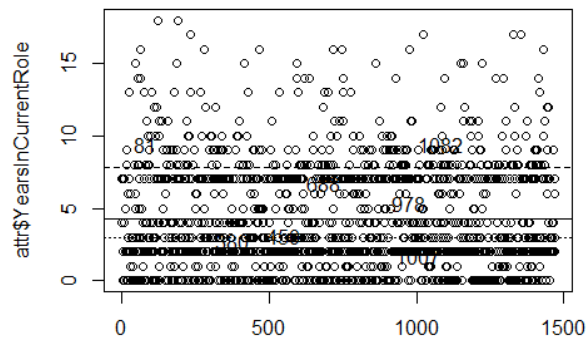
```
> #Plotting the TrainingTimesLastYear with 3 lines for mean, median and mean
+std
> plot(attr$TrainingTimesLastYear, xlab = "")
> abline(h = mean(attr$TrainingTimesLastYear, na.rm = T), lty = 1)
> abline(h = mean(attr$TrainingTimesLastYear, na.rm = T) + sd(attr$TrainingTi
mesLastYear, na.rm = T), lty = 2)
> abline(h = median(attr$TrainingTimesLastYear, na.rm = T), lty = 3)
> identify(attr$TrainingTimesLastYear)
[1] 87 228 726 730 831 1230
```



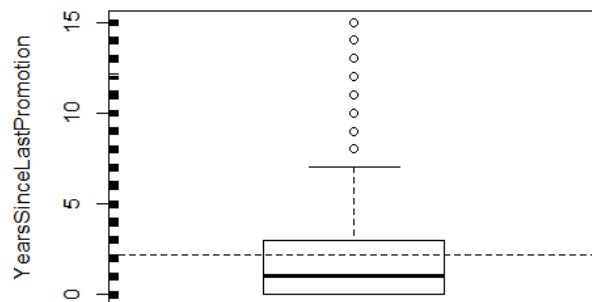
```
> #Boxplot distributions for YearsInCurrentRole
> boxplot(attr$YearsInCurrentRole, ylab = "YearsInCurrentRole")
> rug(jitter(attr$YearsInCurrentRole), side = 2)
> abline(h = mean(attr$YearsInCurrentRole, na.rm = T), lty = 2)
```



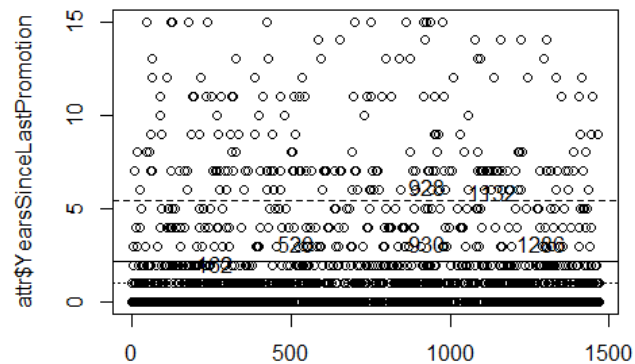
```
> #Plotting the YearsInCurrentRole with 3 lines for mean, median and mean+std
> plot(attr$YearsInCurrentRole, xlab = "")
> abline(h = mean(attr$YearsInCurrentRole, na.rm = T), lty = 1)
> abline(h = mean(attr$YearsInCurrentRole, na.rm = T) + sd(attr$YearsInCurrentRole, na.rm = T), lty = 2)
> abline(h = median(attr$YearsInCurrentRole, na.rm = T), lty = 3)
> identify(attr$YearsInCurrentRole)
[1] 81 380 450 688 978 1007 1082
```



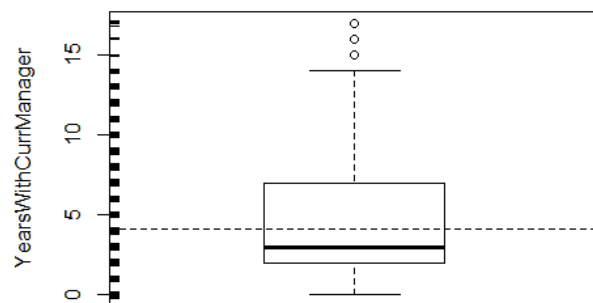
```
> #Boxplot distributions for YearsSinceLastPromotion
> boxplot(attr$YearsSinceLastPromotion, ylab = "YearsSinceLastPromotion")
> rug(jitter(attr$YearsSinceLastPromotion), side = 2)
> abline(h = mean(attr$YearsSinceLastPromotion, na.rm = T), lty = 2)
```



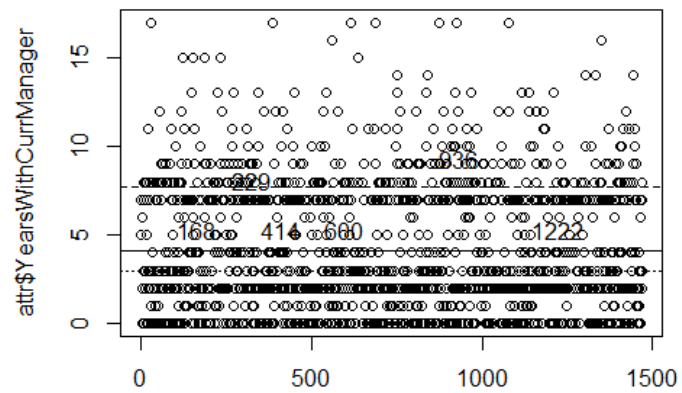
```
> #Plotting the YearsSinceLastPromotion with 3 lines for mean, median and me
an+std
> plot(attr$YearsSinceLastPromotion, xlab = "")
> abline(h = mean(attr$YearsSinceLastPromotion, na.rm = T), lty = 1)
> abline(h = mean(attr$YearsSinceLastPromotion, na.rm = T) + sd(attr$YearsSin
ceLastPromotion, na.rm = T), lty = 2)
> abline(h = median(attr$YearsSinceLastPromotion, na.rm = T), lty = 3)
> identify(attr$YearsSinceLastPromotion)
[1] 162 520 928 930 1132 1286
```



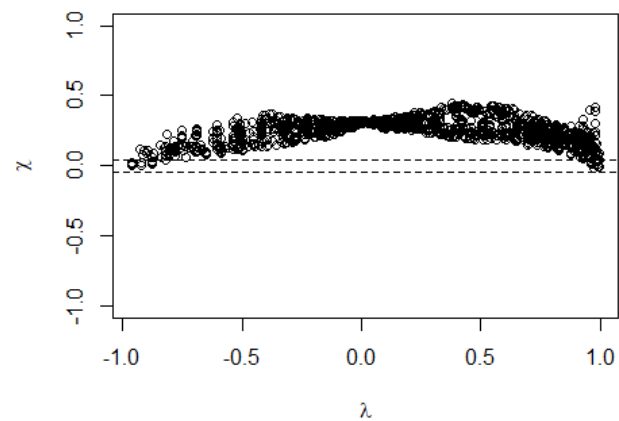
```
> #Boxplot distributions for YearsWithCurrManager
> boxplot(attr$YearsWithCurrManager, ylab = "YearsWithCurrManager")
> rug(jitter(attr$YearsWithCurrManager), side = 2)
> abline(h = mean(attr$YearsWithCurrManager, na.rm = T), lty = 2)
```



```
> #Boxplot distributions for YearsWithCurrManager
> plot(attr$YearsWithCurrManager, xlab = "")
> abline(h = mean(attr$YearsWithCurrManager, na.rm = T), lty = 1)
> abline(h = mean(attr$YearsWithCurrManager, na.rm = T) + sd(attr$YearsWithCu
rrManager, na.rm = T), lty = 2)
> abline(h = median(attr$YearsWithCurrManager, na.rm = T), lty = 3)
> identify(attr$YearsWithCurrManager)
[1] 168 229 414 600 936 1222
```

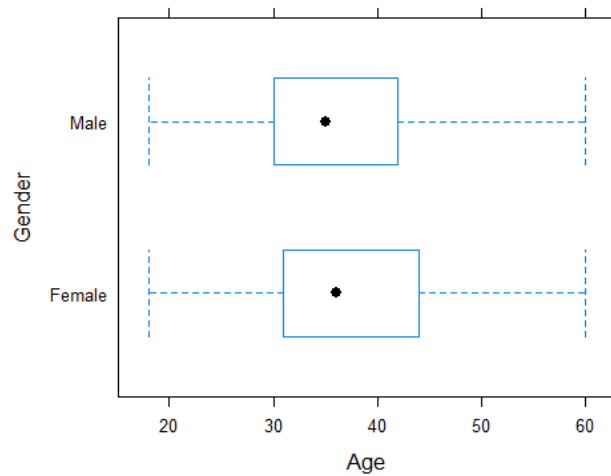
```
> #Chi Plot for inspecting the independence
> chi.plot(attr$MonthlyIncome,attr$Age)
```



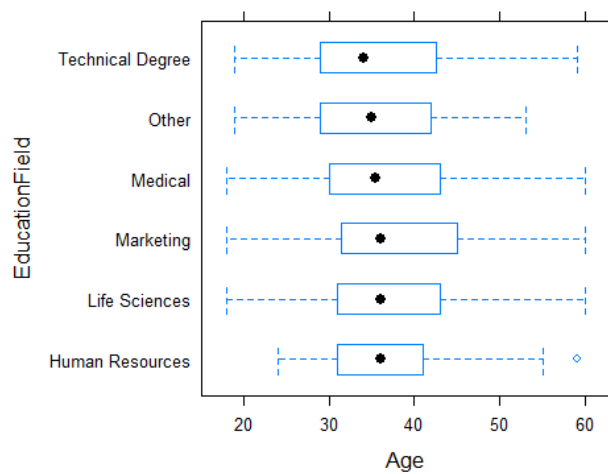
```
> #Plotting joint boxplots for various categories wrt Age
> bwplot(attr$Department ~ attr$Age, data=attr, ylab='Department',xlab='Age')
```



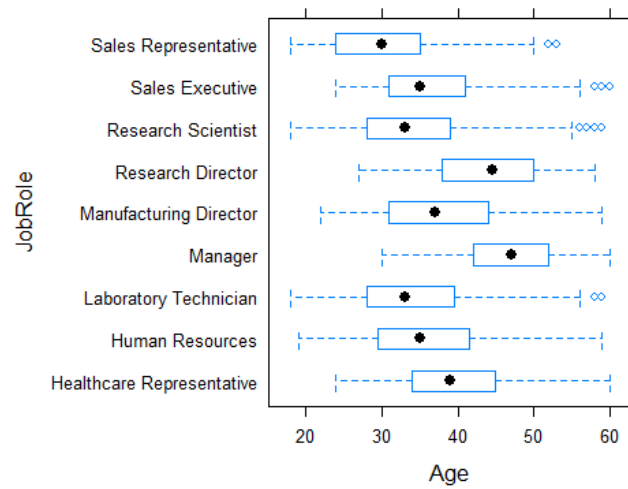
```
> bwplot(attr$Gender ~ attr$Age, data=attr, ylab='Gender',xlab='Age')
```



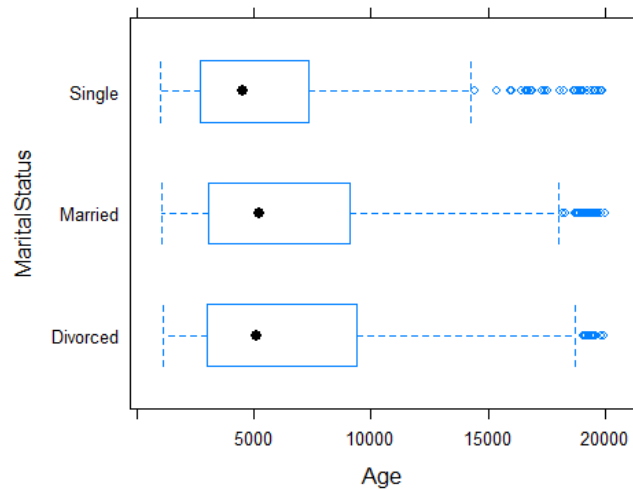
```
> bwplot(attr$EducationField ~ attr$Age, data=attr, ylab='EducationField',xlab='Age')
```



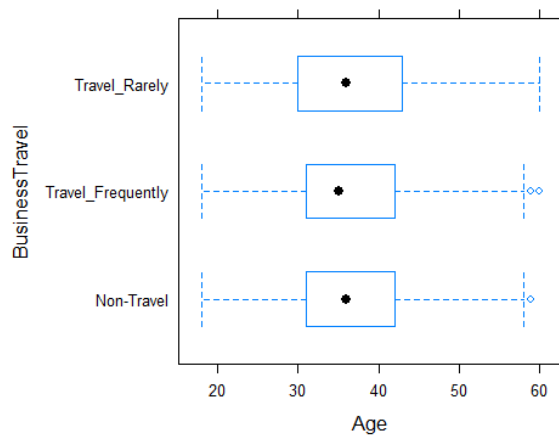
```
> bwplot(attr$JobRole ~ attr$Age, data=attr, ylab='JobRole',xlab='Age')
```



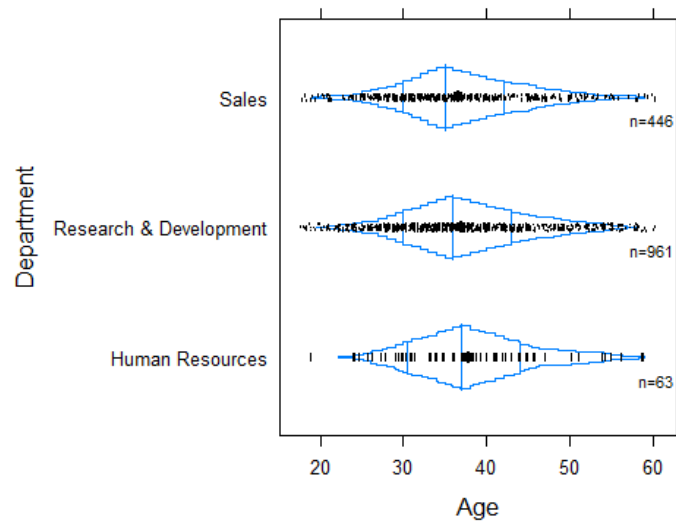
```
> bwplot(attr$MaritalStatus ~ attr$MonthlyIncome, data=attr, ylab='MaritalStatus',xlab='Age')
```



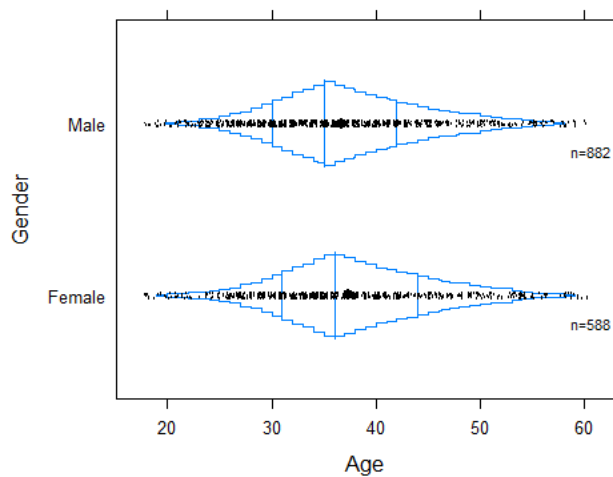
```
> bwplot(attr$BusinessTravel ~ attr$Age, data=attr, ylab='BusinessTravel',xlab='Age')
```



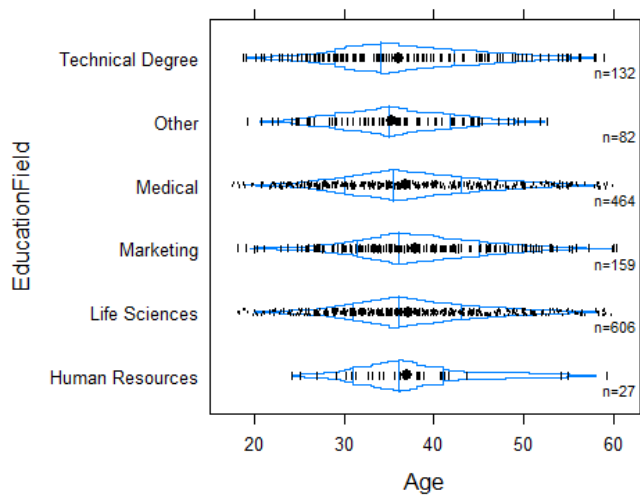
```
#Plotting stripplots for various categories wrt numerical column TotalCharges
> bwplot(attr$Department ~ attr$Age, data=attr,panel=panel.bpplot,
+       probs=seq(.01,.49,by=.01), datadensity=TRUE, ylab='Department',xlab=
+ 'Age')
```



```
> bwplot(attr$Gender ~ attr$Age, data=attr,panel=panel.bpplot,
+       probs=seq(.01,.49,by=.01), datadensity=TRUE, ylab='Gender',xlab='Age')
```



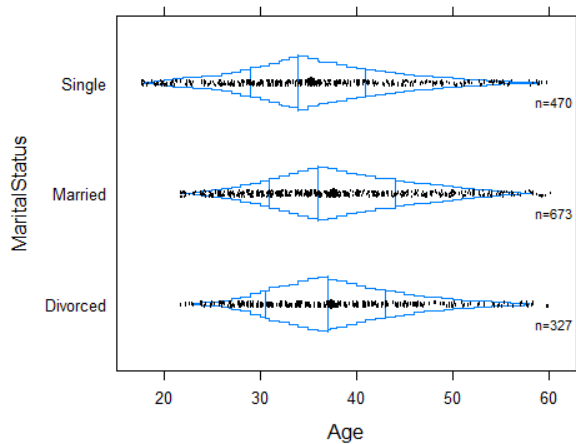
```
> bwplot(attr$EducationField ~ attr$Age, data=attr,panel=panel.bpplot,
+       probs=seq(.01,.49,by=.01), datadensity=TRUE, ylab='EducationField',xlab='Age')
```



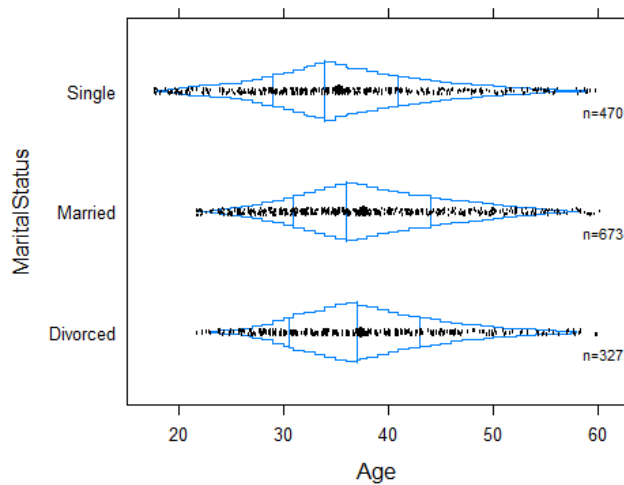
```
> bwplot(attr$JobRole ~ attr$Age, data=attr, panel=panel.bwplot,
+        probs=seq(.01, .49, by=.01), datadensity=TRUE, ylab='JobRole', xlab='Age')
```



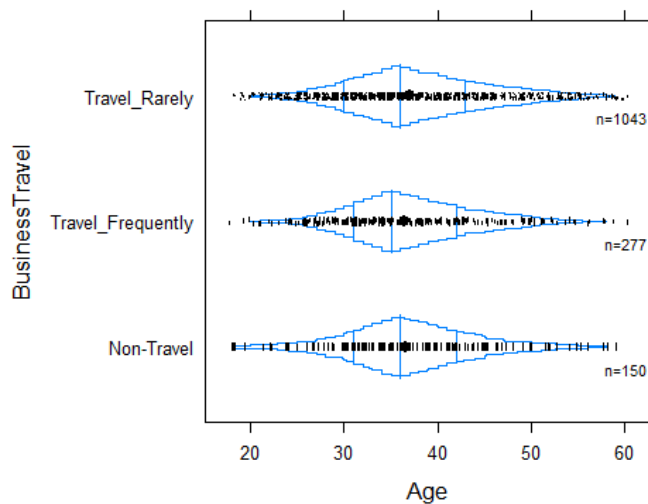
```
> bwplot(attr$MaritalStatus ~ attr$Age, data=attr, panel=panel.bwplot,
+        probs=seq(.01, .49, by=.01), datadensity=TRUE, ylab='MaritalStatus', xlab='Age')
```



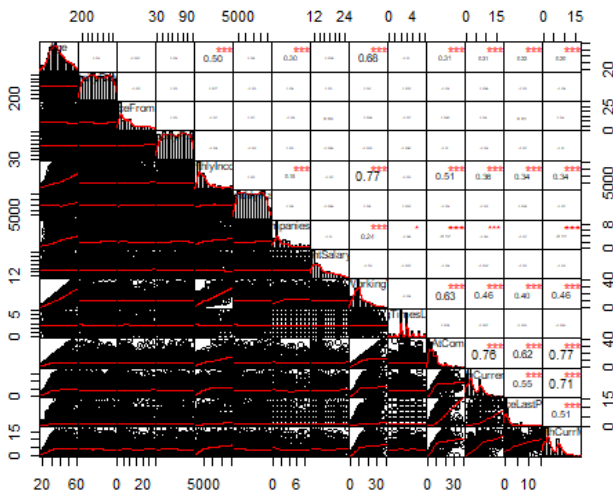
```
> bwplot(attr$MaritalStatus ~ attr$Age, data=attr, panel=panel.bwplot,
+        probs=seq(.01, .49, by=.01), datadensity=TRUE, ylab='MaritalStatus', xlab='Age')
```



```
> bwplot(attr$BusinessTravel ~ attr$Age, data=attr, panel=panel.bwplot,
+        probs=seq(.01, .49, by=.01), datadensity=TRUE, ylab='BusinessTravel', xlab='Age')
```



```
> data<-attr[,c('Age', 'DailyRate', 'DistanceFromHome', 'HourlyRate',
+               'MonthlyIncome', 'MonthlyRate', 'NumCompaniesWorked', 'PercentsSalaryHike', 'T
+               'TrainingTimesLastYear', 'YearsAtCompany',
+               'YearsInCurrentRole', 'YearsSinceLastPromotion', 'YearswithCurrManager')]
> chart.Correlation(data, histogram = TRUE, pch=19)
```



```
#-----
> ##Creating Temporary Variables
> #-----
>
> #Converting double/int columns to numeric
> numeric_col <- c("Age","DailyRate","DistanceFromHome","HourlyRate",
+                 "MonthlyIncome","MonthlyRate","NumCompaniesWorked","PercentSalaryHike",
+                 "TrainingTimesLastYear","YearsAtCompany",
+                 "YearsInCurrentRole","YearsSinceLastPromotion","YearswithCurrManager")
> attr[numeric_col] <- sapply(attr[numeric_col], as.numeric)

e out the numeric columns from categorical columns and storing them as a seperate dataframe
> attr_i <- attr[,c("Age","DailyRate","DistanceFromHome","HourlyRate",
+                 "MonthlyIncome","MonthlyRate","NumCompaniesWorked","PercentSalaryHike",
+                 "TrainingTimesLastYear","YearsAtCompany",
+                 "YearsInCurrentRole","YearsSinceLastPromotion","YearswithCurrManager")
> attr_i <- data.frame(scale(attr_i))

> #Creating temporary variables for the categorical data
> attr_c <- attr[, -c(2,3,5,8,10,11,12,13,14,15,19,21,22,23)]
> temporary<- data.frame(sapply(attr_c,function(x) data.frame(model.matrix(~x-1,data =attr_c[,x]))))
> head(temporary)
  Education.x2 Education.x3 Education.x4 Education.x5 EnvironmentSatisfaction.x2 Environm
1             1             0             0             0                     1
2             0             0             0             0                     0
3             1             0             0             0                     0
4             0             0             1             0                     0
5             0             0             0             0                     0
6             1             0             0             0                     0
  EnvironmentSatisfaction.x4 MaritalStatus.xMarried MaritalStatus.xSingle overTime stockO
1              0              0              1              1
2              0              1              0              0
3              1              0              1              1
4              1              1              0              1
5              0              1              0              0
6              1              0              1              0
  StockOptionLevel.x2 StockOptionLevel.x3 workLifeBalance.x2 workLifeBalance.x3 workLifeB
1              0              0              0              0
2              0              0              0              1
3              0              0              0              1
4              0              0              0              1
5              0              0              0              1
6              0              0              1              0
```

```
> View(attr)
```

```
> #Combining the temporary and the numeric columns and create the final dataset
> attr_final <- cbind(attr_i,temporary)
> head(attr_final)
```

	Age	DailyRate	DistanceFromHome	HourlyRate	MonthlyIncome	MonthlyRate	NumCompanies
1	0.44619856	0.7422739	-1.0105654	1.3826677	-0.1083127	0.7257730	2
2	1.32191535	-1.2973331	-0.1470997	-0.2405949	-0.2916193	1.4883696	-0
3	0.00834016	1.4138821	-0.8872132	1.2842882	-0.9373347	-1.6742711	1
4	-0.42951824	1.4609690	-0.7638609	-0.4865438	-0.7633739	1.2427877	-0
5	-1.08630583	-0.5241163	-0.8872132	-1.2735802	-0.6446387	0.3257890	2
6	-0.53898284	0.5018828	-0.8872132	0.6448211	-0.7296013	-0.3440822	-1
	PercentSalaryHike	TotalWorkingYears	TrainingTimesLastYear	YearsAtCompany	YearsInCurrent		
1	-1.15016269	-0.4214990	-2.1712429	-0.164557109	-0.0632		
2	2.12858163	-0.1644554	0.1556541	0.488341541	0.7647		
3	-0.05724792	-0.5500208	0.1556541	-1.143905083	-1.1672		
4	-1.15016269	-0.4214990	0.1556541	0.161892216	0.7647		
5	-0.87693400	-0.6785426	0.1556541	-0.817455758	-0.6152		
6	-0.60370530	-0.4214990	-0.6199782	-0.001332446	0.7647		
	YearsSinceLastPromotion	YearsWithCurrManager	Education.x2	Education.x3	Education.x4	Education.x5	
1	-0.67891464	0.2457504	1	0	0	0	
2	-0.36858985	0.8062671	0	0	0	0	
3	-0.67891464	-1.1555415	1	0	0	0	
4	0.25205973	-1.1555415	0	0	1	0	
5	-0.05826506	-0.5950247	0	0	0	0	
6	0.25205973	0.5260087	1	0	0	0	
	EnvironmentsSatisfaction.x2	EnvironmentsSatisfaction.x3	EnvironmentsSatisfaction.x4	EnvironmentsSatisfaction.x5	EnvironmentsSatisfaction.x6	EnvironmentsSatisfaction.x7	MaritalStatus
1	1	0	0	0	0	0	0
2	0	1	0	0	0	0	0
3	0	0	0	0	0	0	1
4	0	0	0	0	0	0	1
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	1
	MaritalStatus.xSingle	OverTime	StockOptionLevel.x1	StockOptionLevel.x2	StockOptionLevel.x3	StockOptionLevel.x4	StockOptionLevel.x5
1	1	1	0	0	0	0	0
2	0	0	1	0	0	0	0
3	1	1	0	0	0	0	0
4	0	1	0	0	0	0	0
5	0	0	1	0	0	0	0
6	1	0	0	0	0	0	0
	WorkLifeBalance.x2	WorkLifeBalance.x3	WorkLifeBalance.x4	WorkLifeBalance.x5	WorkLifeBalance.x6	WorkLifeBalance.x7	WorkLifeBalance.x8
1	0	0	0	0	0	0	0
2	0	1	0	0	0	0	0
3	0	1	0	0	0	0	0
4	0	1	0	0	0	0	0
5	0	1	0	0	0	0	0
6	1	0	0	0	0	0	0

```
> glimpse(attr_final)
```

```
Observations: 1,470
```

```
Variables: 30
```

```
$ Age          <dbl> 0.44619856, 1.32191535, 0.00834016, -0.42951824, -1.08630583, -0.53898284, ...
$ DailyRate    <dbl> 0.74227393, -1.29733311, 1.41388208, 1.46096900, -0.52411630, 0.50188284, ...
$ DistanceFromHome <dbl> -1.01056544, -0.14709966, -0.88721318, -0.76386093, -0.88721320, -0.88721320, ...
$ HourlyRate    <dbl> 1.38266773, -0.24059489, 1.28428818, -0.48654378, -1.27358020, 0.64482110, ...
$ MonthlyIncome <dbl> -0.108312654, -0.291619349, -0.937334707, -0.763373892, -0.644638700, -0.729601300, ...
$ MonthlyRate   <dbl> 0.72577730, 1.4883696, -1.6742711, 1.2427877, 0.3257890, -0.3440822, ...
$ NumCompaniesworked <dbl> 2.1244130, -0.6778187, 1.3237753, -0.6778187, 2.524731, 0.7647373, ...
$ PercentSalaryHike <dbl> -1.15016269, 2.12858163, -0.05724792, -1.15016269, -0.87693400, 0.50188284, ...
$ TotalWorkingYears <dbl> -0.42149902, -0.16445544, -0.55002081, -0.42149902, -0.67854260, -0.42149902, ...
$ TrainingTimesLastYear <dbl> -2.1712429, 0.1556541, 0.1556541, 0.1556541, 0.1556541, -0.6199782, ...
$ YearsAtCompany <dbl> -0.164557109, 0.488341541, -1.143905083, 0.161892216, -0.817455758, -0.001332446, ...
$ YearsInCurrentRole <dbl> -0.06327437, 0.76473737, -1.16729002, 0.76473737, -0.61520000, 0.76473737, ...
$ YearsSinceLastPromotion <dbl> -0.67891464, -0.36858985, -0.67891464, 0.25205973, -0.05826506, 0.25205973, ...
$ YearsWithCurrManager <dbl> 0.2457504, 0.8062671, -1.1555415, -1.1555415, -0.5950247, 0.5260087, ...
```



```

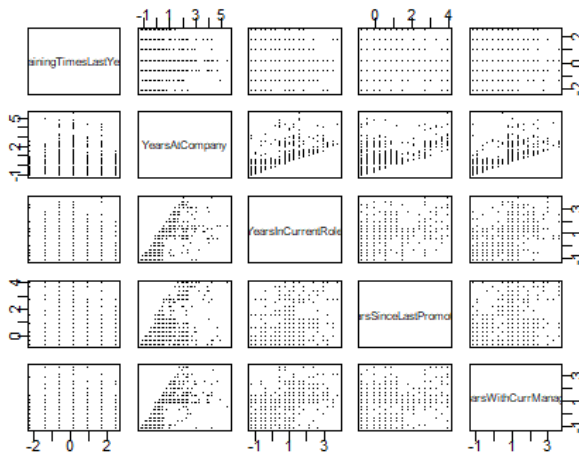
$ Education.x2 <dbl> 1, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 1,
$ Education.x3 <dbl> 0, 0, 0, 0, 0, 0, 1, 0, 1, 1, 1, 0, 0, 0, 1, 0, 0, 0,
$ Education.x4 <dbl> 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0,
$ Education.x5 <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
$ EnvironmentSatisfaction.x2 <dbl> 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0,
$ EnvironmentSatisfaction.x3 <dbl> 0, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0,
$ EnvironmentSatisfaction.x4 <dbl> 0, 0, 1, 1, 0, 1, 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1,
$ MaritalStatus.xMarried <dbl> 0, 1, 0, 1, 1, 0, 1, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0,
$ MaritalStatus.xSingle <dbl> 1, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 0,
$ OverTime <dbl> 1, 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1, 1,
$ StockOptionLevel.x1 <dbl> 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 1, 1, 1, 0, 1, 0,
$ StockOptionLevel.x2 <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1,
$ StockOptionLevel.x3 <dbl> 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
$ WorkLifeBalance.x2 <dbl> 0, 0, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0, 1, 0, 0, 0, 1, 1,
$ WorkLifeBalance.x3 <dbl> 0, 1, 1, 1, 1, 0, 0, 1, 1, 0, 1, 1, 0, 1, 1, 1, 0, 0,
$ WorkLifeBalance.x4 <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,

```

```

##Matrix Plots, Covariance and Correlations Plots
#ScatterPlot matrix
pairs(attr_final[,10:14],pch=".",cex=1.5)

```



```
##Test of Significance
```

```
#T-Test
```

```
#Null Hypothesis - The two means are equal
```

```
#Alternate Hypothesis - Difference in the two means is not zero
```

```
#pvalue >= 0.05, accept null hypothesis
```

```
#Or
```

```
#else accept the alternate hypothesis
```

```
#Univariate mean comparison using t test
```

```
> #Monthly Income and Attrition
```

```
> with(data=attr,t.test(attr$MonthlyIncome[attr$Attrition=="Yes"],attr$MonthlyIncome[attr$Attrition=="No"],var.equal=TRUE))
```

```
Two Sample t-test
```

```
data: attr$MonthlyIncome[attr$Attrition == "Yes"] and attr$MonthlyIncome[attr$Attrition == "No"]
t = -6.2039, df = 1468, p-value = 7.147e-10
```

```
alternative hypothesis: true difference in means is not equal to 0
```

```
95 percent confidence interval:
```

```
-2692.446 -1398.847
sample estimates:
mean of x mean of y
 4787.093  6832.740
```

```
> #HourlyRate and Attrition
> with(data=attr,t.test(attr$HourlyRate[attr$Attrition=="Yes"],attr$HourlyRate[attr$Attrition=="No"],var.equal=TRUE))
```

Two Sample t-test

```
data: attr$HourlyRate[attr$Attrition == "Yes"] and attr$HourlyRate[attr$Attrition == "No"]
t = -0.26229, df = 1468, p-value = 0.7931
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -3.207565  2.450946
sample estimates:
mean of x mean of y
 65.57384  65.95215
```

```
> #Daily Rate and Attrition
> with(data=attr,t.test(attr$DailyRate[attr$Attrition=="Yes"],attr$DailyRate[attr$Attrition=="No"],var.equal=TRUE))
```

Two Sample t-test

```
data: attr$DailyRate[attr$Attrition == "Yes"] and attr$DailyRate[attr$Attrition == "No"]
t = -2.1741, df = 1468, p-value = 0.02986
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -118.209251  -6.073932
sample estimates:
mean of x mean of y
 750.3629  812.5045
```

```
> #Age and Attrition
> with(data=attr,t.test(attr$Age[attr$Attrition=="Yes"],attr$Age[attr$Attrition=="No"],var.equal=TRUE))
```

Two Sample t-test

```
data: attr$Age[attr$Attrition == "Yes"] and attr$Age[attr$Attrition == "No"]
t = -6.1787, df = 1468, p-value = 8.356e-10
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -5.208825 -2.698450
sample estimates:
mean of x mean of y
 33.60759  37.56123
```

```
> #DistanceFromHome and Attrition
> with(data = attr,t.test(attr$DistanceFromHome[attr$Attrition=="Yes"],attr$DistanceFromHome[attr$Attrition=="No"],var.equal=TRUE))
```

Two Sample t-test

```
data: attr$DistanceFromHome[attr$Attrition == "Yes"] and attr$DistanceFromHome[attr$Attrition == "No"]
t = -43.048, df = 1468, p-value < 2.2e-16
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -28.15538 -25.70126
sample estimates:
mean of x mean of y
 10.63291  37.56123
```

```
> #Monthly Income and Gender
```

```
> with(data = attr,t.test(attr$MonthlyIncome[attr$Gender=="Male"],attr$MonthlyIncome[attr$Gender=="Female"],var.equal = TRUE))
```

Two Sample t-test

```
data: attr$MonthlyIncome[attr$Gender == "Male"] and attr$MonthlyIncome[attr$Gender == "Female"]
t = -1.2213, df = 1468, p-value = 0.2222
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -797.6470  185.5303
sample estimates:
mean of x mean of y
 6380.508  6686.566
```

```
> #DistanceFromHome and Gender
```

```
> with(data = attr,t.test(attr$DistanceFromHome[attr$Gender=="Male"],attr$DistanceFromHome[attr$Gender=="Female"],var.equal = TRUE))
```

Two Sample t-test

```
data: attr$DistanceFromHome[attr$Gender == "Male"] and attr$DistanceFromHome[attr$Gender == "Female"]
t = -0.070902, df = 1468, p-value = 0.9435
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.8775316  0.8163071
sample estimates:
mean of x mean of y
 9.180272  9.210884
```

```
> #Monthly Income and gender
```

```
> t2testgender <- hotelling.test(attr$MonthlyIncome + attr$DistanceFromHome ~ attr$Gender)
```

```
> cat("T2 statistic =",t2testgender$stat[[1]],"\n")
```

```
T2 statistic = 1.499903
```

```
> print(t2testgender)
```

```
Test stat: 0.74944
```

```
Numerator df: 2
```

```
Denominator df: 1467
```

```
P-value: 0.4728
```

```
> #Monthly Income and Attrition
```

```
> t2testattr <- hotelling.test(attr$MonthlyIncome + attr$DistanceFromHome ~ attr$Attrition)
```

```
> cat("T2 statistic =",t2testattr$stat[[1]],"\n")
```

```
T2 statistic = 47.28597
```

```
> print(t2testattr)
```

```
Test stat: 23.627
```

```
Numerator df: 2
```

```
Denominator df: 1467
```

```
P-value: 7.957e-11
```

```
> #PCA
```

```
> #plot.new(); dev.off()
```

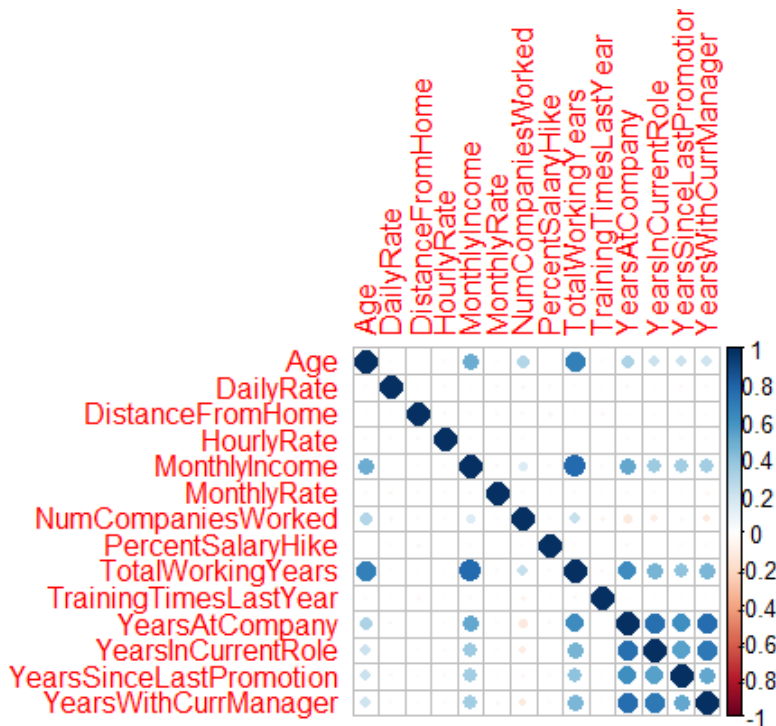
```
> #Considering the numeric columns that will help to get variance in data
```

```
> attr_pca <- attr[,numvar]
```

```
> #Plotting correlation plot to understand the how feature are related to each other
```

```
> correplot<-cor(attr_pca)
```

```
> corrplot(corrplot,method="circle")
```



```
> #Finding the principal components of data
> attr_pca <- prcomp(attr_pca,scale=TRUE)
> attr_pca
Standard deviations (1, ..., p=14):
 [1] 2.0041891 1.2846031 1.0336848 1.0257290 1.0046944 0.9962218 0.9763963 0.9578606 0.84
[11] 0.6854527 0.5321872 0.4397545 0.3742537
```

Rotation (n x k) = (14 x 14):

	PC1	PC2	PC3	PC4	PC5
Age	0.280157344	-0.472170158	0.003362193	0.004488409	-0.039563410
DailyRate	-0.006815197	-0.077962430	-0.207301367	-0.609569867	-0.211568990
DistanceFromHome	0.004812032	0.041564987	-0.664884791	0.306131593	0.048941659
HourlyRate	-0.011288550	-0.062668026	-0.352147686	-0.255816205	0.602292088
MonthlyIncome	0.360622909	-0.290395305	0.052415102	0.025332267	-0.034941693
MonthlyRate	0.001123298	-0.086158010	0.020312197	0.664085954	-0.101166486
NumCompaniesWorked	0.030991906	-0.560133264	0.005628265	-0.041875610	0.017785645
PercentSalaryHike	-0.015351368	0.004618486	-0.465841883	-0.055689609	-0.698726672
TotalWorkingYears	0.415285665	-0.318115831	0.009368263	0.007027664	-0.024159198
TrainingTimesLastYear	-0.010993402	0.092457674	0.409028173	-0.138279489	-0.293982017
YearsAtCompany	0.443443529	0.213079968	0.002115638	-0.010571214	0.024921329
YearsInCurrentRole	0.391353065	0.279423881	-0.048111956	-0.038785223	-0.004927194
YearsSinceLastPromotion	0.344322397	0.198658357	0.003993040	0.027659809	0.019935007
YearsWithCurrManager	0.386171187	0.295138965	-0.031745944	-0.034459502	0.021898300

	PC7	PC8	PC9	PC10	PC11
Age	-0.098196914	-0.05927715	-0.183114693	0.005033984	-0.74367068
DailyRate	0.715405171	-0.02770642	-0.028707475	0.040304455	-0.01980752
DistanceFromHome	0.031447533	-0.65217193	0.037737577	0.002338630	0.02927699
HourlyRate	-0.221010405	0.40142111	-0.004675476	0.018009772	0.03725997
MonthlyIncome	-0.012272736	-0.03685912	-0.377381332	0.104651321	0.61775910
MonthlyRate	0.482943083	0.40448871	0.056690883	-0.044889268	-0.01681584
NumCompaniesWorked	-0.032989593	-0.03355765	0.775796629	-0.129586743	0.19687866
PercentSalaryHike	-0.376210309	0.38335261	0.012190972	0.019568502	0.04082482
TotalWorkingYears	-0.029511945	-0.04398227	-0.196663458	-0.038585533	0.08301594
TrainingTimesLastYear	-0.217564575	-0.29622601	0.130785998	-0.017811234	0.02954240
YearsAtCompany	0.005335572	0.01862614	-0.001551392	-0.104225054	0.03762072
YearsInCurrentRole	0.062086964	0.05420752	0.201595025	-0.271683842	-0.04458982
YearsSinceLastPromotion	0.022129234	0.03850513	0.306725567	0.845951303	-0.08053456

```

YearsWithCurrManager    0.011525930  0.04176204  0.161413516 -0.407140185 -0.06576770  0
                        PC13      PC14
Age                    0.1893016403  0.237072230
DailyRate              -0.0099081253  0.018837870
DistanceFromHome       0.0057709912  0.011991386
HourlyRate              0.0049037331 -0.003314012
MonthlyIncome           0.4041044054  0.279006032
MonthlyRate            -0.0083381972  0.009367738
NumCompaniesWorked     -0.0369554196  0.107234673
PercentSalaryHike      -0.0183445446  0.010585240
TotalWorkingYears      -0.4158888971 -0.705989494
TrainingTimesLastYear  0.0008431661 -0.012085362
YearsAtCompany          -0.6494086309  0.562584645
YearsInCurrentRole     0.1948014145 -0.130643692
YearsSinceLastPromotion 0.0977011821 -0.083447864
YearsWithCurrManager    0.3959144832 -0.121010943
> names(attr_pca)
[1] "sdev" "rotation" "center" "scale" "x"
> head(attr_pca)
$sdev
[1] 2.0041891 1.2846031 1.0336848 1.0257290 1.0046944 0.9962218 0.9763963 0.9578606 0.84
[11] 0.6854527 0.5321872 0.4397545 0.3742537

```

```

$rotation
                        PC1      PC2      PC3      PC4      PC5
Age                    0.280157344 -0.472170158  0.003362193  0.004488409 -0.039563410
DailyRate              -0.006815197 -0.077962430 -0.207301367 -0.609569867 -0.211568990
DistanceFromHome       0.004812032  0.041564987 -0.664884791  0.306131593  0.048941659
HourlyRate              -0.011288550 -0.062668026 -0.352147686 -0.255816205  0.602292088
MonthlyIncome           0.360622909 -0.290395305  0.052415102  0.025332267 -0.034941693
MonthlyRate            0.001123298 -0.086158010  0.020312197  0.664085954 -0.101166486
NumCompaniesWorked     0.030991906 -0.560133264  0.005628265 -0.041875610  0.017785645
PercentSalaryHike      -0.015351368  0.004618486 -0.465841883 -0.055689609 -0.698726672
TotalWorkingYears      0.415285665 -0.318115831  0.009368263  0.007027664 -0.024159198
TrainingTimesLastYear  -0.010993402  0.092457674  0.409028173 -0.138279489 -0.293982017
YearsAtCompany          0.443443529  0.213079968  0.002115638 -0.010571214  0.024921329
YearsInCurrentRole     0.391353065  0.279423881 -0.048111956 -0.038785223 -0.004927194
YearsSinceLastPromotion 0.344322397  0.198658357  0.003993040  0.027659809  0.019935007
YearsWithCurrManager    0.386171187  0.295138965 -0.031745944 -0.034459502  0.021898300
                        PC7      PC8      PC9      PC10     PC11
Age                    -0.098196914 -0.05927715 -0.183114693  0.005033984 -0.74367068 -0
DailyRate              0.715405171 -0.02770642 -0.028707475  0.040304455 -0.01980752  0
DistanceFromHome       0.031447533 -0.65217193  0.037737577  0.002338630  0.02927699  0
HourlyRate              -0.221010405  0.40142111 -0.004675476  0.018009772  0.03725997 -0
MonthlyIncome           -0.012272736 -0.03685912 -0.377381332  0.104651321  0.61775910 -0
MonthlyRate            0.482943083  0.40448871  0.056690883 -0.044889268 -0.01681584  0
NumCompaniesWorked     -0.032989593 -0.03355765  0.775796629 -0.129586743  0.19687866  0
PercentSalaryHike      -0.376210309  0.38335261  0.012190972  0.019568502  0.04082482  0
TotalWorkingYears      -0.029511945 -0.04398227 -0.196663458 -0.038585533  0.08301594  0
TrainingTimesLastYear  -0.217564575 -0.29622601  0.130785998 -0.017811234  0.02954240 -0
YearsAtCompany          0.005335572  0.01862614 -0.001551392 -0.104225054  0.03762072  0
YearsInCurrentRole     0.062086964  0.05420752  0.201595025 -0.271683842 -0.04458982 -0
YearsSinceLastPromotion 0.022129234  0.03850513  0.306725567  0.845951303 -0.08053456  0
YearsWithCurrManager    0.011525930  0.04176204  0.161413516 -0.407140185 -0.06576770  0
                        PC13      PC14
Age                    0.1893016403  0.237072230
DailyRate              -0.0099081253  0.018837870
DistanceFromHome       0.0057709912  0.011991386
HourlyRate              0.0049037331 -0.003314012
MonthlyIncome           0.4041044054  0.279006032
MonthlyRate            -0.0083381972  0.009367738
NumCompaniesWorked     -0.0369554196  0.107234673
PercentSalaryHike      -0.0183445446  0.010585240
TotalWorkingYears      -0.4158888971 -0.705989494

```

TrainingTimesLastYear	0.0008431661	-0.012085362
YearsAtCompany	-0.6494086309	0.562584645
YearsInCurrentRole	0.1948014145	-0.130643692
YearsSinceLastPromotion	0.0977011821	-0.083447864
YearsWithCurrManager	0.3959144832	-0.121010943

\$center

Age	DailyRate	DistanceFromHome	Hour
36.923810	802.485714	9.192517	65.
MonthlyIncome	MonthlyRate	NumCompaniesWorked	PercentSala
6502.931293	14313.103401	2.693197	15.
TotalWorkingYears	TrainingTimesLastYear	YearsAtCompany	YearsInCurre
11.279592	2.799320	7.008163	4.
YearsSinceLastPromotion	YearsWithCurrManager		
2.187755	4.123129		

\$scale

Age	DailyRate	DistanceFromHome	Hour
9.135373	403.509100	8.106864	20.
MonthlyIncome	MonthlyRate	NumCompaniesWorked	PercentSala
4707.956783	7117.786044	2.498009	3.
TotalWorkingYears	TrainingTimesLastYear	YearsAtCompany	YearsInCurre
7.780782	1.289271	6.126525	3.
YearsSinceLastPromotion	YearsWithCurrManager		
3.222430	3.568136		

\$x

	PC1	PC2	PC3	PC4	PC5	PC6
[1,]	-0.243044079	-1.805296680	-0.3104169553	-0.384994275	2.0169575215	0.984793983
[2,]	0.854288163	0.381073595	-0.5252390003	1.608645799	-1.5927436292	-0.481865695
[3,]	-2.198275394	-1.413301606	-0.0582282745	-2.596801032	0.6022422032	-0.023230640
[4,]	-0.570845554	0.682294015	0.9530781591	-0.112517223	0.0144209522	-0.415235118
[5,]	-1.567685771	-0.965438549	1.6427717726	0.537047071	-0.0703157168	0.940560119
[6,]	-0.033228256	1.476192828	0.1768758528	-0.871158691	0.9282306482	0.367849216
[7,]	-1.176981984	-2.344142438	-0.5229233979	-1.666338771	-0.8793271137	-0.417767837
[8,]	-2.668563284	0.310022541	-2.6128166708	-0.330963952	-1.2486460778	-0.052250851
[9,]	0.910894519	1.213005861	-1.5039201417	1.144947290	-1.1238829367	1.049881443
[10,]	1.339778839	-0.208584655	-1.9076328247	-0.281672326	1.0866328829	-1.252674274
[11,]	-1.227202504	0.961999888	0.0613545738	0.034499533	0.4709461858	-2.043427871
[12,]	-0.073116546	1.760186112	0.5344916830	1.247906142	0.5189044912	0.442256861
[13,]	-1.087474516	1.023377864	-1.5147071841	1.573775407	-0.7475549471	1.511464717
[14,]	-1.814073316	0.601874393	-1.3014136722	-1.101977678	1.6522331947	-0.334506872
[15,]	-1.659410211	0.292702788	-0.0672556843	1.527211158	0.0369416431	-0.176183833
[16,]	1.744251934	1.686663324	-1.1177364895	-0.381693162	0.6609099755	1.223658522
[17,]	-1.118546968	1.132058901	1.4189672811	0.273681898	0.7687430566	-1.460717606
[18,]	-2.875446285	0.684977918	-1.2101773533	-1.069482747	1.5219403902	-0.105065952
[19,]	4.306398521	-1.060188116	0.2102166478	-0.374474127	-0.3205736368	-1.006842601
[20,]	-1.274793286	-0.518252552	1.7607337154	-0.263605442	0.4775025923	1.296215086
[21,]	-1.707674413	1.416074395	-0.2866612249	-0.911443288	0.0740619531	-1.694982203
[22,]	-0.973935456	-1.013413533	-1.1120212000	-1.850388185	-1.3640205357	-0.666890243
[23,]	1.686994016	1.312303531	1.5096245660	1.224455487	0.2429059015	-0.652215366
[24,]	-3.186960204	1.127496005	0.4028852195	0.661084708	0.6427677466	-2.782189999
[25,]	-1.236420346	0.070998887	0.2998566707	0.248336464	1.5088956715	0.030328006
[26,]	4.335210193	-1.187855044	0.8439064948	-1.135518002	0.1502712115	0.089980426
[27,]	0.202667449	1.487707345	-1.0496066009	-1.510499974	-1.5194444667	-1.172856717
[28,]	0.522611662	0.517960123	0.7496484428	1.189509235	0.3725504816	0.467749272
[29,]	4.167497779	1.068632778	1.1917707595	-0.655936499	-0.3603395503	0.680646739
[30,]	0.855668649	-2.594944348	0.7337329455	0.725830150	0.9881939586	-0.389610046
[31,]	-2.101453288	-0.598109160	0.9218830885	-1.261397525	1.1285699242	0.185406411
[32,]	-0.628686779	-0.506577343	1.0557480273	-0.359363863	-1.2767722294	-1.259019980
[33,]	-0.585760317	1.290594877	1.0175278792	0.759970743	0.8434796204	-1.537202603
[34,]	-1.453000790	-0.878346751	1.6553451372	-1.466979255	-0.7652620288	-1.050427892
[35,]	-2.295426038	0.497391245	0.3961407175	-1.173667681	0.0495687553	1.396660954
[36,]	-0.832994065	0.042990012	0.7006144001	-0.308495224	0.3417332881	-0.722274641

[37,]	-1.354693336	-0.382172652	-0.0113330121	-1.423881781	1.0314915947	0.517495020	-
[38,]	-1.788459375	0.520002398	0.3186189447	-1.168483914	1.3010327250	-0.499080505	-
[39,]	-1.940888185	-1.947119717	0.3014065269	-0.616302576	0.6580712905	-0.112112477	-
[40,]	-0.826827035	0.269317986	0.4683770185	-1.617065750	-1.5424619460	1.078602496	-
[41,]	-2.540242339	0.231335668	0.9249250633	-0.019213294	1.0357898965	0.023182442	-
[42,]	-2.775064596	0.699871648	2.2688244419	-0.255818018	-1.5958498425	-1.351223462	-
[43,]	-2.660977369	0.709039810	-1.1151323620	-0.173311857	0.1700305471	0.580484544	-
[44,]	0.494241988	1.355663630	-0.4558314906	-0.773576913	-0.0893201999	2.889936395	-
[45,]	0.755465347	1.607572626	-0.5109637132	-0.506888091	-1.4233075836	1.057147451	-
[46,]	5.804951893	1.078091201	-0.6975281151	0.051444706	0.4337848886	1.614106696	-
[47,]	0.806658069	1.653442819	-2.3068106160	-0.295882847	-0.4722918379	0.134169049	-
[48,]	-1.995881882	-0.926896408	-1.9960316143	0.633599363	-0.1729888148	1.021151201	-
[49,]	0.844245935	-0.616849916	-0.8194206960	-0.921810229	-0.7717068286	-1.818536061	-
[50,]	-2.418330657	0.297326189	-0.3513459999	-1.101751982	-1.5156578641	1.499053343	-
[51,]	-0.617002088	-3.634989196	0.3562096372	0.118216390	1.4389894618	-0.220229442	-
[52,]	-1.874898008	0.830881805	0.6248015543	-1.142134976	-0.3600199657	0.329946720	-
[53,]	-0.595964470	-1.218466650	-0.8408839570	-2.447215614	-0.9399446833	0.774272087	-
[54,]	-0.697653611	-0.440311397	-0.1001609790	-1.002941201	0.6741005136	-0.305412825	-
[55,]	-2.079810230	-0.955185144	-1.8161177942	0.441813227	-1.3960822450	0.253432093	-
[56,]	3.708466615	1.814109184	-0.0097541922	-0.036909451	2.1090226075	0.552998695	-
[57,]	0.809848967	1.103897503	-1.7108414088	-0.291327045	-1.1137226784	-0.318923581	-
[58,]	-1.465681948	0.058005177	-0.5799431432	0.624721643	-1.1676958094	0.275086845	-
[59,]	0.172118882	0.857390902	-0.3222266947	-0.286150650	-1.6974104391	0.722818482	-
[60,]	-0.134488687	0.774824505	0.0742047436	-1.668328387	-0.8320217703	1.458220908	-
[61,]	1.154466224	1.922306493	0.5340354541	0.208456672	-2.0449281318	1.172737829	-
[62,]	1.015549604	1.685679343	-1.0836803069	0.522264077	0.9425346951	0.960676995	-
[63,]	5.230825960	-1.151655660	0.8119758029	0.364485427	-0.0405314789	0.826552609	-
[64,]	5.030282900	-0.755218265	-1.7678975054	-2.044562287	1.6478909242	-0.737221001	-
[65,]	3.788984539	1.946298043	-0.0945560272	-1.067010987	0.3184679516	0.860439229	-
[66,]	0.660742882	-2.427444222	0.7464731633	1.051907583	-0.8666771968	0.700339962	-
[67,]	-0.689313482	0.194433528	-0.4992692899	-0.091816631	0.9077818943	-1.467101142	-
[68,]	-0.360119052	-2.235551626	-0.3033093916	-0.208683127	-0.8858009134	0.057772762	-
[69,]	-1.590660053	-0.244778958	0.5118655703	-0.944308747	1.1711060680	0.909011154	-
[70,]	-2.349000231	-0.024496709	-1.0212757577	1.625278907	0.8108621115	0.977055716	-
[71,]	0.537061435	-3.049510452	0.9612799574	0.240109595	0.1951466351	0.179765350	-

	PC8	PC9	PC10	PC11	PC12	PC
[1,]	1.5917738507	1.1863471823	-0.8721216003	-0.0964053395	0.1652689774	2.697995e-
[2,]	1.4396138690	-0.2915207036	-0.9133153760	-1.2704956060	-0.1223848585	3.003787e-
[3,]	0.1645450520	0.7037177946	0.2334286037	-0.2063109991	0.0757180104	-2.034191e-
[4,]	0.3788485663	-0.0232142896	0.4483748666	-0.4255970757	-1.1905425766	-5.888785e-
[5,]	-0.2110090034	2.3132854086	-0.0092829889	0.7911383832	0.0932147601	-1.001822e-
[6,]	0.8232618244	-0.2219554949	-0.0872069258	-0.4352547853	-0.2311142456	2.074828e-
[7,]	0.6783978017	-0.4439152914	0.2850426885	-1.9955214056	0.0476998780	-7.608564e-
[8,]	-0.3684730529	-0.4875080936	0.4800518063	0.0543954145	0.1020736714	-4.659415e-
[9,]	-0.9351740522	-0.8467583073	-0.7791175369	0.1173708729	-0.0207647030	7.178969e-
[10,]	-0.9887551265	1.8168832792	0.5496258442	0.0893646974	0.1719743118	1.482873e-
[11,]	-0.7428933771	-0.3487121205	-0.3578297611	-0.5029560805	-0.2422407358	-3.914638e-
[12,]	-1.0813690872	-0.3767620037	-1.1058405989	0.0965394361	0.4399899746	-2.594555e-
[13,]	-1.2884619372	-0.0363538480	0.8308304610	-0.2190499489	0.3017206595	-5.138678e-
[14,]	-0.8195524226	-0.7310455341	0.3812739185	-0.4949317648	-0.0110627441	2.587105e-
[15,]	-1.9271549894	1.2343495139	-0.5198251249	0.4250203594	0.1772497877	-2.805626e-
[16,]	-1.2962378063	0.1672283742	0.9190505173	0.6052322133	-0.1396419825	7.886224e-
[17,]	-0.0866130578	-0.4359922773	-0.4908235512	-0.1712840455	0.4964863948	-6.197885e-
[18,]	-0.3703968876	-0.4515944960	0.4707221281	0.6870011577	0.0480464742	-1.323742e-
[19,]	1.1419762947	-1.3201148540	-0.5553725566	-0.0202145544	0.0106513546	-1.330532e+
[20,]	-0.9326540622	0.6299363640	-0.0098247146	-0.2880597580	-0.0739027515	1.175321e-
[21,]	0.0042898132	-0.3112305780	0.1801517860	0.6691640181	0.1912063602	-6.152712e-
[22,]	0.3446067836	1.3648622584	-0.4792426584	0.2130812121	0.0911878469	-3.605121e-
[23,]	-0.2496196395	-0.6875524464	-0.9335162824	0.6027692112	0.8094891808	7.005028e-
[24,]	-0.3520700093	0.2822430507	0.2555611279	0.6350192662	0.0179911182	-1.389628e-
[25,]	0.5077089246	-0.1612550579	-0.0186130089	-0.3041024579	0.2026623054	-1.190615e-
[26,]	-0.6259760526	-0.5375940379	-0.5583140528	0.3347066400	-1.0951792994	8.320370e-
[27,]	-0.6537874675	0.3570074959	0.9290619928	-0.0189461399	1.1560600116	-2.554831e-
[28,]	-0.0648482848	-0.7354981588	0.5503138531	-0.7380133792	-0.9496643546	8.389053e-


```

[29,] -1.2648397307 0.3155536872 -1.1110140575 -0.1549320265 2.1008653026 -1.743973e-
[30,] 0.9457428880 -1.6915126800 0.7155359778 1.0274567321 -0.2257845320 7.444228e-
[31,] -0.1895100955 0.2414887412 0.1464112473 -0.0495438258 -0.1690167656 -2.514129e-
[32,] -1.1586344712 -0.3666531671 0.0562237019 -0.6611355034 0.2298295473 2.991824e-
[33,] -0.1491699406 0.0895757307 -0.5992509197 -0.0332054293 1.5600371817 -5.381913e-
[34,] -1.5329294741 -0.2065832996 0.1820633909 -0.4482305144 0.1077454163 -8.542825e-
[35,] 0.2134201607 -0.1299260602 0.8657952064 0.4687972163 0.1202434785 -4.949487e-
[36,] 0.7203396398 -0.3895527430 -0.1574012260 -1.2429413892 0.1954059923 1.912162e-
[37,] 0.2688390818 -0.9067448813 0.0479551510 -1.6866316116 -0.1441330064 4.304295e-
[38,] 0.6935995880 -0.2003120841 0.5271573093 -0.6067308937 -0.0279386513 2.824748e-
[39,] 0.2429085978 1.7646246196 -0.1129573297 0.2507919469 -0.1314289782 -1.482093e-
[40,] -0.1179524881 -0.3580190226 0.0556865761 0.1396045303 0.0353093528 -1.389953e-
[41,] 0.0181823818 -0.5107722810 0.3263458397 -0.5465772678 -0.0602546854 5.658773e-
[42,] -0.7388494377 -0.0587506994 0.2787045616 0.0926434197 0.0901210156 -1.196858e-
[43,] -1.9884712967 -0.3763602810 0.3022550599 0.1729522027 0.2552767122 -3.327794e-
[44,] -0.3462124514 -0.6086221030 -0.7113741266 0.7779144715 -0.3180020334 4.068577e-
[45,] 1.5058488466 0.0966839023 -0.4001732785 0.0586933619 -0.1521141805 -3.945470e-
[46,] 0.0542470485 -0.2605203348 2.2309102556 0.7861699813 -1.1179707031 4.072934e-
[47,] -0.3676769926 0.0803763634 1.3065788470 -0.3439303856 0.5396748825 1.926447e-
[48,] 0.0379981462 0.0139823408 0.2379323987 -0.1482978143 0.0345722067 -2.626249e-
[49,] 1.5880220441 0.4128727770 -1.2321509722 -0.6278155609 0.3533099316 1.678164e-
[50,] -0.4960323101 -0.6439180110 0.3515209761 -0.5484838822 0.2054958400 1.408071e-
[51,] 1.1704670085 0.8200564211 -0.1123759892 -0.2977384011 0.1285674151 -6.899389e-
[52,] -0.3941110717 -0.1764307635 0.5591763859 0.0448168714 0.0596852002 2.356005e-
[53,] 0.8857772453 0.2519075061 0.0130817786 -0.4850733698 0.0278447233 1.985134e-
[54,] -0.6111756017 -0.7690695559 0.6284517406 0.6011938058 0.6113545988 3.056229e-
[55,] -0.5984018598 1.3970676765 -0.0643320469 0.9721652618 -0.1949743264 -3.069309e-
[56,] 1.7422401316 0.1408058227 -0.0199461188 0.7410413537 -0.5297862525 1.093202e+
[57,] -0.10108146406 -0.3106679951 -0.8493487541 0.3863867848 -0.1458192162 6.892529e-
[58,] -1.8215348214 0.3621471351 0.4006851921 -0.2172714122 0.0608335537 2.928318e-
[59,] 0.3335120551 0.4740138563 -0.8411057977 0.4163000283 -0.0858083206 2.931242e-
[60,] 0.2284006406 -0.6348604010 -0.7475512841 -0.2920548376 0.2496513450 4.888034e-
[61,] 0.7408606053 0.5122781140 0.5793496320 -0.0105572994 -0.0042066309 5.488545e-
[62,] -2.4733087118 0.5540510535 1.2979592812 -0.9935329529 1.2766076994 1.734229e-
[63,] -0.4001018830 0.0656254162 2.1963468297 0.5895255433 1.4470277217 -1.086096e+
[64,] -1.7992385929 1.6436332545 -0.5355851584 -1.3269684512 -1.2755865234 -5.269145e-
[65,] -0.1566109309 0.5395449026 1.4430413025 0.0325762440 -1.0121301749 2.073019e-
[66,] -0.5389467786 -2.0662901268 0.1446763110 -0.3168046990 0.3722514197 2.468134e-
[67,] 0.6267828319 -0.5362398552 -0.3750836045 -0.0545365082 -0.4224485744 2.452230e-
[68,] 0.3270971145 -1.6969908177 0.3987065997 -0.0530068030 0.1509487886 -4.247686e-
[69,] 0.3792991801 0.4293974391 0.0802128266 -0.3229283966 -0.0234897322 -3.881229e-
[70,] 1.5255487349 -1.1502222404 0.3958031962 -0.5136583440 -0.0367616655 1.303524e-
[71,] 0.4884620531 0.4469007175 -0.3625035208 -1.6091056814 0.0695982865 -7.853735e-
[ reached getOption("max.print") -- omitted 1399 rows ]

```

```
> summary(attr_pca)
```

```
Importance of components:
```

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9
Standard deviation	2.0042	1.2846	1.03368	1.02573	1.0047	0.99622	0.9764	0.95786	0.8500
Proportion of Variance	0.2869	0.1179	0.07632	0.07515	0.0721	0.07089	0.0681	0.06554	0.0516
Cumulative Proportion	0.2869	0.4048	0.48111	0.55626	0.6284	0.69925	0.7673	0.83288	0.8845

	PC12	PC13	PC14
Standard deviation	0.53219	0.43975	0.3743
Proportion of Variance	0.02023	0.01381	0.0100
Cumulative Proportion	0.97618	0.99000	1.0000

```
> #Extract variance against features
```

```
> eigenvalues<-attr_pca$sdev^2
```

```
> eigenvalues
```

```
[1] 4.0167738 1.6502052 1.0685042 1.0521201 1.0094108 0.9924579 0.9533497 0.9174969 0.72
[11] 0.4698454 0.2832233 0.1933840 0.1400658
```

```
> sum(eigenvalues)
```

```
[1] 14
```

```
> names(eigenvalues) <- paste("PC",1:14,sep="")
```

```
> eigenvalues
```



```

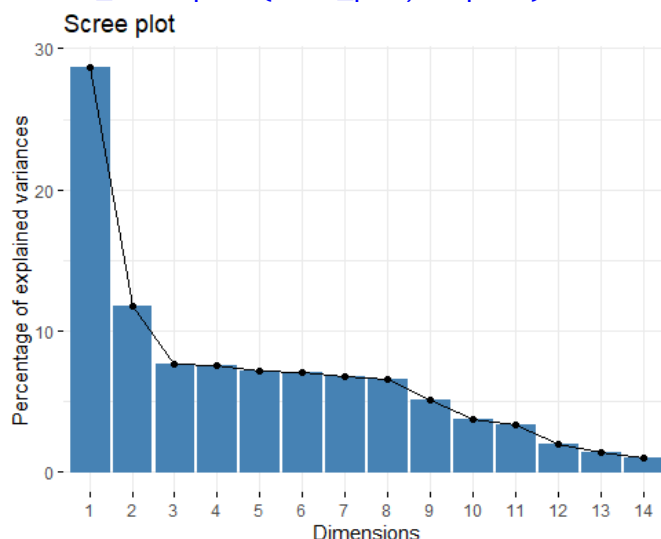
      PC1      PC2      PC3      PC4      PC5      PC6      PC7      PC8      PC9
4.0167738 1.6502052 1.0685042 1.0521201 1.0094108 0.9924579 0.9533497 0.9174969 0.7224654
      PC12     PC13     PC14
0.2832233 0.1933840 0.1400658
> sumoflambdas <- sum(eigenvalues)
> sumoflambdas
[1] 14
> #Variance %
> pctvar<- (eigenvalues/sumoflambdas)*100
> pctvar
      PC1      PC2      PC3      PC4      PC5      PC6      PC7      PC8      PC9
28.691241 11.787180  7.632173  7.515143  7.210077  7.088985  6.809641  6.553550  5.160467
      PC12     PC13     PC14
 2.023023  1.381314  1.000470
> #Calculate cumulative of variance
> cumvar <- cumsum(pctvar)
> cumvar
      PC1      PC2      PC3      PC4      PC5      PC6      PC7      PC8      PC9
28.69124 40.47842 48.11059 55.62574 62.83581 69.92480 76.73444 83.28799 88.44846
      PC12     PC13     PC14
97.61822 98.99953 100.00000

```

```

> #Visualize PCA using Scree plot
> fviz_screplot(attr_pca, ncp=14)

```



```

> summary(attr_pca)
Importance of components:
      PC1      PC2      PC3      PC4      PC5      PC6      PC7      PC8      PC9
Standard deviation  2.0042  1.2846  1.03368  1.02573  1.0047  0.99622  0.9764  0.95786  0.8500
Proportion of Variance 0.2869  0.1179  0.07632  0.07515  0.0721  0.07089  0.0681  0.06554  0.0516
Cumulative Proportion 0.2869  0.4048  0.48111  0.55626  0.6284  0.69925  0.7673  0.83288  0.8845
      PC12     PC13     PC14
Standard deviation  0.53219  0.43975  0.3743
Proportion of Variance 0.02023  0.01381  0.0100
Cumulative Proportion 0.97618  0.99000  1.0000

```

```

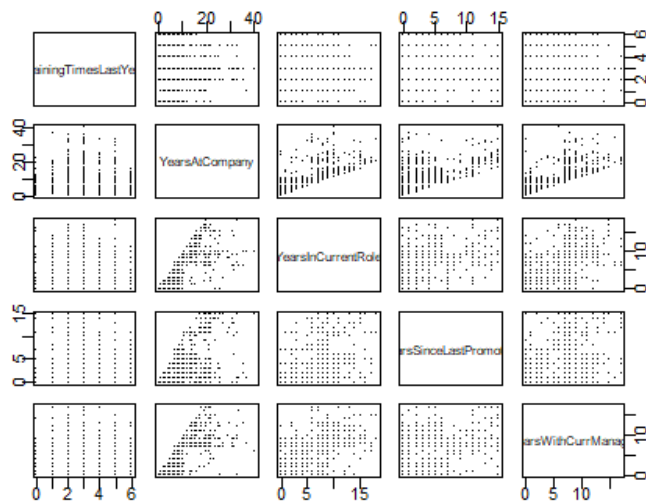
> #PCA
> #plot.new(); dev.off()
> #Considering the numeric columns that will help to get variance in data
> attr_pca <- attr[,numvar]
> # solve the error "Figure margins too large"
> par("mar")
[1] 5.1 4.1 4.1 2.1

```

```

> par(mar=c(1,1,1,1))
> #graphics.off()
> #dev.off()
> ##Matrix Plots, Covariance and Correlations Plots
> #ScatterPlot matrix
> pairs(attr_pca[,10:14],pch=".",cex=1.5)

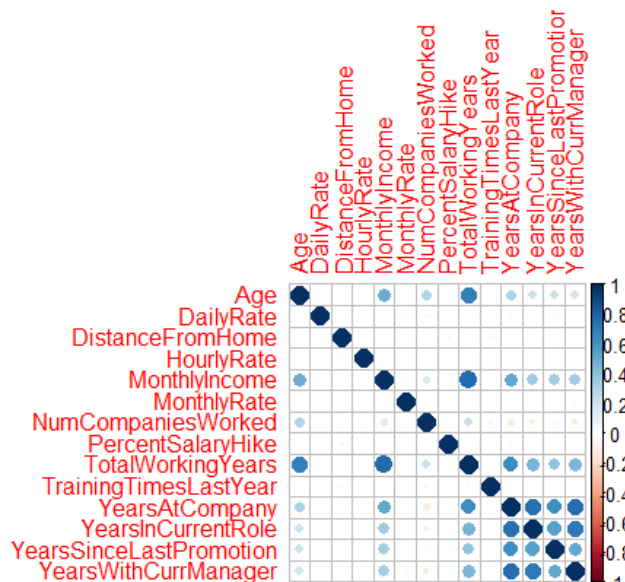
```



```

> #Plotting correlation plot to understand the how feature are related to each other
> correplot<-cor(attr_pca)
> corrplot(corrplot,method="circle")

```



```

> #Finding the principal components of data
> attr_pca_done <- prcomp(attr_pca,scale=TRUE)
> attr_pca_done

```

Standard deviations (1, ..., p=14):

```

[1] 2.0041891 1.2846031 1.0336848 1.0257290 1.0046944 0.9962218 0.9763963 0.9578606 0.84
[11] 0.6854527 0.5321872 0.4397545 0.3742537

```

Rotation (n x k) = (14 x 14):

	PC1	PC2	PC3	PC4	PC5
Age	0.280157344	-0.472170158	0.003362193	0.004488409	-0.039563410
DailyRate	-0.006815197	-0.077962430	-0.207301367	-0.609569867	-0.211568990
DistanceFromHome	0.004812032	0.041564987	-0.664884791	0.306131593	0.048941659
HourlyRate	-0.011288550	-0.062668026	-0.352147686	-0.255816205	0.602292088
MonthlyIncome	0.360622909	-0.290395305	0.052415102	0.025332267	-0.034941693
MonthlyRate	0.001123298	-0.086158010	0.020312197	0.664085954	-0.101166486
NumCompaniesWorked	0.030991906	-0.560133264	0.005628265	-0.041875610	0.017785645
PercentsSalaryHike	-0.015351368	0.004618486	-0.465841883	-0.055689609	-0.698726672
TotalWorkingYears	0.415285665	-0.318115831	0.009368263	0.007027664	-0.024159198
TrainingTimesLastYear	-0.010993402	0.092457674	0.409028173	-0.138279489	-0.293982017
YearsAtCompany	0.443443529	0.213079968	0.002115638	-0.010571214	0.024921329
YearsInCurrentRole	0.391353065	0.279423881	-0.048111956	-0.038785223	-0.004927194
YearsSinceLastPromotion	0.344322397	0.198658357	0.003993040	0.027659809	0.019935007
YearsWithCurrManager	0.386171187	0.295138965	-0.031745944	-0.034459502	0.021898300

	PC7	PC8	PC9	PC10	PC11
Age	-0.098196914	-0.05927715	-0.183114693	0.005033984	-0.74367068
DailyRate	0.715405171	-0.02770642	-0.028707475	0.040304455	-0.01980752
DistanceFromHome	0.031447533	-0.65217193	0.037737577	0.002338630	0.02927699
HourlyRate	-0.221010405	0.40142111	-0.004675476	0.018009772	0.03725997
MonthlyIncome	-0.012272736	-0.03685912	-0.377381332	0.104651321	0.61775910
MonthlyRate	0.482943083	0.40448871	0.056690883	-0.044889268	-0.01681584
NumCompaniesWorked	-0.032989593	-0.03355765	0.775796629	-0.129586743	0.19687866
PercentsSalaryHike	-0.376210309	0.38335261	0.012190972	0.019568502	0.04082482
TotalWorkingYears	-0.029511945	-0.04398227	-0.196663458	-0.038585533	0.08301594
TrainingTimesLastYear	-0.217564575	-0.29622601	0.130785998	-0.017811234	0.02954240
YearsAtCompany	0.005335572	0.01862614	-0.001551392	-0.104225054	0.03762072
YearsInCurrentRole	0.062086964	0.05420752	0.201595025	-0.271683842	-0.04458982
YearsSinceLastPromotion	0.022129234	0.03850513	0.306725567	0.845951303	-0.08053456
YearsWithCurrManager	0.011525930	0.04176204	0.161413516	-0.407140185	-0.06576770

	PC13	PC14
Age	0.1893016403	0.237072230
DailyRate	-0.0099081253	0.018837870
DistanceFromHome	0.0057709912	0.011991386
HourlyRate	0.0049037331	-0.003314012
MonthlyIncome	0.4041044054	0.279006032
MonthlyRate	-0.0083381972	0.009367738
NumCompaniesWorked	-0.0369554196	0.107234673
PercentsSalaryHike	-0.0183445446	0.010585240
TotalWorkingYears	-0.4158888971	-0.705989494
TrainingTimesLastYear	0.0008431661	-0.012085362
YearsAtCompany	-0.6494086309	0.562584645
YearsInCurrentRole	0.1948014145	-0.130643692
YearsSinceLastPromotion	0.0977011821	-0.083447864
YearsWithCurrManager	0.3959144832	-0.121010943

```

> names(attr_pca_done)
[1] "sdev" "rotation" "center" "scale" "x"
> head(attr_pca_done)
$sdev
[1] 2.0041891 1.2846031 1.0336848 1.0257290 1.0046944 0.9962218 0.9763963 0.9578606 0.84
[11] 0.6854527 0.5321872 0.4397545 0.3742537

```

\$rotation

	PC1	PC2	PC3	PC4	PC5
Age	0.280157344	-0.472170158	0.003362193	0.004488409	-0.039563410
DailyRate	-0.006815197	-0.077962430	-0.207301367	-0.609569867	-0.211568990
DistanceFromHome	0.004812032	0.041564987	-0.664884791	0.306131593	0.048941659
HourlyRate	-0.011288550	-0.062668026	-0.352147686	-0.255816205	0.602292088
MonthlyIncome	0.360622909	-0.290395305	0.052415102	0.025332267	-0.034941693
MonthlyRate	0.001123298	-0.086158010	0.020312197	0.664085954	-0.101166486
NumCompaniesWorked	0.030991906	-0.560133264	0.005628265	-0.041875610	0.017785645
PercentsSalaryHike	-0.015351368	0.004618486	-0.465841883	-0.055689609	-0.698726672
TotalWorkingYears	0.415285665	-0.318115831	0.009368263	0.007027664	-0.024159198
TrainingTimesLastYear	-0.010993402	0.092457674	0.409028173	-0.138279489	-0.293982017

YearsAtCompany	0.443443529	0.213079968	0.002115638	-0.010571214	0.024921329
YearsInCurrentRole	0.391353065	0.279423881	-0.048111956	-0.038785223	-0.004927194
YearsSinceLastPromotion	0.344322397	0.198658357	0.003993040	0.027659809	0.019935007
YearsWithCurrManager	0.386171187	0.295138965	-0.031745944	-0.034459502	0.021898300
	PC7	PC8	PC9	PC10	PC11
Age	-0.098196914	-0.05927715	-0.183114693	0.005033984	-0.74367068
DailyRate	0.715405171	-0.02770642	-0.028707475	0.040304455	-0.01980752
DistanceFromHome	0.031447533	-0.65217193	0.037737577	0.002338630	0.02927699
HourlyRate	-0.221010405	0.40142111	-0.004675476	0.018009772	0.03725997
MonthlyIncome	-0.012272736	-0.03685912	-0.377381332	0.104651321	0.61775910
MonthlyRate	0.482943083	0.40448871	0.056690883	-0.044889268	-0.01681584
NumCompaniesworked	-0.032989593	-0.03355765	0.775796629	-0.129586743	0.19687866
PercentSalaryHike	-0.376210309	0.38335261	0.012190972	0.019568502	0.04082482
TotalWorkingYears	-0.029511945	-0.04398227	-0.196663458	-0.038585533	0.08301594
TrainingTimesLastYear	-0.217564575	-0.29622601	0.130785998	-0.017811234	0.02954240
YearsAtCompany	0.005335572	0.01862614	-0.001551392	-0.104225054	0.03762072
YearsInCurrentRole	0.062086964	0.05420752	0.201595025	-0.271683842	-0.04458982
YearsSinceLastPromotion	0.022129234	0.03850513	0.306725567	0.845951303	-0.08053456
YearsWithCurrManager	0.011525930	0.04176204	0.161413516	-0.407140185	-0.06576770

	PC13	PC14
Age	0.1893016403	0.237072230
DailyRate	-0.0099081253	0.018837870
DistanceFromHome	0.0057709912	0.011991386
HourlyRate	0.0049037331	-0.003314012
MonthlyIncome	0.4041044054	0.279006032
MonthlyRate	-0.0083381972	0.009367738
NumCompaniesworked	-0.0369554196	0.107234673
PercentSalaryHike	-0.0183445446	0.010585240
TotalWorkingYears	-0.4158888971	-0.705989494
TrainingTimesLastYear	0.0008431661	-0.012085362
YearsAtCompany	-0.6494086309	0.562584645
YearsInCurrentRole	0.1948014145	-0.130643692
YearsSinceLastPromotion	0.0977011821	-0.083447864
YearsWithCurrManager	0.3959144832	-0.121010943

\$center

Age	DailyRate	DistanceFromHome	HourlyRate
36.923810	802.485714	9.192517	65.15
MonthlyIncome	MonthlyRate	NumCompaniesworked	PercentSalaryHike
6502.931293	14313.103401	2.693197	15.15
TotalWorkingYears	TrainingTimesLastYear	YearsAtCompany	YearsInCurrentRole
11.279592	2.799320	7.008163	4.15
YearsSinceLastPromotion	YearsWithCurrManager		
2.187755	4.123129		

\$scale

Age	DailyRate	DistanceFromHome	HourlyRate
9.135373	403.509100	8.106864	20.15
MonthlyIncome	MonthlyRate	NumCompaniesworked	PercentSalaryHike
4707.956783	7117.786044	2.498009	3.15
TotalWorkingYears	TrainingTimesLastYear	YearsAtCompany	YearsInCurrentRole
7.780782	1.289271	6.126525	3.15
YearsSinceLastPromotion	YearsWithCurrManager		
3.222430	3.568136		

\$x

	PC1	PC2	PC3	PC4	PC5	PC6
[1,]	-0.243044079	-1.805296680	-0.3104169553	-0.384994275	2.0169575215	0.984793983
[2,]	0.854288163	0.381073595	-0.5252390003	1.608645799	-1.5927436292	-0.481865695
[3,]	-2.198275394	-1.413301606	-0.0582282745	-2.596801032	0.6022422032	-0.023230640
[4,]	-0.570845554	0.682294015	0.9530781591	-0.112517223	0.0144209522	-0.415235118
[5,]	-1.567685771	-0.965438549	1.6427717726	0.537047071	-0.0703157168	0.940560119
[6,]	-0.033228256	1.476192828	0.1768758528	-0.871158691	0.9282306482	0.367849216
[7,]	-1.176981984	-2.344142438	-0.5229233979	-1.666338771	-0.8793271137	-0.417767837

[8,]	-2.668563284	0.310022541	-2.6128166708	-0.330963952	-1.2486460778	-0.052250851
[9,]	0.910894519	1.213005861	-1.5039201417	1.144947290	-1.1238829367	1.049881443
[10,]	1.339778839	-0.208584655	-1.9076328247	-0.281672326	1.0866328829	-1.252674274
[11,]	-1.227202504	0.961999888	0.0613545738	0.034499533	0.4709461858	-2.043427871
[12,]	-0.073116546	1.760186112	0.5344916830	1.247906142	0.5189044912	0.442256861
[13,]	-1.087474516	1.023377864	-1.5147071841	1.573775407	-0.7475549471	1.511464717
[14,]	-1.814073316	0.601874393	-1.3014136722	-1.101977678	1.6522331947	-0.334506872
[15,]	-1.659410211	0.292702788	-0.0672556843	1.527211158	0.0369416431	-0.176183833
[16,]	1.744251934	1.686663324	-1.1177364895	-0.381693162	0.6609099755	1.223658522
[17,]	-1.118546968	1.132058901	1.4189672811	0.273681898	0.7687430566	-1.460717606
[18,]	-2.875446285	0.684977918	-1.2101773533	-1.069482747	1.5219403902	-0.105065952
[19,]	4.306398521	-1.060188116	0.2102166478	-0.374474127	-0.3205736368	-1.006842601
[20,]	-1.274793286	-0.518252552	1.7607337154	-0.263605442	0.4775025923	1.296215086
[21,]	-1.707674413	1.416074395	-0.2866612249	-0.911443288	0.0740619531	-1.694982203
[22,]	-0.973935456	-1.013413533	-1.1120212000	-1.850388185	-1.3640205357	-0.666890243
[23,]	1.686994016	1.312303531	1.5096245660	1.224455487	0.04956875015	-0.652215366
[24,]	-3.186960204	1.127496005	0.4028852195	0.661084708	0.6427677466	-2.782189999
[25,]	-1.236420346	0.070998887	0.2998566707	0.248336464	1.5088956715	0.030328006
[26,]	4.335210193	-1.187855044	0.8439064948	-1.135518002	0.1502712115	0.089980426
[27,]	0.202667449	1.487707345	-1.0496066009	-1.510499974	-1.5194444667	-1.172856717
[28,]	0.522611662	0.517960123	0.7496484428	1.189509235	0.3725504816	0.467749272
[29,]	4.167497779	1.068632778	1.1917707595	-0.655936499	-0.3603395503	0.680646739
[30,]	0.855668649	-2.594944348	0.7337329455	0.725830150	0.9881939586	-0.389610046
[31,]	-2.101453288	-0.598109160	0.9218830885	-1.261397525	1.1285699242	0.185406411
[32,]	-0.628686779	-0.506577343	1.0557480273	-0.359363863	-1.2767722294	-1.259019980
[33,]	-0.585760317	1.290594877	1.0175278792	0.759970743	0.8434796204	-1.537202603
[34,]	-1.453000790	-0.878346751	1.6553451372	-1.466979255	-0.7652620288	-1.050427892
[35,]	-2.295426038	0.497391245	0.3961407175	-1.173667681	0.0495687553	1.396660954
[36,]	-0.832994065	0.042990012	0.7006144001	-0.308495224	0.3417332881	-0.722274641
[37,]	-1.354693336	-0.382172652	-0.0113330121	-1.423881781	1.0314915947	0.517495020
[38,]	-1.788459375	0.520002398	0.3186189447	-1.168483914	1.3010327250	-0.499080505
[39,]	-1.940888185	-1.947119717	0.3014065269	-0.616302576	0.6580712905	-0.112112477
[40,]	-0.826827035	0.269317986	0.4683770185	-1.617065750	-1.5424619460	1.078602496
[41,]	-2.540242339	0.231335668	0.9249250633	-0.019213294	1.0357898965	0.023182442
[42,]	-2.775064596	0.699871648	2.2688244419	-0.255818018	-1.5958498425	-1.351223462
[43,]	-2.660977369	0.709039810	-1.1151323620	-0.173311857	0.1700305471	0.580484544
[44,]	0.494241988	1.355663630	-0.4558314906	-0.773576913	-0.0893201999	2.889936395
[45,]	0.755465347	1.607572626	-0.5109637132	-0.506888091	-1.4233075836	1.057147451
[46,]	5.804951893	1.078091201	-0.6975281151	0.051444706	0.4337848886	1.614106696
[47,]	0.806658069	1.653442819	-2.3068106160	-0.295882847	-0.4722918379	0.134169049
[48,]	-1.995881882	-0.926896408	-1.9960316143	0.633599363	-0.1729888148	1.021151201
[49,]	0.844245935	-0.616849916	-0.8194206960	-0.921810229	-0.7717068286	-1.818536061
[50,]	-2.418330657	0.297326189	-0.3513459999	-1.101751982	-1.5156578641	1.499053343
[51,]	-0.617002088	-3.634989196	0.3562096372	0.118216390	1.4389894618	-0.220229442
[52,]	-1.874898008	0.830881805	0.6248015543	-1.142134976	-0.3600199657	0.329946720
[53,]	-0.595964470	-1.218466650	-0.8408839570	-2.447215614	-0.9399446833	0.774272087
[54,]	-0.697653611	-0.440311397	-0.1001609790	-1.002941201	0.6741005136	-0.305412825
[55,]	-2.079810230	-0.955185144	-1.8161177942	0.441813227	-1.3960822450	0.253432093
[56,]	3.708466615	1.814109184	-0.0097541922	-0.036909451	2.1090226075	0.552998695
[57,]	0.809848967	1.103897503	-1.7108414088	-0.291327045	-1.1137226784	-0.318923581
[58,]	-1.465681948	0.058005177	-0.5799431432	0.624721643	-1.1676958094	0.275086845
[59,]	0.172118882	0.857390902	-0.3222266947	-0.286150650	-1.6974104391	0.722818482
[60,]	-0.134488687	0.774824505	0.0742047436	-1.668328387	-0.8320217703	1.458220908
[61,]	1.154466224	1.922306493	0.5340354541	0.208456672	-2.0449281318	1.172737829
[62,]	1.015549604	1.685679343	-1.0836803069	0.522264077	0.9425346951	0.960676995
[63,]	5.230825960	-1.151655660	0.8119758029	0.364485427	-0.0405314789	0.826552609
[64,]	5.030282900	-0.755218265	-1.7678975054	-2.044562287	1.6478909242	-0.737221001
[65,]	3.788984539	1.946298043	-0.0945560272	-1.067010987	0.3184679516	0.860439229
[66,]	0.660742882	-2.427444222	0.7464731633	1.051907583	-0.8666771968	0.700339962
[67,]	-0.689313482	0.194433528	-0.4992692899	-0.091816631	0.9077818943	-1.467101142
[68,]	-0.360119052	-2.235551626	-0.3033093916	-0.208683127	-0.8858009134	0.057772762
[69,]	-1.590660053	-0.244778958	0.5118655703	-0.944308747	1.1711060680	0.909011154
[70,]	-2.349000231	-0.024496709	-1.0212757577	1.625278907	0.8108621115	0.977055716
[71,]	0.537061435	-3.049510452	0.9612799574	0.240109595	0.1951466351	0.179765350

	PC8	PC9	PC10	PC11	PC12	PC13
[1,]	1.5917738507	1.1863471823	-0.8721216003	-0.0964053395	0.1652689774	2.697995e-
[2,]	1.4396138690	-0.2915207036	-0.9133153760	-1.2704956060	-0.1223848585	3.003787e-
[3,]	0.1645450520	0.7037177946	0.2334286037	-0.2063109991	0.0757180104	-2.034191e-
[4,]	0.3788485663	-0.0232142896	0.4483748666	-0.4255970757	-1.1905425766	-5.888785e-
[5,]	-0.2110090034	2.3132854086	-0.0092829889	0.7911383832	0.0932147601	-1.001822e-
[6,]	0.8232618244	-0.2219554949	-0.0872069258	-0.4352547853	-0.2311142456	2.074828e-
[7,]	0.6783978017	-0.4439152914	0.2850426885	-1.9955214056	0.0476998780	-7.608564e-
[8,]	-0.3684730529	-0.4875080936	0.4800518063	0.0543954145	0.1020736714	-4.659415e-
[9,]	-0.9351740522	-0.8467583073	-0.7791175369	0.1173708729	-0.0207647030	7.178969e-
[10,]	-0.9887551265	1.8168832792	0.5496258442	0.0893646974	0.1719743118	1.482873e-
[11,]	-0.7428933771	-0.3487121205	-0.3578297611	-0.5029560805	-0.2422407358	-3.914638e-
[12,]	-1.0813690872	-0.3767620037	-1.1058405989	0.0965394361	0.4399899746	-2.594555e-
[13,]	-1.2884619372	-0.0363538480	0.8308304610	-0.2190499489	0.3017206595	-5.138678e-
[14,]	-0.8195524226	-0.7310455341	0.3812739185	-0.4949317648	-0.0110627441	2.587105e-
[15,]	-1.9271549894	1.2343495139	-0.5198251249	0.4250203594	0.1772497877	-2.805626e-
[16,]	-1.2962378063	0.1672283742	0.9190505173	0.6052322133	-0.1396419825	7.886224e-
[17,]	-0.0866130578	-0.4359922773	-0.4908235512	-0.1712840455	0.4964863948	-6.197885e-
[18,]	-0.3703968876	-0.4515944960	0.4707221281	0.6870011577	0.0480464742	-1.323742e-
[19,]	1.1419762947	-1.3201148540	-0.5553725566	-0.0202145544	0.0106513546	-1.330532e+
[20,]	-0.9326540622	0.6299363640	-0.0098247146	-0.2880597580	-0.0739027515	1.175321e-
[21,]	0.0042898132	-0.3112305780	0.1801517860	0.6691640181	0.1912063602	-6.152712e-
[22,]	0.3446067836	1.3648622584	-0.4792426584	0.2130812121	0.0911878469	-3.605121e-
[23,]	-0.2496196395	-0.6875524464	-0.9335162824	0.6027692112	0.8094891808	7.005028e-
[24,]	-0.3520700093	0.2822430507	0.2555611279	0.6350192662	0.0179911182	-1.389628e-
[25,]	0.5077089246	-0.1612550579	-0.0186130089	-0.3041024579	0.2026623054	-1.190615e-
[26,]	-0.6259760526	-0.5375940379	-0.5583140528	0.3347066400	-1.0951792994	8.320370e-
[27,]	-0.6537874675	0.3570074959	0.9290619928	-0.0189461399	1.1560600116	-2.554831e-
[28,]	-0.0648482848	-0.7354981588	0.5503138531	-0.7380133792	-0.9496643546	8.389053e-
[29,]	-1.2648397307	0.3155536872	-1.1110140575	-0.1549320265	2.1008653026	-1.743973e-
[30,]	0.9457428880	-1.6915126800	0.7155359778	1.0274567321	-0.2257845320	7.444228e-
[31,]	-0.1895100955	0.2414887412	0.1464112473	-0.0495438258	-0.1690167656	-2.514129e-
[32,]	-1.1586344712	-0.3666531671	0.0562237019	-0.6611355034	0.2298295473	2.991824e-
[33,]	-0.1491699406	0.0895757307	-0.5992509197	-0.0332054293	1.5600371817	-5.381913e-
[34,]	-1.5329294741	-0.2065832996	0.1820633909	-0.4482305144	0.1077454163	-8.542825e-
[35,]	0.2134201607	-0.1299260602	0.8657952064	0.4687972163	0.1202434785	-4.949487e-
[36,]	0.7203396398	-0.3895527430	-0.1574012260	-1.2429413892	0.1954059923	1.912162e-
[37,]	0.2688390818	-0.9067448813	0.0479551510	-1.6866316116	-0.1441330064	4.304295e-
[38,]	0.6935995880	-0.2003120841	0.5271573093	-0.6067308937	-0.0279386513	2.824748e-
[39,]	0.2429085978	1.7646246196	-0.1129573297	0.2507919469	-0.1314289782	-1.482093e-
[40,]	-0.1179524881	-0.3580190226	0.0556865761	0.1396045303	0.0353093528	-1.389953e-
[41,]	0.0181823818	-0.5107722810	0.3263458397	-0.5465772678	-0.0602546854	5.658773e-
[42,]	-0.7388494377	-0.0587506994	0.2787045616	0.0926434197	0.0901210156	-1.196858e-
[43,]	-1.9884712967	-0.3763602810	0.3022550599	0.1729522027	0.2552767122	-3.327794e-
[44,]	-0.3462124514	-0.6086221030	-0.7113741266	0.7779144715	-0.3180020334	4.068577e-
[45,]	1.5058488466	0.0966839023	-0.4001732785	0.0586933619	-0.1521141805	-3.945470e-
[46,]	0.0542470485	-0.2605203348	2.2309102556	0.7861699813	-1.1179707031	4.072934e-
[47,]	-0.3676769926	0.0803763634	1.3065788470	-0.3439303856	0.5396748825	1.926447e-
[48,]	0.0379981462	0.0139823408	0.2379323987	-0.1482978143	0.0345722067	-2.626249e-
[49,]	1.5880220441	0.4128727770	-1.2321509722	-0.6278155609	0.3533099316	1.678164e-
[50,]	-0.4960323101	-0.6439180110	0.3515209761	-0.5484838822	0.2054958400	1.408071e-
[51,]	1.1704670085	0.8200564211	-0.1123759892	-0.2977384011	0.1285674151	-6.899389e-
[52,]	-0.3941110717	-0.1764307635	0.5591763859	0.0448168714	0.0596852002	2.356005e-
[53,]	0.8857772453	0.2519075061	0.0130817786	-0.4850733698	0.0278447233	1.985134e-
[54,]	-0.6111756017	-0.7690695559	0.6284517406	0.6011938058	0.6113545988	3.056229e-
[55,]	-0.5984018598	1.3970676765	-0.0643320469	0.9721652618	-0.1949743264	-3.069309e-
[56,]	1.7422401316	0.1408058227	-0.0199461188	0.7410413537	-0.5297862525	1.093202e+
[57,]	-0.0108146406	-0.3106679951	-0.8493487541	0.3863867848	-0.1458192162	6.892529e-
[58,]	-1.8215348214	0.3621471351	0.4006851921	-0.2172714122	0.0608335537	2.928318e-
[59,]	0.3335120551	0.4740138563	-0.8411057977	0.4163000283	-0.0858083206	2.931242e-
[60,]	0.2284006406	-0.6348604010	-0.7475512841	-0.2920548376	0.2496513450	4.888034e-
[61,]	0.7408606053	0.5122781140	0.5793496320	-0.0105572994	-0.0042066309	5.488545e-
[62,]	-2.4733087118	0.5540510535	1.2979592812	-0.9935329529	1.2766076994	1.734229e-
[63,]	-0.4001018830	0.0656254162	2.1963468297	0.5895255433	1.4470277217	-1.086096e+

```

[64,] -1.7992385929  1.6436332545 -0.5355851584 -1.3269684512 -1.2755865234 -5.269145e-
[65,] -0.1566109309  0.5395449026  1.4430413025  0.0325762440 -1.0121301749  2.073019e-
[66,] -0.5389467786 -2.0662901268  0.1446763110 -0.3168046990  0.3722514197  2.468134e-
[67,]  0.6267828319 -0.5362398552 -0.3750836045 -0.0545365082 -0.4224485744  2.452230e-
[68,]  0.3270971145 -1.6969908177  0.3987065997 -0.0530068030  0.1509487886 -4.247686e-
[69,]  0.3792991801  0.4293974391  0.0802128266 -0.3229283966 -0.0234897322 -3.881229e-
[70,]  1.5255487349 -1.1502222404  0.3958031962 -0.5136583440 -0.0367616655  1.303524e-
[71,]  0.4884620531  0.4469007175 -0.3625035208 -1.6091056814  0.0695982865 -7.853735e-
[ reached getOption("max.print") -- omitted 1399 rows ]

```

```

> summary(attr_pca_done)
Importance of components:

```

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9
Standard deviation	2.0042	1.2846	1.03368	1.02573	1.0047	0.99622	0.9764	0.95786	0.8500
Proportion of Variance	0.2869	0.1179	0.07632	0.07515	0.0721	0.07089	0.0681	0.06554	0.0516
Cumulative Proportion	0.2869	0.4048	0.48111	0.55626	0.6284	0.69925	0.7673	0.83288	0.8845

	PC12	PC13	PC14
Standard deviation	0.53219	0.43975	0.3743
Proportion of Variance	0.02023	0.01381	0.0100
Cumulative Proportion	0.97618	0.99000	1.0000

```

> #Extract variance against features

```

```

> eigenvalues<-attr_pca_done$sdev^2

```

```

> eigenvalues

```

```

[1] 4.0167738 1.6502052 1.0685042 1.0521201 1.0094108 0.9924579 0.9533497 0.9174969 0.7224654
[11] 0.4698454 0.2832233 0.1933840 0.1400658

```

```

> sum(eigenvalues)

```

```

[1] 14

```

```

> names(eigenvalues) <- paste("PC",1:14,sep="")

```

```

> eigenvalues

```

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9
4.0167738	1.6502052	1.0685042	1.0521201	1.0094108	0.9924579	0.9533497	0.9174969	0.7224654	
	PC12	PC13	PC14						
0.2832233	0.1933840	0.1400658							

```

> sumoflambdas <- sum(eigenvalues)

```

```

> sumoflambdas

```

```

[1] 14

```

```

> #Variance %

```

```

> pctvar<- (eigenvalues/sumoflambdas)*100

```

```

> pctvar

```

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9
28.691241	11.787180	7.632173	7.515143	7.210077	7.088985	6.809641	6.553550	5.160467	
	PC12	PC13	PC14						
2.023023	1.381314	1.000470							

```

> #Calculate cumulative of variance

```

```

> cumvar <- cumsum(pctvar)

```

```

> cumvar

```

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9
28.69124	40.47842	48.11059	55.62574	62.83581	69.92480	76.73444	83.28799	88.44846	
	PC12	PC13	PC14						
97.61822	98.99953	100.00000							

```

> matlambdas <- rbind(eigenvalues,pctvar,cumvar)

```

```

> matlambdas

```

	PC1	PC2	PC3	PC4	PC5	PC6	PC7		
eigenvalues	4.016774	1.650205	1.068504	1.052120	1.009411	0.9924579	0.9533497	0.9174969	0.7224654
pctvar	28.691241	11.787180	7.632173	7.515143	7.210077	7.0889848	6.8096407	6.553550	5.160467
cumvar	28.691241	40.478422	48.110594	55.625738	62.835815	69.9247997	76.7344404	83.28799	88.44846
	PC10	PC11	PC12	PC13	PC14				
eigenvalues	0.5306975	0.4698454	0.2832233	0.193384	0.1400658				
pctvar	3.7906965	3.3560388	2.0230233	1.381314	1.0004700				
cumvar	92.2391537	95.5951925	97.6182158	98.999530	100.0000000				

```

> rownames(matlambdas) <- c("Eigenvalues","Prop. variance","Cum. prop. variance")

```

```

> round(matlambdas,4)

```

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9
Eigenvalues	4.0168	1.6502	1.0685	1.0521	1.0094	0.9925	0.9533	0.9175	0.7225


```

Prop. variance      28.6912 11.7872  7.6322  7.5151  7.2101  7.0890  6.8096  6.5535  5.16
Cum. prop. variance 28.6912 40.4784 48.1106 55.6257 62.8358 69.9248 76.7344 83.2880 88.44
Eigenvalues          PC12    PC13    PC14
Prop. variance       2.0230  1.3813  1.0005
Cum. prop. variance 97.6182 98.9995 100.0000

```

```
> attr_pca_done$rotation
```

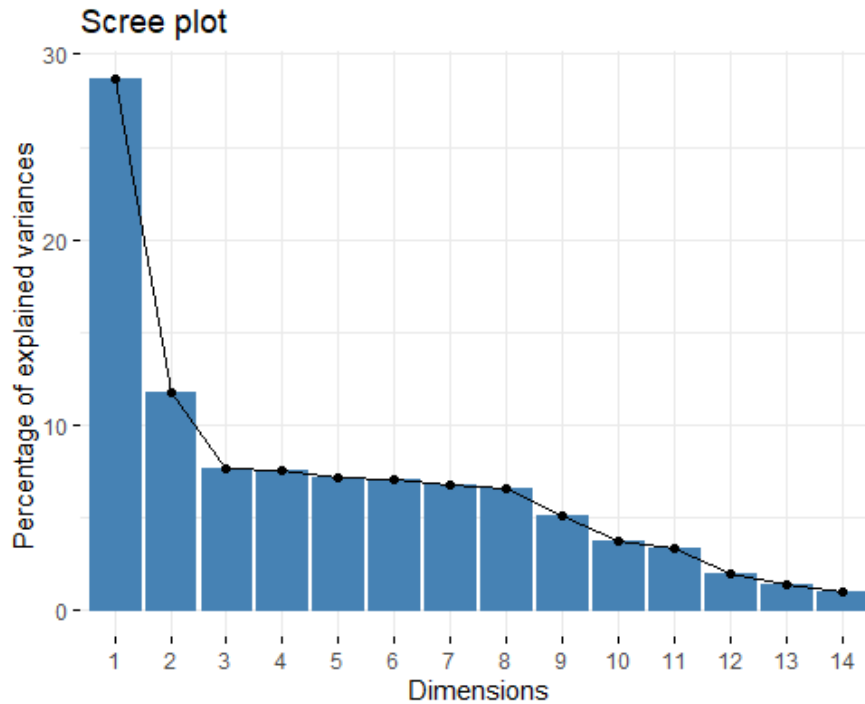
	PC1	PC2	PC3	PC4	PC5
Age	0.280157344	-0.472170158	0.003362193	0.004488409	-0.039563410
DailyRate	-0.006815197	-0.077962430	-0.207301367	-0.609569867	-0.211568990
DistanceFromHome	0.004812032	0.041564987	-0.664884791	0.306131593	0.048941659
HourlyRate	-0.011288550	-0.062668026	-0.352147686	-0.255816205	0.602292088
MonthlyIncome	0.360622909	-0.290395305	0.052415102	0.025332267	-0.034941693
MonthlyRate	0.001123298	-0.086158010	0.020312197	0.664085954	-0.101166486
NumCompaniesWorked	0.030991906	-0.560133264	0.005628265	-0.041875610	0.017785645
PercentSalaryHike	-0.015351368	0.004618486	-0.465841883	-0.055689609	-0.698726672
TotalWorkingYears	0.415285665	-0.318115831	0.009368263	0.007027664	-0.024159198
TrainingTimesLastYear	-0.010993402	0.092457674	0.409028173	-0.138279489	-0.293982017
YearsAtCompany	0.443443529	0.213079968	0.002115638	-0.010571214	0.024921329
YearsInCurrentRole	0.391353065	0.279423881	-0.048111956	-0.038785223	-0.004927194
YearsSinceLastPromotion	0.344322397	0.198658357	0.003993040	0.027659809	0.019935007
YearsWithCurrManager	0.386171187	0.295138965	-0.031745944	-0.034459502	0.021898300

	PC7	PC8	PC9	PC10	PC11
Age	-0.098196914	-0.05927715	-0.183114693	0.005033984	-0.74367068
DailyRate	0.715405171	-0.02770642	-0.028707475	0.040304455	-0.01980752
DistanceFromHome	0.031447533	-0.65217193	0.037737577	0.002338630	0.02927699
HourlyRate	-0.221010405	0.40142111	-0.004675476	0.018009772	0.03725997
MonthlyIncome	-0.012272736	-0.03685912	-0.377381332	0.104651321	0.61775910
MonthlyRate	0.482943083	0.40448871	0.056690883	-0.044889268	-0.01681584
NumCompaniesWorked	-0.032989593	-0.03355765	0.775796629	-0.129586743	0.19687866
PercentSalaryHike	-0.376210309	0.38335261	0.012190972	0.019568502	0.04082482
TotalWorkingYears	-0.029511945	-0.04398227	-0.196663458	-0.038585533	0.08301594
TrainingTimesLastYear	-0.217564575	-0.29622601	0.130785998	-0.017811234	0.02954240
YearsAtCompany	0.005335572	0.01862614	-0.001551392	-0.104225054	0.03762072
YearsInCurrentRole	0.062086964	0.05420752	0.201595025	-0.271683842	-0.04458982
YearsSinceLastPromotion	0.022129234	0.03850513	0.306725567	0.845951303	-0.08053456
YearsWithCurrManager	0.011525930	0.04176204	0.161413516	-0.407140185	-0.06576770

	PC13	PC14
Age	0.1893016403	0.237072230
DailyRate	-0.0099081253	0.018837870
DistanceFromHome	0.0057709912	0.011991386
HourlyRate	0.0049037331	-0.003314012
MonthlyIncome	0.4041044054	0.279006032
MonthlyRate	-0.0083381972	0.009367738
NumCompaniesWorked	-0.0369554196	0.107234673
PercentSalaryHike	-0.0183445446	0.010585240
TotalWorkingYears	-0.4158888971	-0.705989494
TrainingTimesLastYear	0.0008431661	-0.012085362
YearsAtCompany	-0.6494086309	0.562584645
YearsInCurrentRole	0.1948014145	-0.130643692
YearsSinceLastPromotion	0.0977011821	-0.083447864
YearsWithCurrManager	0.3959144832	-0.121010943

```
> #Visualize PCA using Scree plot
```

```
> fviz_screplot(attr_pca_done, ncp=14)
```

```
> summary(attr_pca_done)
Importance of components:
```

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9
Standard deviation	2.0042	1.2846	1.03368	1.02573	1.0047	0.99622	0.9764	0.95786	0.8500
Proportion of Variance	0.2869	0.1179	0.07632	0.07515	0.0721	0.07089	0.0681	0.06554	0.0516
Cumulative Proportion	0.2869	0.4048	0.48111	0.55626	0.6284	0.69925	0.7673	0.83288	0.8845

	PC12	PC13	PC14
Standard deviation	0.53219	0.43975	0.3743
Proportion of Variance	0.02023	0.01381	0.0100
Cumulative Proportion	0.97618	0.99000	1.0000

```
> #Sample scores stored in attr_pca$x
```

```
> #we need to calculate the scores on each of these components for each individual in our
```

```
> attr_pca_done$x
```

	PC1	PC2	PC3	PC4	PC5	PC6
[1,]	-0.243044079	-1.805296680	-0.3104169553	-0.384994275	2.0169575215	0.984793983
[2,]	0.854288163	0.381073595	-0.5252390003	1.608645799	-1.5927436292	-0.481865695
[3,]	-2.198275394	-1.413301606	-0.0582282745	-2.596801032	0.6022422032	-0.023230640
[4,]	-0.570845554	0.682294015	0.9530781591	-0.112517223	0.0144209522	-0.415235118
[5,]	-1.567685771	-0.965438549	1.6427717726	0.537047071	-0.0703157168	0.940560119
[6,]	-0.033228256	1.476192828	0.1768758528	-0.871158691	0.9282306482	0.367849216
[7,]	-1.176981984	-2.344142438	-0.5229233979	-1.666338771	-0.8793271137	-0.417767837
[8,]	-2.668563284	0.310022541	-2.6128166708	-0.330963952	-1.2486460778	-0.052250851
[9,]	0.910894519	1.213005861	-1.5039201417	1.144947290	-1.1238829367	1.049881443
[10,]	1.339778839	-0.208584655	-1.9076328247	-0.281672326	1.0866328829	-1.252674274
[11,]	-1.227202504	0.961999888	0.0613545738	0.034499533	0.4709461858	-2.043427871
[12,]	-0.073116546	1.760186112	0.5344916830	1.247906142	0.5189044912	0.442256861
[13,]	-1.087474516	1.023377864	-1.5147071841	1.573775407	-0.7475549471	1.511464717
[14,]	-1.814073316	0.601874393	-1.3014136722	-1.101977678	1.6522331947	-0.334506872
[15,]	-1.659410211	0.292702788	-0.0672556843	1.527211158	0.0369416431	-0.176183833
[16,]	1.744251934	1.686663324	-1.1177364895	-0.381693162	0.6609099755	1.223658522
[17,]	-1.118546968	1.132058901	1.4189672811	0.273681898	0.7687430566	-1.460717606
[18,]	-2.875446285	0.684977918	-1.2101773533	-1.069482747	1.5219403902	-0.105065952
[19,]	4.306398521	-1.060188116	0.2102166478	-0.374474127	-0.3205736368	-1.006842601
[20,]	-1.274793286	-0.518252552	1.7607337154	-0.263605442	0.4775025923	1.296215086
[21,]	-1.707674413	1.416074395	-0.2866612249	-0.911443288	0.0740619531	-1.694982203

[22,]	-0.973935456	-1.013413533	-1.1120212000	-1.850388185	-1.3640205357	-0.666890243	-
[23,]	1.686994016	1.312303531	1.5096245660	1.224455487	0.2429059015	-0.652215366	-
[24,]	-3.186960204	1.127496005	0.4028852195	0.661084708	0.6427677466	-2.782189999	-
[25,]	-1.236420346	0.070998887	0.2998566707	0.248336464	1.5088956715	0.030328006	-
[26,]	4.335210193	-1.187855044	0.8439064948	-1.135518002	0.1502712115	0.089980426	-
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6	No	-0.03322826	1.47619283	0.176875853	-0.87115869	0.92823065	0.36784922	0.
7	No	-1.17698198	-2.34414244	-0.522923398	-1.66633877	-0.87932711	-0.41776784	-0.
8	No	-2.66856328	0.31002254	-2.612816671	-0.33096395	-1.24864608	-0.05225085	0.
9	No	0.91089452	1.21300586	-1.503920142	1.14494729	-1.12388294	1.04988144	-1.
10	No	1.33977884	-0.20858466	-1.907632825	-0.28167233	1.08663288	-1.25267427	1.
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43	Yes	-2.66097737	0.70903981	-1.115132362	-0.17331186	0.17003055	0.58048454	1.
44	No	0.49424199	1.35566363	-0.455831491	-0.77357691	-0.08932020	2.88993639	0.
45	No	0.75546535	1.60757263	-0.510963713	-0.50688809	-1.42330758	1.05714745	-0.
46	Yes	5.80495189	1.07809120	-0.697528115	0.05144471	0.43378489	1.61410670	2.
47	No	0.80665807	1.65344282	-2.306810616	-0.29588285	-0.47229184	0.13416905	-0.
48	No	-1.99588188	-0.92689641	-1.996031614	0.63359936	-0.17298881	1.02115120	-1.
49	No	0.84424593	-0.61684992	-0.819420696	-0.92181023	-0.77170683	-1.81853606	-0.
50	No	-2.41833066	0.29732619	-0.351346000	-1.10175198	-1.51565786	1.49905334	0.
51	Yes	-0.61700209	-3.63498920	0.356209637	0.11821639	1.43898946	-0.22022944	-0.
52	Yes	-1.87489801	0.83088181	0.624801554	-1.14213498	-0.36001997	0.32994672	1.
53	No	-0.59596447	-1.21846665	-0.840883957	-2.44721561	-0.93994468	0.77427209	-0.
54	No	-0.69765361	-0.44031140	-0.100160979	-1.00294120	0.67410051	-0.30541283	0.
55	No	-2.07981023	-0.95518514	-1.816117794	0.44181323	-1.39608225	0.25343209	1.
56	No	3.70846662	1.81410918	-0.009754192	-0.03690945	2.10902261	0.55299870	0.
57	No	0.80984897	1.10389750	-1.710841409	-0.29132705	-1.11372268	-0.31892358	-0.
58	No	-1.46568195	0.05800518	-0.579943143	0.62472164	-1.16769581	0.27508684	1.
59	No	0.17211888	0.85739090	-0.322226695	-0.28615065	-1.69741044	0.72281848	-1.
60	No	-0.13448869	0.77482451	0.074204744	-1.66832839	-0.83202177	1.45822091	-0.
61	No	1.15446622	1.92230649	0.534035454	0.20845667	-2.04492813	1.17273783	-1.
62	No	1.01554960	1.68567934	-1.083680307	0.52226408	0.94253470	0.96067700	0.
63	No	5.23082596	-1.15165566	0.811975803	0.36448543	-0.04053148	0.82655261	1.
64	No	5.03028290	-0.75521827	-1.767897505	-2.04456229	1.64789092	-0.73722100	0.
65	No	3.78898454	1.94629804	-0.094556027	-1.06701099	0.31846795	0.86043923	1.
66	No	0.66074288	-2.42744422	0.746473163	1.05190758	-0.86667720	0.70033996	0.
		PC9	PC10	PC11	PC12	PC13	PC14	

1	1.18634718	-0.872121600	-0.09640534	0.165268977	0.269799504	0.56169756
2	-0.29152070	-0.913315376	-1.27049561	-0.122384858	0.300378690	0.39264772
3	0.70371779	0.233428604	-0.20631100	0.075718010	-0.203419065	-0.03027029
4	-0.02321429	0.448374867	-0.42559708	-1.190542577	-0.588878508	0.03760515
5	2.31328541	-0.009282989	0.79113838	0.093214760	-0.100182192	-0.01465031
6	-0.22195549	-0.087206926	-0.43525479	-0.231114246	0.207482785	-0.34016769
7	-0.44391529	0.285042689	-1.99552141	0.047699878	-0.076085636	0.15272680
8	-0.48750809	0.480051806	0.05439541	0.102073671	-0.046594152	0.32533830
9	-0.84675831	-0.779117537	0.11737087	-0.020764703	0.717896928	0.20342651
10	1.81688328	0.549625844	0.08936470	0.171974312	0.148287350	-0.75927968
11	-0.34871212	-0.357829761	-0.50295608	-0.242240736	-0.039146384	-0.02624589
12	-0.37676200	-1.105840599	0.09653944	0.439989975	-0.025945549	-0.29403497
13	-0.03635385	0.830830461	-0.21904995	0.301720660	-0.051386781	0.06517152
14	-0.73104553	0.381273918	-0.49493176	-0.011062744	0.258710503	0.07880223
15	1.23434951	-0.519825125	0.42502036	0.177249788	-0.280562634	-0.04452694
16	0.16722837	0.919050517	0.60523221	-0.139641983	0.788622438	-0.08889241
17	-0.43599228	-0.490823551	-0.17128405	0.496486395	-0.061978852	-0.08960470
18	-0.45159450	0.470722128	0.68700116	0.048046474	-0.132374244	0.07059914
19	-1.32011485	-0.555372557	-0.02021455	0.010651355	-1.330532123	0.54193113
20	0.62993636	-0.009824715	-0.28805976	-0.073902751	0.117532074	0.21483103
21	-0.31123058	0.180151786	0.66916402	0.191206360	-0.061527117	-0.18474214
22	1.36486226	-0.479242658	0.21308121	0.091187847	-0.360512122	0.06632427
23	-0.68755245	-0.933516282	0.60276921	0.809489181	0.700502805	0.11071287
24	0.28224305	0.255561128	0.63501927	0.017991118	-0.138962804	-0.11188786
25	-0.16125506	-0.018613009	-0.30410246	0.202662305	-0.119061534	-0.15837894
26	-0.53759404	-0.558314053	0.33470664	-1.095179299	0.832036960	0.02989736
27	0.35700750	0.929061993	-0.01894614	1.156060012	-0.255483067	-0.06819902
28	-0.73549816	0.550313853	-0.73801338	-0.949664355	0.008389053	0.25967553
29	0.31555369	-1.111014058	-0.15493203	2.100865303	-0.174397307	0.02246194
30	-1.69151268	0.715535978	1.02745673	-0.225784532	0.744422810	-0.26383596
31	0.24148874	0.146411247	-0.04954383	-0.169016766	-0.251412918	-0.16472346
32	-0.36665317	0.056223702	-0.66113550	0.229829547	0.299182395	0.24667601
33	0.08957573	-0.599250920	-0.03320543	1.560037182	-0.538191327	-0.12374748
34	-0.20658330	0.182063391	-0.44823051	0.107745416	-0.854282470	-1.14616941
35	-0.12992606	0.865795206	0.46879722	0.120243478	-0.494948660	-0.31419900
36	-0.38955274	-0.157401226	-1.24294139	0.195405992	0.191216222	0.23944677
37	-0.90674488	0.047955151	-1.68663161	-0.144133006	0.430429526	0.61334413
38	-0.20031208	0.527157309	-0.60673089	-0.027938651	0.282474819	0.12472443
39	1.76462462	-0.112957330	0.25079195	-0.131428978	-0.148209341	0.29073071
40	-0.35801902	0.055686576	0.13960453	0.035309353	-0.138995276	-0.15147123
41	-0.51077228	0.326345840	-0.54657727	-0.060254685	0.056587730	0.29700932
42	-0.05875070	0.278704562	0.09264342	0.090121016	-0.119685794	0.13898868
43	-0.37636028	0.302255060	0.17295220	0.255276712	-0.003327794	0.13586788
44	-0.60862210	-0.711374127	0.77791447	-0.318002033	0.406857687	0.01109437
45	0.09668390	-0.400173278	0.05869336	-0.152114181	-0.394547025	-0.25084901
46	-0.26052033	2.230910256	0.78616998	-1.117970703	0.407293367	0.32005748
47	0.08037636	1.306578847	-0.34393039	0.539674882	0.192644669	-0.23562251
48	0.01398234	0.237932399	-0.14829781	0.034572207	-0.262624929	-0.03020186
49	0.41287278	-1.232150972	-0.62781556	0.353309932	0.167816354	0.06690825
50	-0.64391801	0.351520976	-0.54848388	0.205495840	0.140807097	0.35162772
51	0.82005642	-0.112375989	-0.29773840	0.128567415	-0.689938913	-0.79242652
52	-0.17643076	0.559176386	0.04481687	0.059685200	0.235600513	0.06709468
53	0.25190751	0.013081779	-0.48507337	0.027844723	0.198513442	0.29335630
54	-0.76906956	0.628451741	0.60119381	0.611354599	0.305622885	0.15411449
55	1.39706768	-0.064332047	0.97216526	-0.194974326	-0.306930947	0.23036887
56	0.14080582	-0.019946119	0.74104135	-0.529786253	1.093201883	-0.15809731
57	-0.31066800	-0.849348754	0.38638678	-0.145819216	0.689252882	0.21050825
58	0.36214714	0.400685192	-0.21727141	0.060833554	0.292831786	0.21548050
59	0.47401386	-0.841105798	0.41630003	-0.085808321	0.293124207	-0.22251524
60	-0.63486040	-0.747551284	-0.29205484	0.249651345	0.488803355	0.22308994
61	0.51227811	0.579349632	-0.01055730	-0.004206631	0.548854514	-0.23403874
62	0.55405105	1.297959281	-0.99353295	1.276607699	0.173422905	-0.18562460
63	0.06562542	2.196346830	0.58952554	1.447027722	-1.086096447	1.03490915
64	1.64363325	-0.535585158	-1.32696845	-1.275586523	-0.526914507	-0.10402533

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65 0.53954490 1.443041303 0.03257624 -1.012130175 0.207301917 -0.21108226
66 -2.06629013 0.144676311 -0.31680470 0.372251420 0.246813433 0.15949383
[ reached 'max' / getOption("max.print") -- omitted 1404 rows ]

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'data.frame': 1470 obs. of 15 variables:
 $ Attrition: Factor w/ 2 levels "No","Yes": 2 1 2 1 1 1 1 1 1 1 ...
 $ PC1      : num -0.243 0.854 -2.198 -0.571 -1.568 ...
 $ PC2      : num -1.805 0.381 -1.413 0.682 -0.965 ...
 $ PC3      : num -0.3104 -0.5252 -0.0582 0.9531 1.6428 ...
 $ PC4      : num -0.385 1.609 -2.597 -0.113 0.537 ...
 $ PC5      : num 2.017 -1.5927 0.6022 0.0144 -0.0703 ...
 $ PC6      : num 0.9848 -0.4819 -0.0232 -0.4152 0.9406 ...
 $ PC7      : num 1.332 -1.043 -0.245 2.255 0.333 ...
 $ PC8      : num 1.592 1.44 0.165 0.379 -0.211 ...
 $ PC9      : num 1.1863 -0.2915 0.7037 -0.0232 2.3133 ...
 $ PC10     : num -0.87212 -0.91332 0.23343 0.44837 -0.00928 ...
 $ PC11     : num -0.0964 -1.2705 -0.2063 -0.4256 0.7911 ...
 $ PC12     : num 0.1653 -0.1224 0.0757 -1.1905 0.0932 ...
 $ PC13     : num 0.27 0.3 -0.203 -0.589 -0.1 ...
 $ PC14     : num 0.5617 0.3926 -0.0303 0.0376 -0.0147 ...

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> #typ_pca
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> typ_pca
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1	Yes	-0.24304408	-1.80529668	-0.310416955	-0.38499428	2.01695752	0.98479398	1.
2	No	0.85428816	0.38107360	-0.525239000	1.60864580	-1.59274363	-0.48186570	-1.
3	Yes	-2.19827539	-1.41330161	-0.058228274	-2.59680103	0.60224220	-0.02323064	-0.
4	No	-0.57084555	0.68229402	0.953078159	-0.11251722	0.01442095	-0.41523512	2.
5	No	-1.56768577	-0.96543855	1.642771773	0.53704707	-0.07031572	0.94056012	0.
6	No	-0.03322826	1.47619283	0.176875853	-0.87115869	0.92823065	0.36784922	0.
7	No	-1.17698198	-2.34414244	-0.522923398	-1.66633877	-0.87932711	-0.41776784	-0.
8	No	-2.66856328	0.31002254	-2.612816671	-0.33096395	-1.24864608	-0.05225085	0.
9	No	0.91089452	1.21300586	-1.503920142	1.14494729	-1.12388294	1.04988144	-1.
10	No	1.33977884	-0.20858466	-1.907632825	-0.28167233	1.08663288	-1.25267427	1.
11	No	-1.22720250	0.96199989	0.061354574	0.03449953	0.47094619	-2.04342787	-0.
12	No	-0.07311655	1.76018611	0.534491683	1.24790614	0.51890449	0.44225686	-0.
13	No	-1.08747452	1.02337786	-1.514707184	1.57377541	-0.74755495	1.51146472	0.
14	No	-1.81407332	0.60187439	-1.301413672	-1.10197768	1.65223319	-0.33450687	0.
15	Yes	-1.65941021	0.29270279	-0.067255684	1.52721116	0.03694164	-0.17618383	-1.
16	No	1.74425193	1.68666332	-1.117736489	-0.38169316	0.66090998	1.22365852	1.
17	No	-1.11854697	1.13205890	1.418967281	0.27368190	0.76874306	-1.46071761	-0.
18	No	-2.87544628	0.68497792	-1.210177353	-1.06948275	1.52194039	-0.10506595	0.
19	No	4.30639852	-1.06018812	0.210216648	-0.37447413	-0.32057364	-1.00684260	0.
20	No	-1.27479329	-0.51825255	1.760733715	-0.26360544	0.47750259	1.29621509	-0.
21	No	-1.70767441	1.41607440	-0.286661225	-0.91144329	0.07406195	-1.69498220	-1.
22	Yes	-0.97393546	-1.01341353	-1.112021200	-1.85038818	-1.36402054	-0.66689024	-1.
23	No	1.68699402	1.31230353	1.509624566	1.22445549	0.24290590	-0.65221537	0.
24	No	-3.18696020	1.12749600	0.402885220	0.66108471	0.64276775	-2.78219000	-0.
25	Yes	-1.23642035	0.07099889	0.299856671	0.24833646	1.50889567	0.03032801	0.
26	No	4.33521019	-1.18785504	0.843906495	-1.13551800	0.15027121	0.08998043	0.
27	Yes	0.20266745	1.48770734	-1.049606601	-1.51049997	-1.51944447	-1.17285672	-1.
28	No	0.52261166	0.51796012	0.749648443	1.18950923	0.37255048	0.46774927	1.
29	No	4.16749778	1.06863278	1.191770760	-0.65593650	-0.36033955	0.68064674	-1.
30	No	0.85566865	-2.59494435	0.733732945	0.72583015	0.98819396	-0.38961005	0.
31	No	-2.10145329	-0.59810916	0.921883088	-1.26139753	1.12856992	0.18540641	-0.
32	No	-0.62868678	-0.50657734	1.055748027	-0.35936386	-1.27677223	-1.25901998	1.
33	No	-0.58576032	1.29059488	1.017527879	0.75997074	0.84347962	-1.53720260	-1.
34	Yes	-1.45300079	-0.87834675	1.655345137	-1.46697925	-0.76526203	-1.05042789	-1.
35	Yes	-2.29542604	0.49739124	0.396140718	-1.17366768	0.04956876	1.39666095	-0.
36	No	-0.83299406	0.04299001	0.700614400	-0.30849522	0.34173329	-0.72227464	1.
37	Yes	-1.35469334	-0.38217265	-0.011333012	-1.42388178	1.03149159	0.51749502	-0.
38	No	-1.78845938	0.52000240	0.318618945	-1.16848391	1.30103272	-0.49908050	-0.
39	No	-1.94088819	-1.94711972	0.301406527	-0.61630258	0.65807129	-0.11211248	-0.
40	No	-0.82682704	0.26931799	0.468377019	-1.61706575	-1.54246195	1.07860250	-0.
41	No	-2.54024234	0.23133567	0.924925063	-0.01921329	1.03578990	0.02318244	-0.

42	No	-2.77506460	0.69987165	2.268824442	-0.25581802	-1.59584984	-1.35122346	1.
43	Yes	-2.66097737	0.70903981	-1.115132362	-0.17331186	0.17003055	0.58048454	1.
44	No	0.49424199	1.35566363	-0.455831491	-0.77357691	-0.08932020	2.88993639	0.
45	No	0.75546535	1.60757263	-0.510963713	-0.50688809	-1.42330758	1.05714745	-0.
46	Yes	5.80495189	1.07809120	-0.697528115	0.05144471	0.43378489	1.61410670	2.
47	No	0.80665807	1.65344282	-2.306810616	-0.29588285	-0.47229184	0.13416905	-0.
48	No	-1.99588188	-0.92689641	-1.996031614	0.63359936	-0.17298881	1.02115120	-1.
49	No	0.84424593	-0.61684992	-0.819420696	-0.92181023	-0.77170683	-1.81853606	-0.
50	No	-2.41833066	0.29732619	-0.351346000	-1.10175198	-1.51565786	1.49905334	0.
51	Yes	-0.61700209	-3.63498920	0.356209637	0.11821639	1.43898946	-0.22022944	-0.
52	Yes	-1.87489801	0.83088181	0.624801554	-1.14213498	-0.36001997	0.32994672	1.
53	No	-0.59596447	-1.21846665	-0.840883957	-2.44721561	-0.93994468	0.77427209	-0.
54	No	-0.69765361	-0.44031140	-0.100160979	-1.00294120	0.67410051	-0.30541283	0.
55	No	-2.07981023	-0.95518514	-1.816117794	0.44181323	-1.39608225	0.25343209	1.
56	No	3.70846662	1.81410918	-0.009754192	-0.03690945	2.10902261	0.55299870	0.
57	No	0.80984897	1.10389750	-1.710841409	-0.29132705	-1.11372268	-0.31892358	-0.
58	No	-1.46568195	0.05800518	-0.579943143	0.62472164	-1.16769581	0.27508684	1.
59	No	0.17211888	0.85739090	-0.322226695	-0.28615065	-1.69741044	0.72281848	-1.
60	No	-0.13448869	0.77482451	0.074204744	-1.66832839	-0.83202177	1.45822091	-0.
61	No	1.15446622	1.92230649	0.534035454	0.20845667	-2.04492813	1.17273783	-1.
62	No	1.01554960	1.68567934	-1.083680307	0.52226408	0.94253470	0.96067700	0.
63	No	5.23082596	-1.15165566	0.811975803	0.36448543	-0.04053148	0.82655261	1.
64	No	5.03028290	-0.75521827	-1.767897505	-2.04456229	1.64789092	-0.73722100	0.
65	No	3.78898454	1.94629804	-0.094556027	-1.06701099	0.31846795	0.86043923	1.
66	No	0.66074288	-2.42744422	0.746473163	1.05190758	-0.86667720	0.70033996	0.

	PC9	PC10	PC11	PC12	PC13	PC14
1	1.18634718	-0.872121600	-0.09640534	0.165268977	0.269799504	0.56169756
2	-0.29152070	-0.913315376	-1.27049561	-0.122384858	0.300378690	0.39264772
3	0.70371779	0.233428604	-0.20631100	0.075718010	-0.203419065	-0.03027029
4	-0.02321429	0.448374867	-0.42559708	-1.190542577	-0.588878508	0.03760515
5	2.31328541	-0.009282989	0.79113838	0.093214760	-0.100182192	-0.01465031
6	-0.22195549	-0.087206926	-0.43525479	-0.231114246	0.207482785	-0.34016769
7	-0.44391529	0.285042689	-1.99552141	0.047699878	-0.076085636	0.15272680
8	-0.48750809	0.480051806	0.05439541	0.102073671	-0.046594152	0.32533830
9	-0.84675831	-0.779117537	0.11737087	-0.020764703	0.717896928	0.20342651
10	1.81688328	0.549625844	0.08936470	0.171974312	0.148287350	-0.75927968
11	-0.34871212	-0.357829761	-0.50295608	-0.242240736	-0.039146384	-0.02624589
12	-0.37676200	-1.105840599	0.09653944	0.439989975	-0.025945549	-0.29403497
13	-0.03635385	0.830830461	-0.21904995	0.301720660	-0.051386781	0.06517152
14	-0.73104553	0.381273918	-0.49493176	-0.011062744	0.258710503	0.07880223
15	1.23434951	-0.519825125	0.42502036	0.177249788	-0.280562634	-0.04452694
16	0.16722837	0.919050517	0.60523221	-0.139641983	0.788622438	-0.08889241
17	-0.43599228	-0.490823551	-0.17128405	0.496486395	-0.061978852	-0.08960470
18	-0.45159450	0.470722128	0.68700116	0.048046474	-0.132374244	0.07059914
19	-1.32011485	-0.555372557	-0.02021455	0.010651355	-1.330532123	0.54193113
20	0.62993636	-0.009824715	-0.28805976	-0.073902751	0.117532074	0.21483103
21	-0.31123058	0.180151786	0.66916402	0.191206360	-0.061527117	-0.18474214
22	1.36486226	-0.479242658	0.21308121	0.091187847	-0.360512122	0.06632427
23	-0.68755245	-0.933516282	0.60276921	0.809489181	0.700502805	0.11071287
24	0.28224305	0.255561128	0.63501927	0.017991118	-0.138962804	-0.11188786
25	-0.16125506	-0.018613009	-0.30410246	0.202662305	-0.119061534	-0.15837894
26	-0.53759404	-0.558314053	0.33470664	-1.095179299	0.832036960	0.02989736
27	0.35700750	0.929061993	-0.01894614	1.156060012	-0.255483067	-0.06819902
28	-0.73549816	0.550313853	-0.73801338	-0.949664355	0.008389053	0.25967553
29	0.31555369	-1.111014058	-0.15493203	2.100865303	-0.174397307	0.02246194
30	-1.69151268	0.715535978	1.02745673	-0.225784532	0.744422810	-0.26383596
31	0.24148874	0.146411247	-0.04954383	-0.169016766	-0.251412918	-0.16472346
32	-0.36665317	0.056223702	-0.66113550	0.229829547	0.299182395	0.24667601
33	0.08957573	-0.599250920	-0.03320543	1.560037182	-0.538191327	-0.12374748
34	-0.20658330	0.182063391	-0.44823051	0.107745416	-0.854282470	-1.14616941
35	-0.12992606	0.865795206	0.46879722	0.120243478	-0.494948660	-0.31419900
36	-0.38955274	-0.157401226	-1.24294139	0.195405992	0.191216222	0.23944677
37	-0.90674488	0.047955151	-1.68663161	-0.144133006	0.430429526	0.61334413
38	-0.20031208	0.527157309	-0.60673089	-0.027938651	0.282474819	0.12472443


```

39 1.76462462 -0.112957330 0.25079195 -0.131428978 -0.148209341 0.29073071
40 -0.35801902 0.055686576 0.13960453 0.035309353 -0.138995276 -0.15147123
41 -0.51077228 0.326345840 -0.54657727 -0.060254685 0.056587730 0.29700932
42 -0.05875070 0.278704562 0.09264342 0.090121016 -0.119685794 0.13898868
43 -0.37636028 0.302255060 0.17295220 0.255276712 -0.003327794 0.13586788
44 -0.60862210 -0.711374127 0.77791447 -0.318002033 0.406857687 0.01109437
45 0.09668390 -0.400173278 0.05869336 -0.152114181 -0.394547025 -0.25084901
46 -0.26052033 2.230910256 0.78616998 -1.117970703 0.407293367 0.32005748
47 0.08037636 1.306578847 -0.34393039 0.539674882 0.192644669 -0.23562251
48 0.01398234 0.237932399 -0.14829781 0.034572207 -0.262624929 -0.03020186
49 0.41287278 -1.232150972 -0.62781556 0.353309932 0.167816354 0.06690825
50 -0.64391801 0.351520976 -0.54848388 0.205495840 0.140807097 0.35162772
51 0.82005642 -0.112375989 -0.29773840 0.128567415 -0.689938913 -0.79242652
52 -0.17643076 0.559176386 0.04481687 0.059685200 0.235600513 0.06709468
53 0.25190751 0.013081779 -0.48507337 0.027844723 0.198513442 0.29335630
54 -0.76906956 0.628451741 0.60119381 0.611354599 0.305622885 0.15411449
55 1.39706768 -0.064332047 0.97216526 -0.194974326 -0.306930947 0.23036887
56 0.14080582 -0.019946119 0.74104135 -0.529786253 1.093201883 -0.15809731
57 -0.31066800 -0.849348754 0.38638678 -0.145819216 0.689252882 0.21050825
58 0.36214714 0.400685192 -0.21727141 0.060833554 0.292831786 0.21548050
59 0.47401386 -0.841105798 0.41630003 -0.085808321 0.293124207 -0.22251524
60 -0.63486040 -0.747551284 -0.29205484 0.249651345 0.488803355 0.22308994
61 0.51227811 0.579349632 -0.01055730 -0.004206631 0.548854514 -0.23403874
62 0.55405105 1.297959281 -0.99353295 1.276607699 0.173422905 -0.18562460
63 0.06562542 2.196346830 0.58952554 1.447027722 -1.086096447 1.03490915
64 1.64363325 -0.535585158 -1.32696845 -1.275586523 -0.526914507 -0.10402533
65 0.53954490 1.443041303 0.03257624 -1.012130175 0.207301917 -0.21108226
66 -2.06629013 0.144676311 -0.31680470 0.372251420 0.246813433 0.15949383
[ reached 'max' / getOption("max.print") -- omitted 1404 rows ]

```

```
> str(typ_pca)
```

```

'data.frame': 1470 obs. of 15 variables:
 $ Attrition: Factor w/ 2 levels "No","Yes": 2 1 2 1 1 1 1 1 1 1 ...
 $ PC1      : num -0.243 0.854 -2.198 -0.571 -1.568 ...
 $ PC2      : num -1.805 0.381 -1.413 0.682 -0.965 ...
 $ PC3      : num -0.3104 -0.5252 -0.0582 0.9531 1.6428 ...
 $ PC4      : num -0.385 1.609 -2.597 -0.113 0.537 ...
 $ PC5      : num 2.017 -1.5927 0.6022 0.0144 -0.0703 ...
 $ PC6      : num 0.9848 -0.4819 -0.0232 -0.4152 0.9406 ...
 $ PC7      : num 1.332 -1.043 -0.245 2.255 0.333 ...
 $ PC8      : num 1.592 1.44 0.165 0.379 -0.211 ...
 $ PC9      : num 1.1863 -0.2915 0.7037 -0.0232 2.3133 ...
 $ PC10     : num -0.87212 -0.91332 0.23343 0.44837 -0.00928 ...
 $ PC11     : num -0.0964 -1.2705 -0.2063 -0.4256 0.7911 ...
 $ PC12     : num 0.1653 -0.1224 0.0757 -1.1905 0.0932 ...
 $ PC13     : num 0.27 0.3 -0.203 -0.589 -0.1 ...
 $ PC14     : num 0.5617 0.3926 -0.0303 0.0376 -0.0147 ...

```

```
> #typ_pca
```

```
> #T-Test-- we see that true difference in all the means is different from zero.
```

```
> t.test(PC1~attr$Attrition,data=typ_pca)
```

```
Welch Two Sample t-test
```

```

data: PC1 by attr$Attrition
t = 7.0668, df = 332.39, p-value = 9.363e-12
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.7147174 1.2660970
sample estimates:
mean in group No mean in group Yes
 0.1596779      -0.8307293

```

```
> t.test(PC2~attr$Attrition,data=typ_pca)
```

```
Welch Two Sample t-test
```



```
data: PC2 by attr$Attrition
t = -0.85944, df = 359.22, p-value = 0.3907
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.23869831  0.09351411
sample estimates:
mean in group No mean in group Yes
 -0.01170362      0.06088848
```

```
> t.test(PC3~attr$Attrition,data=typ_pca)
```

```
Welch Two Sample t-test
```

```
data: PC3 by attr$Attrition
t = 1.9682, df = 330.99, p-value = 0.04988
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.0000754401 0.2902563607
sample estimates:
mean in group No mean in group Yes
 0.0234043      -0.1217616
```

```
> t.test(PC4~attr$Attrition,data=typ_pca)
```

```
Welch Two Sample t-test
```

```
data: PC4 by attr$Attrition
t = -2.9421, df = 316.05, p-value = 0.003501
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.37886461 -0.07520897
sample estimates:
mean in group No mean in group Yes
 -0.03660389      0.19043290
```

```
> t.test(PC5~attr$Attrition,data=typ_pca)
```

```
Welch Two Sample t-test
```

```
data: PC5 by attr$Attrition
t = -1.8185, df = 335.9, p-value = 0.06988
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.26708955  0.01048367
sample estimates:
mean in group No mean in group Yes
 -0.02068558      0.10761736
```

```
> t.test(PC6~attr$Attrition,data=typ_pca)
```

```
Welch Two Sample t-test
```

```
data: PC6 by attr$Attrition
t = -2.045, df = 337.68, p-value = 0.04163
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.27902161 -0.00542244
sample estimates:
mean in group No mean in group Yes
 -0.02292967      0.11929235
```

```
> t.test(PC7~attr$Attrition,data=typ_pca)
```

Welch Two Sample t-test

```
data: PC7 by attr$Attrition
t = 0.12903, df = 338.09, p-value = 0.8974
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.1252946  0.1428859
sample estimates:
mean in group No mean in group Yes
 0.001418073      -0.007377570
```

```
> t.test(PC8~attr$Attrition,data=typ_pca)
```

Welch Two Sample t-test

```
data: PC8 by attr$Attrition
t = 1.2417, df = 333.18, p-value = 0.2152
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.04925478  0.21789000
sample estimates:
mean in group No mean in group Yes
 0.01359406      -0.07072355
```

```
> t.test(PC9~attr$Attrition,data=typ_pca)
```

Welch Two Sample t-test

```
data: PC9 by attr$Attrition
t = -4.0487, df = 341.99, p-value = 6.374e-05
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.3508967 -0.1214329
sample estimates:
mean in group No mean in group Yes
 -0.03807555      0.19808925
```

```
> t.test(PC10~attr$Attrition,data=typ_pca)
```

Welch Two Sample t-test

```
data: PC10 by attr$Attrition
t = -4.7135, df = 407.32, p-value = 3.348e-06
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.2874191 -0.1182375
sample estimates:
mean in group No mean in group Yes
 -0.03270088      0.17012739
```

```
> t.test(PC11~attr$Attrition,data=typ_pca)
```

Welch Two Sample t-test

```
data: PC11 by attr$Attrition
t = -1.716, df = 344.09, p-value = 0.08705
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.17290429  0.01177642
sample estimates:
mean in group No mean in group Yes
 -0.01298888      0.06757505
```

```
> t.test(PC12~attr$Attrition,data=typ_pca)
```

Welch Two Sample t-test

```
data: PC12 by attr$Attrition
t = -1.3139, df = 419.64, p-value = 0.1896
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.10145603  0.02016025
sample estimates:
mean in group No mean in group Yes
 -0.006553436      0.034094458
```

```
> t.test(PC13~attr$Attrition,data=typ_pca)
```

Welch Two Sample t-test

```
data: PC13 by attr$Attrition
t = 2.8529, df = 328.06, p-value = 0.004608
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 0.02802803 0.15253970
sample estimates:
mean in group No mean in group Yes
 0.01455597      -0.07572789
```

```
> t.test(PC14~attr$Attrition,data=typ_pca)
```

Welch Two Sample t-test

```
data: PC14 by attr$Attrition
t = -1.1951, df = 362.54, p-value = 0.2328
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.07713631  0.01882051
sample estimates:
mean in group No mean in group Yes
 -0.004700967      0.024456932
```

```
> #F-Test #Testing Variation
```

```
>
```

```
>
```

```
> #Variance Test- Test for variance
```

```
> var.test(PC1~attr$Attrition,data=typ_pca)
```

F test to compare two variances

```
data: PC1 by attr$Attrition
F = 0.99326, num df = 1232, denom df = 236, p-value = 0.9282
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.8099491 1.2018726
sample estimates:
ratio of variances
 0.9932578
```

```
> var.test(PC2~attr$Attrition,data=typ_pca)
```

F test to compare two variances

```
data: PC2 by attr$Attrition
F = 1.2515, num df = 1232, denom df = 236, p-value = 0.03136
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 1.020537 1.514360
```

```
sample estimates:
ratio of variances
      1.251506
```

```
> var.test(PC3~attr$Attrition,data=typ_pca)
```

```
F test to compare two variances
```

```
data: PC3 by attr$Attrition
F = 0.97956, num df = 1232, denom df = 236, p-value = 0.8191
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.7987755 1.1852922
sample estimates:
ratio of variances
      0.9795553
```

```
> var.test(PC4~attr$Attrition,data=typ_pca)
```

```
F test to compare two variances
```

```
data: PC4 by attr$Attrition
F = 0.8328, num df = 1232, denom df = 236, p-value = 0.06007
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.6791035 1.0077126
sample estimates:
ratio of variances
      0.832799
```

```
> var.test(PC5~attr$Attrition,data=typ_pca)
```

```
F test to compare two variances
```

```
data: PC5 by attr$Attrition
F = 1.0274, num df = 1232, denom df = 236, p-value = 0.8065
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.8377538 1.2431317
sample estimates:
ratio of variances
      1.027355
```

```
> var.test(PC6~attr$Attrition,data=typ_pca)
```

```
F test to compare two variances
```

```
data: PC6 by attr$Attrition
F = 1.0446, num df = 1232, denom df = 236, p-value = 0.6821
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.8518521 1.2640519
sample estimates:
ratio of variances
      1.044644
```

```
> var.test(PC7~attr$Attrition,data=typ_pca)
```

```
F test to compare two variances
```

```
data: PC7 by attr$Attrition
F = 1.0486, num df = 1232, denom df = 236, p-value = 0.6552
alternative hypothesis: true ratio of variances is not equal to 1
```

```
95 percent confidence interval:
 0.8550597 1.2688116
sample estimates:
ratio of variances
 1.048578
```

```
> var.test(PC8~attr$Attrition,data=typ_pca)
```

```
      F test to compare two variances
```

```
data:  PC8 by attr$Attrition
F = 1.0009, num df = 1232, denom df = 236, p-value = 0.9893
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.8162071 1.2111588
sample estimates:
ratio of variances
 1.000932
```

```
> var.test(PC9~attr$Attrition,data=typ_pca)
```

```
      F test to compare two variances
```

```
data:  PC9 by attr$Attrition
F = 1.0863, num df = 1232, denom df = 236, p-value = 0.4278
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.8858151 1.3144492
sample estimates:
ratio of variances
 1.086294
```

```
> var.test(PC10~attr$Attrition,data=typ_pca)
```

```
      F test to compare two variances
```

```
data:  PC10 by attr$Attrition
F = 1.702, num df = 1232, denom df = 236, p-value = 7.271e-07
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 1.387916 2.059510
sample estimates:
ratio of variances
 1.702031
```

```
> var.test(PC11~attr$Attrition,data=typ_pca)
```

```
      F test to compare two variances
```

```
data:  PC11 by attr$Attrition
F = 1.1066, num df = 1232, denom df = 236, p-value = 0.3303
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.9023918 1.3390472
sample estimates:
ratio of variances
 1.106622
```

```
> var.test(PC12~attr$Attrition,data=typ_pca)
```

```
      F test to compare two variances
```

```
data:  PC12 by attr$Attrition
```

```
F = 1.8153, num df = 1232, denom df = 236, p-value = 3.477e-08
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 1.480290 2.196582
sample estimates:
ratio of variances
 1.815311
```

```
> var.test(PC13~attr$Attrition,data=typ_pca)
```

F test to compare two variances

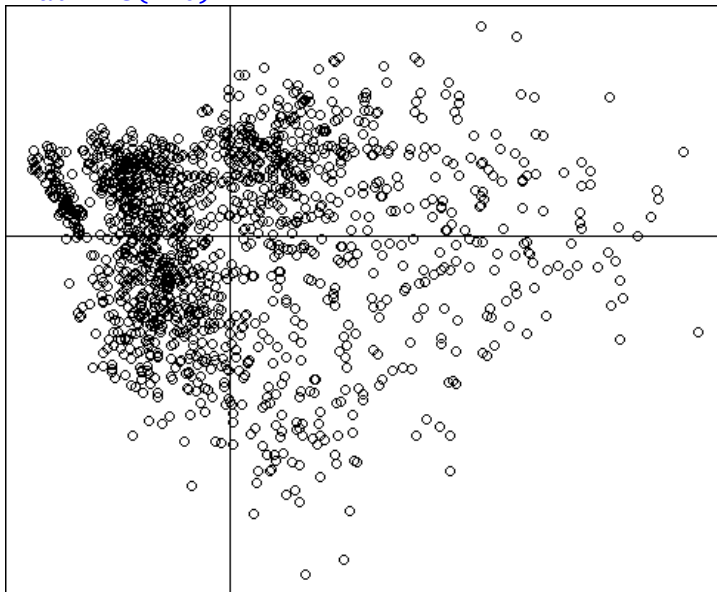
```
data: PC13 by attr$Attrition
F = 0.95092, num df = 1232, denom df = 236, p-value = 0.5988
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 0.7754288 1.1506484
sample estimates:
ratio of variances
 0.9509248
```

```
> var.test(PC14~attr$Attrition,data=typ_pca)
```

F test to compare two variances

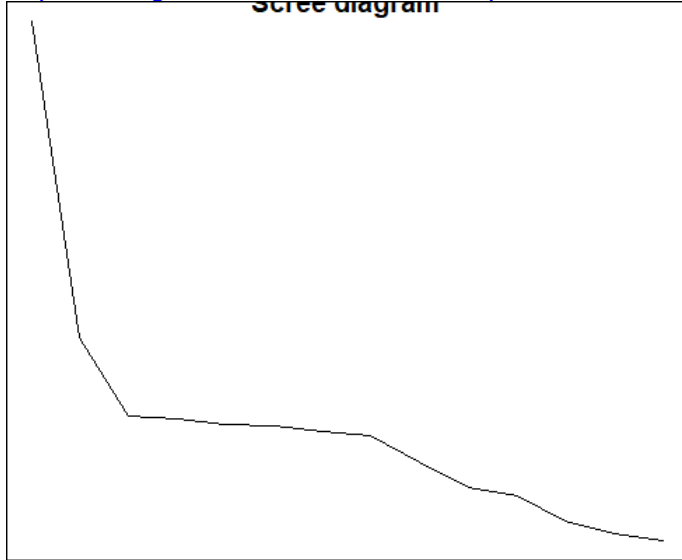
```
data: PC14 by attr$Attrition
F = 1.2831, num df = 1232, denom df = 236, p-value = 0.01698
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 1.046275 1.552554
sample estimates:
ratio of variances
 1.28307
```

```
> #Plotting the scores of Principal Component 1 and Principal component 2
> plot(typ_pca$PC1, typ_pca$PC2,xlab="PC1:", ylab="PC2")
> abline(h=0)
> abline(v=0)
```

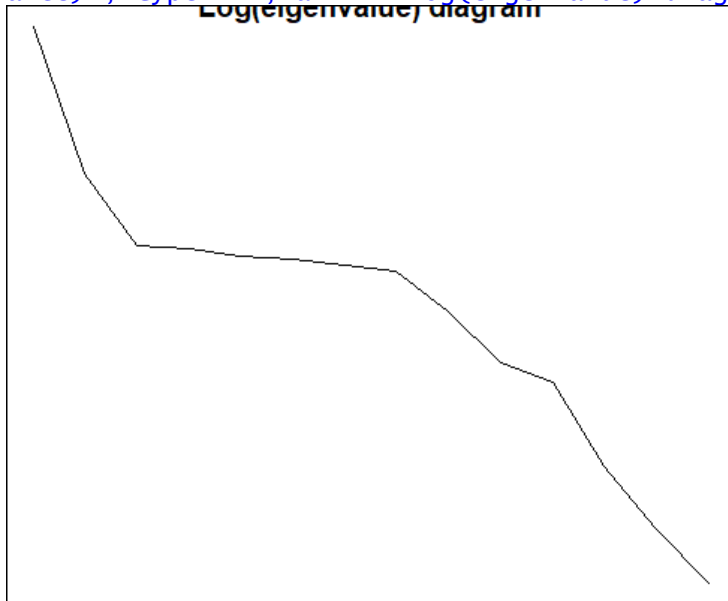


```
> #Plotting the Variance of Principal Components
```

```
> plot(eigenvalues, xlab= "Component number", ylab = "Component variance", type = "l", ma
```



```
> #Plotting the Log variance of Components
> plot(log(eigenvalues), xlab = "Component number", ylab = "log(Component vari
ance)", type="l", main = "Log(eigenvalue) diagram")
```



```
> #Variance of the principal components
```

```
>
```

```
> #View(attr_pca_done)
```

```
> diag(cov(attr_pca_done$x))
```

```
      PC1      PC2      PC3      PC4      PC5      PC6      PC7      P
C8      PC9      PC10     PC11
4.0167738 1.6502052 1.0685042 1.0521201 1.0094108 0.9924579 0.9533497 0.91749
69 0.7224654 0.5306975 0.4698454
      PC12      PC13      PC14
0.2832233 0.1933840 0.1400658
```

```
> #x_pca$x[,1]
```

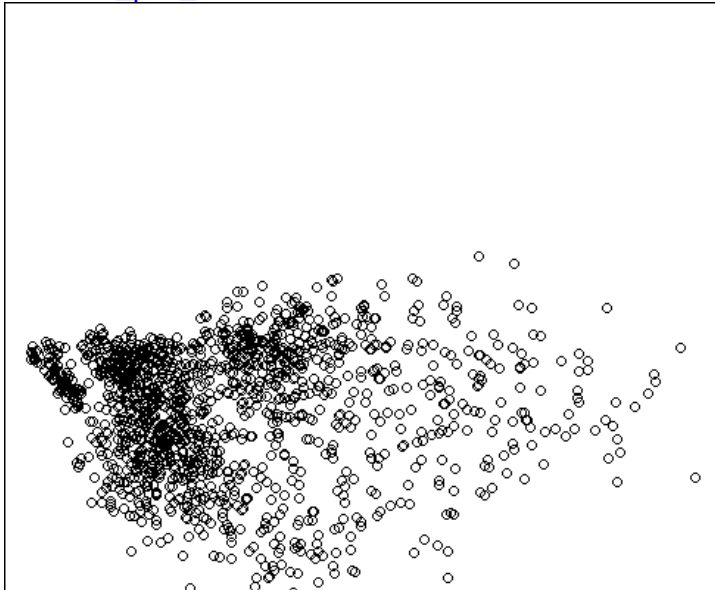
```
> #x_pca$x
```

```
> #Plotting the scores
```

```
>
```

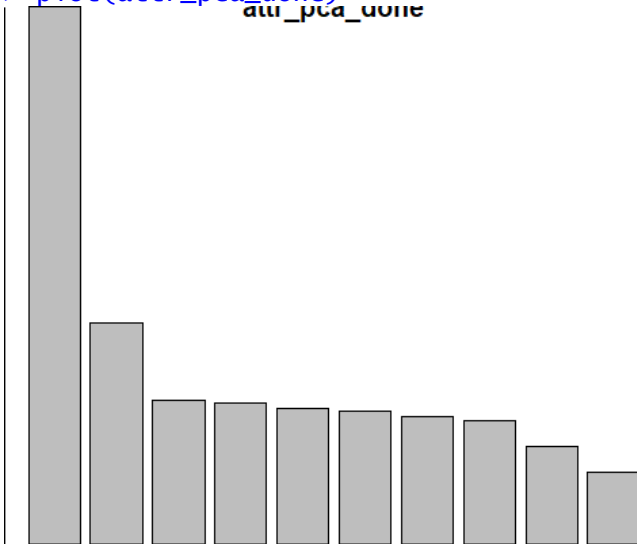
```
> xlim <- range(attr_pca_done$x[,1])
```

```
> plot(attr_pca_done$x,xlim=xlim,ylim=xlim)
> #attr_pca_done$rotation[,1]
> #attr_pca_done$rotation
```



```
> #Variance plot for each component. We can see that all components play a do
minant role.
```

```
> plot(attr_pca_done)
```



```
> #get the original value of the data based on PCA
```

```
> center <- attr_pca_done$center
```

```
> scale <- attr_pca_done$scale
```

```
> new_attrition <- as.matrix(attr[, -2])
```

```
> new_attrition
```

	Age	BusinessTravel	DailyRate	Department	DistanceF
romHome Education					
"1"	"41"	"Travel_Rarely"	"1102"	"Sales"	" 1"
"2"	"49"	"Travel_Frequently"	" 279"	"Research & Development"	" 8"
"1"	"37"	"Travel_Rarely"	"1373"	"Research & Development"	" 2"
"2"	"33"	"Travel_Frequently"	"1392"	"Research & Development"	" 3"
"4"					

"1"	[5,]	"27"	"Travel_Rarely"	" 591"	"Research & Development"	" 2"
"2"	[6,]	"32"	"Travel_Frequently"	"1005"	"Research & Development"	" 2"
"3"	[7,]	"59"	"Travel_Rarely"	"1324"	"Research & Development"	" 3"
"1"	[8,]	"30"	"Travel_Rarely"	"1358"	"Research & Development"	"24"
"3"	[9,]	"38"	"Travel_Frequently"	" 216"	"Research & Development"	"23"
"3"	[10,]	"36"	"Travel_Rarely"	"1299"	"Research & Development"	"27"
"3"	[11,]	"35"	"Travel_Rarely"	" 809"	"Research & Development"	"16"
"2"	[12,]	"29"	"Travel_Rarely"	" 153"	"Research & Development"	"15"
"1"	[13,]	"31"	"Travel_Rarely"	" 670"	"Research & Development"	"26"
"2"	[14,]	"34"	"Travel_Rarely"	"1346"	"Research & Development"	"19"
"3"	[15,]	"28"	"Travel_Rarely"	" 103"	"Research & Development"	"24"
"4"	[16,]	"29"	"Travel_Rarely"	"1389"	"Research & Development"	"21"
"2"	[17,]	"32"	"Travel_Rarely"	" 334"	"Research & Development"	" 5"
"2"	[18,]	"22"	"Non-Travel"	"1123"	"Research & Development"	"16"
"4"	[19,]	"53"	"Travel_Rarely"	"1219"	"Sales"	" 2"
"3"	[20,]	"38"	"Travel_Rarely"	" 371"	"Research & Development"	" 2"
"2"	[21,]	"24"	"Non-Travel"	" 673"	"Research & Development"	"11"
"4"	[22,]	"36"	"Travel_Rarely"	"1218"	"Sales"	" 9"
"4"	[23,]	"34"	"Travel_Rarely"	" 419"	"Research & Development"	" 7"
"2"	[24,]	"21"	"Travel_Rarely"	" 391"	"Research & Development"	"15"
"1"	[25,]	"34"	"Travel_Rarely"	" 699"	"Research & Development"	" 6"
"3"	[26,]	"53"	"Travel_Rarely"	"1282"	"Research & Development"	" 5"
"1"	[27,]	"32"	"Travel_Frequently"	"1125"	"Research & Development"	"16"
"4"	[28,]	"42"	"Travel_Rarely"	" 691"	"Sales"	" 8"
"4"	[29,]	"44"	"Travel_Rarely"	" 477"	"Research & Development"	" 7"
"4"	[30,]	"46"	"Travel_Rarely"	" 705"	"Sales"	" 2"
"3"	[31,]	"33"	"Travel_Rarely"	" 924"	"Research & Development"	" 2"
"4"	[32,]	"44"	"Travel_Rarely"	"1459"	"Research & Development"	"10"
"2"	[33,]	"30"	"Travel_Rarely"	" 125"	"Research & Development"	" 9"
		EducationField	EnvironmentSatisfaction	Gender	HourlyRate	JobInv
"2"	[1,]	"Life Sciences"	"2"	"Female"	" 94"	"3"
"2"	[2,]	"Life Sciences"	"3"	"Male"	" 61"	"2"

"1"	[3,]	"Other"	"4"	"Male"	" 92"	"2"
"1"	[4,]	"Life Sciences"	"4"	"Female"	" 56"	"3"
"1"	[5,]	"Medical"	"1"	"Male"	" 40"	"3"
"1"	[6,]	"Life Sciences"	"4"	"Male"	" 79"	"3"
"1"	[7,]	"Medical"	"3"	"Female"	" 81"	"4"
"1"	[8,]	"Life Sciences"	"4"	"Male"	" 67"	"3"
"3"	[9,]	"Life Sciences"	"4"	"Male"	" 44"	"2"
"2"	[10,]	"Medical"	"3"	"Male"	" 94"	"3"
"1"	[11,]	"Medical"	"1"	"Male"	" 84"	"4"
"2"	[12,]	"Life Sciences"	"4"	"Female"	" 49"	"2"
"1"	[13,]	"Life Sciences"	"1"	"Male"	" 31"	"3"
"1"	[14,]	"Medical"	"2"	"Male"	" 93"	"3"
"1"	[15,]	"Life Sciences"	"3"	"Male"	" 50"	"2"
"3"	[16,]	"Life Sciences"	"2"	"Female"	" 51"	"4"
"1"	[17,]	"Life Sciences"	"1"	"Male"	" 80"	"4"
"1"	[18,]	"Medical"	"4"	"Male"	" 96"	"4"
"4"	[19,]	"Life Sciences"	"1"	"Female"	" 78"	"2"
"1"	[20,]	"Life Sciences"	"4"	"Male"	" 45"	"3"
"2"	[21,]	"Other"	"1"	"Female"	" 96"	"4"
"1"	[22,]	"Life Sciences"	"3"	"Male"	" 82"	"2"
"3"	[23,]	"Life Sciences"	"1"	"Female"	" 53"	"3"
"1"	[24,]	"Life Sciences"	"3"	"Male"	" 96"	"3"
"1"	[25,]	"Medical"	"2"	"Male"	" 83"	"3"
"5"	[26,]	"Other"	"3"	"Female"	" 58"	"3"
"1"	[27,]	"Life Sciences"	"2"	"Female"	" 72"	"1"
"2"	[28,]	"Marketing"	"3"	"Male"	" 48"	"3"
"3"	[29,]	"Medical"	"1"	"Female"	" 42"	"2"
"5"	[30,]	"Marketing"	"2"	"Female"	" 83"	"3"
"1"	[31,]	"Medical"	"3"	"Male"	" 78"	"3"
"2"	[32,]	"Other"	"4"	"Male"	" 41"	"3"
"1"	[33,]	"Medical"	"4"	"Male"	" 83"	"2"

JobRole
me MonthlyRate NumCompaniesWorked

JobSatisfaction MaritalStatus MonthlyInco

[1,] "19479"	"Sales Executive" "8"	"4"	"Single"	" 5993"
[2,] "24907"	"Research Scientist" "1"	"2"	"Married"	" 5130"
[3,] " 2396"	"Laboratory Technician" "6"	"3"	"Single"	" 2090"
[4,] "23159"	"Research Scientist" "1"	"3"	"Married"	" 2909"
[5,] "16632"	"Laboratory Technician" "9"	"2"	"Married"	" 3468"
[6,] "11864"	"Laboratory Technician" "0"	"4"	"Single"	" 3068"
[7,] " 9964"	"Laboratory Technician" "4"	"1"	"Married"	" 2670"
[8,] "13335"	"Laboratory Technician" "1"	"3"	"Divorced"	" 2693"
[9,] " 8787"	"Manufacturing Director" "0"	"3"	"Single"	" 9526"
[10,] "16577"	"Healthcare Representative" "6"	"3"	"Married"	" 5237"
[11,] "16479"	"Laboratory Technician" "0"	"2"	"Married"	" 2426"
[12,] "12682"	"Laboratory Technician" "0"	"3"	"Single"	" 4193"
[13,] "15170"	"Research Scientist" "1"	"3"	"Divorced"	" 2911"
[14,] " 8758"	"Laboratory Technician" "0"	"4"	"Divorced"	" 2661"
[15,] "12947"	"Laboratory Technician" "5"	"3"	"Single"	" 2028"
[16,] "10195"	"Manufacturing Director" "1"	"1"	"Divorced"	" 9980"
[17,] "15053"	"Research Scientist" "0"	"2"	"Divorced"	" 3298"
[18,] " 7324"	"Laboratory Technician" "1"	"4"	"Divorced"	" 2935"
[19,] "22021"	"Manager" "2"	"4"	"Married"	"15427"
[20,] " 4306"	"Research Scientist" "5"	"4"	"Single"	" 3944"
[21,] " 8232"	"Manufacturing Director" "0"	"3"	"Divorced"	" 4011"
[22,] " 6986"	"Sales Representative" "7"	"1"	"Single"	" 3407"
[23,] "21293"	"Research Director" "0"	"2"	"Single"	"11994"
[24,] "19281"	"Research Scientist" "1"	"4"	"Single"	" 1232"
[25,] "17102"	"Research Scientist" "2"	"1"	"Single"	" 2960"
[26,] "10735"	"Manager" "4"	"3"	"Divorced"	"19094"
[27,] " 4681"	"Research Scientist" "1"	"1"	"Single"	" 3919"
[28,] "21173"	"Sales Executive" "0"	"2"	"Married"	" 6825"
[29,] " 2094"	"Healthcare Representative" "3"	"4"	"Married"	"10248"
[30,] "22822"	"Manager" "3"	"1"	"Single"	"18947"
[31,] " 6670"	"Laboratory Technician" "4"	"4"	"Single"	" 2496"
[32,] "19121"	"Healthcare Representative" "2"	"4"	"Married"	" 6465"

[33,]	"Laboratory Technician"	"3"	"Single"	" 2206"
"16117"	"1"			
	OverTime	PercentSalaryHike	PerformanceRating	RelationshipSatisfaction
StockOptionLevel				
[1,]	"Yes"	"11"	"3"	"1"
"0"				
[2,]	"No"	"23"	"4"	"4"
"1"				
[3,]	"Yes"	"15"	"3"	"2"
"0"				
[4,]	"Yes"	"11"	"3"	"3"
"0"				
[5,]	"No"	"12"	"3"	"4"
"1"				
[6,]	"No"	"13"	"3"	"3"
"0"				
[7,]	"Yes"	"20"	"4"	"1"
"3"				
[8,]	"No"	"22"	"4"	"2"
"1"				
[9,]	"No"	"21"	"4"	"2"
"0"				
[10,]	"No"	"13"	"3"	"2"
"2"				
[11,]	"No"	"13"	"3"	"3"
"1"				
[12,]	"Yes"	"12"	"3"	"4"
"0"				
[13,]	"No"	"17"	"3"	"4"
"1"				
[14,]	"No"	"11"	"3"	"3"
"1"				
[15,]	"Yes"	"14"	"3"	"2"
"0"				
[16,]	"No"	"11"	"3"	"3"
"1"				
[17,]	"Yes"	"12"	"3"	"4"
"2"				
[18,]	"Yes"	"13"	"3"	"2"
"2"				
[19,]	"No"	"16"	"3"	"3"
"0"				
[20,]	"Yes"	"11"	"3"	"3"
"0"				
[21,]	"No"	"18"	"3"	"4"
"1"				
[22,]	"No"	"23"	"4"	"2"
"0"				
[23,]	"No"	"11"	"3"	"3"
"0"				
[24,]	"No"	"14"	"3"	"4"
"0"				
[25,]	"No"	"11"	"3"	"3"
"0"				
[26,]	"No"	"11"	"3"	"4"
"1"				
[27,]	"Yes"	"22"	"4"	"2"
"0"				
[28,]	"No"	"11"	"3"	"4"
"1"				
[29,]	"No"	"14"	"3"	"4"
"1"				
[30,]	"No"	"12"	"3"	"4"
"0"				

[31,]	"No"	"11"	"3"	"4"
"0"				
[32,]	"Yes"	"13"	"3"	"4"
"0"				
[33,]	"No"	"13"	"3"	"1"
"0"				

	TotalWorkingYears	TrainingTimesLastYear	WorkLifeBalance	YearsAtCompan
y YearsInCurrentRole				
[1,]	" 8"	"0"	"1"	" 6"
" 4"				
[2,]	"10"	"3"	"3"	"10"
" 7"				
[3,]	" 7"	"3"	"3"	" 0"
" 0"				
[4,]	" 8"	"3"	"3"	" 8"
" 7"				
[5,]	" 6"	"3"	"3"	" 2"
" 2"				
[6,]	" 8"	"2"	"2"	" 7"
" 7"				
[7,]	"12"	"3"	"2"	" 1"
" 0"				
[8,]	" 1"	"2"	"3"	" 1"
" 0"				
[9,]	"10"	"2"	"3"	" 9"
" 7"				
[10,]	"17"	"3"	"2"	" 7"
" 7"				
[11,]	" 6"	"5"	"3"	" 5"
" 4"				
[12,]	"10"	"3"	"3"	" 9"
" 5"				
[13,]	" 5"	"1"	"2"	" 5"
" 2"				
[14,]	" 3"	"2"	"3"	" 2"
" 2"				
[15,]	" 6"	"4"	"3"	" 4"
" 2"				
[16,]	"10"	"1"	"3"	"10"
" 9"				
[17,]	" 7"	"5"	"2"	" 6"
" 2"				
[18,]	" 1"	"2"	"2"	" 1"
" 0"				
[19,]	"31"	"3"	"3"	"25"
" 8"				
[20,]	" 6"	"3"	"3"	" 3"
" 2"				
[21,]	" 5"	"5"	"2"	" 4"
" 2"				
[22,]	"10"	"4"	"3"	" 5"
" 3"				
[23,]	"13"	"4"	"3"	"12"
" 6"				
[24,]	" 0"	"6"	"3"	" 0"
" 0"				
[25,]	" 8"	"2"	"3"	" 4"
" 2"				
[26,]	"26"	"3"	"2"	"14"
"13"				
[27,]	"10"	"5"	"3"	"10"
" 2"				
[28,]	"10"	"2"	"3"	" 9"
" 7"				

```

" [29,] "24"          "4"          "3"          "22"
" 6"
" [30,] "22"          "2"          "2"          " 2"
" 2"
" [31,] " 7"          "3"          "3"          " 1"
" 1"
" [32,] " 9"          "5"          "4"          " 4"
" 2"
" [33,] "10"          "5"          "3"          "10"
" 0"

```

```

      YearsSinceLastPromotion YearsWithCurrManager
[1,] " 0" " 5"
[2,] " 1" " 7"
[3,] " 0" " 0"
[4,] " 3" " 0"
[5,] " 2" " 2"
[6,] " 3" " 6"
[7,] " 0" " 0"
[8,] " 0" " 0"
[9,] " 1" " 8"
[10,] " 7" " 7"
[11,] " 0" " 3"
[12,] " 0" " 8"
[13,] " 4" " 3"
[14,] " 1" " 2"
[15,] " 0" " 3"
[16,] " 8" " 8"
[17,] " 0" " 5"
[18,] " 0" " 0"
[19,] " 3" " 7"
[20,] " 1" " 2"
[21,] " 1" " 3"
[22,] " 0" " 3"
[23,] " 2" "11"
[24,] " 0" " 0"
[25,] " 1" " 3"
[26,] " 4" " 8"
[27,] " 6" " 7"
[28,] " 4" " 2"
[29,] " 5" "17"
[30,] " 2" " 1"
[31,] " 0" " 0"
[32,] " 1" " 3"
[33,] " 1" " 8"
[ reached getOption("max.print") -- omitted 1437 rows ]
> #drop(scale(new_attrition,center=center, scale=scale)%%attr_pca_done$rotation[,1])
> predict(attr_pca_done)[,2]
[1] -1.805296680 0.381073595 -1.413301606 0.682294015 -0.965438549 1.47
6192828 -2.344142438 0.310022541
[9] 1.213005861 -0.208584655 0.961999888 1.760186112 1.023377864 0.60
1874393 0.292702788 1.686663324
[17] 1.132058901 0.684977918 -1.060188116 -0.518252552 1.416074395 -1.01
3413533 1.312303531 1.127496005
[25] 0.070998887 -1.187855044 1.487707345 0.517960123 1.068632778 -2.59
4944348 -0.598109160 -0.506577343
[33] 1.290594877 -0.878346751 0.497391245 0.042990012 -0.382172652 0.52
0002398 -1.947119717 0.269317986
[41] 0.231335668 0.699871648 0.709039810 1.355663630 1.607572626 1.07
8091201 1.653442819 -0.926896408
[49] -0.616849916 0.297326189 -3.634989196 0.830881805 -1.218466650 -0.44
0311397 -0.955185144 1.814109184
[57] 1.103897503 0.058005177 0.857390902 0.774824505 1.922306493 1.68
5679343 -1.151655660 -0.755218265

```

[65]	1.946298043	-2.427444222	0.194433528	-2.235551626	-0.244778958	-0.02
4496709	-3.049510452	1.199023366				
[73]	0.353967605	1.166637222	-0.497612851	1.320776948	1.812350789	-2.25
8070681	-1.427059293	-2.441897724				
[81]	0.807194469	0.584129288	-2.585230554	-0.141167810	0.218580349	-2.89
5430481	0.296723552	-0.954905426				
[89]	2.241429270	0.576023363	0.887965015	-0.042960092	1.380522111	0.35
6013463	1.079549026	-3.413896182				
[97]	0.914909460	1.261721220	-0.434370191	-1.169248554	-0.568926672	0.12
9102948	1.011087824	2.027920770				
[105]	-1.948838372	-4.702450356	-2.298624579	0.839192498	0.669627564	0.89
5286352	0.077625437	0.891821802				
[113]	-1.597047470	1.280947911	-1.497945925	-0.429277187	1.224072878	1.02
0308582	-0.957789430	0.880262420				
[121]	1.353815226	1.191138861	-2.058379440	0.529500165	0.751679496	1.33
5263326	0.671199838	0.982963851				
[129]	1.045174946	1.174952007	-1.368344149	-1.863951177	0.022177967	-0.26
4011818	2.036444725	-1.141406936				
[137]	-1.829267033	0.575714072	0.355998339	1.719478916	-0.717497517	-0.91
1991127	-0.552194752	1.056369733				
[145]	1.374272905	-0.221398169	0.984904608	-1.015512767	-0.170499565	0.87
0864126	1.323777612	0.842682999				
[153]	-0.130298641	-0.105131907	1.179951656	1.186521001	-1.542771737	-2.15
0763323	-0.281846005	-0.473514038				
[161]	1.442829624	-0.246305750	1.013239689	-1.617706706	0.316334689	-1.90
8112085	0.459857669	1.028425912				
[169]	-0.503335039	0.520151016	1.016160016	1.138364241	0.275200700	2.43
5407419	-0.740295345	-1.959211019				
[177]	0.657391803	1.312314683	1.475401478	0.313869373	-1.186616073	0.25
1497956	0.176563050	-0.650092650				
[185]	-0.653420939	1.530587781	0.650794334	-1.496934318	1.121355381	-1.55
7550077	1.217522098	1.167325207				
[193]	-0.706157496	-0.338535155	-1.601562460	1.171786028	-0.380339605	-0.23
2375365	-2.690539375	0.586173357				
[201]	-0.379354454	-0.099598881	0.685503217	-1.309110283	-2.277533882	1.40
5549600	1.141579640	0.855506760				
[209]	-1.740164487	-2.419827577	1.386354812	1.266122553	1.023754676	-1.02
5292143	-0.091748705	-1.969695384				
[217]	-0.328858475	0.920927227	-0.356579427	-1.158333264	-0.336179804	-0.57
4363551	0.590940088	2.077646912				
[225]	0.996531429	-1.393185423	0.946643526	1.313998196	0.820141343	0.71
6831172	-1.920647021	2.015699008				
[233]	-2.596950603	-2.868673366	-0.270110430	-0.456100687	-0.106858898	0.29
0135161	0.296073467	0.790979516				
[241]	-1.594967526	0.704070565	-1.187363115	1.105805165	-0.759239466	-2.12
5592581	0.442831846	0.326168549				
[249]	-0.870100460	-1.372383853	-2.079610765	1.289365861	1.134590189	-1.17
1984649	-0.012491244	1.135983263				
[257]	1.712019144	0.523153032	-1.160211079	1.292640892	0.236595751	0.18
2429198	0.096507056	-1.186671020				
[265]	0.134266014	-0.514082583	1.277490688	1.069225272	0.547145926	2.60
1335417	0.008092276	0.769896066				
[273]	0.993772287	-0.553756106	0.977359671	-1.083806073	-0.753986277	0.87
1988007	0.963924380	-2.091565779				
[281]	-2.252752216	1.708700830	1.594191407	-0.119955338	1.098683465	1.68
3621266	-1.691363538	-2.036793449				
[289]	0.525600519	0.892866704	-3.711227520	0.104349489	1.031413296	1.52
0857872	0.473115865	-0.791143696				
[297]	1.009848060	1.710231468	-0.707554545	-2.050277481	-0.120838847	1.08
7088224	1.213645850	0.852701192				
[305]	1.254855369	-0.130287571	1.430153491	-0.960837004	-1.275995353	0.83
1525254	-0.489933412	1.149837686				
[313]	1.161399149	-0.150550244	1.263023911	1.477125975	-3.033069111	-0.19
5916530	0.687582276	2.247438397				

[321]	0.987656073	0.342069059	-0.510910929	-0.314411292	1.498546319	1.82
3274743	0.425938296	-1.411326957				
[329]	0.631088025	-2.748517333	0.151196917	0.923918009	-1.444700203	-2.72
3449105	-0.386767126	-0.469344410				
[337]	1.800778713	1.116045123	1.218205478	1.506695120	-1.423296616	1.22
0046981	1.554219085	1.418490592				
[345]	1.422286260	0.884577024	-1.104769407	-1.506959695	-1.837521719	0.66
1610739	0.239309897	0.928176528				
[353]	-2.227861990	0.188797707	-0.642782258	1.841730098	-1.502857977	1.18
4556891	-0.858822239	0.616062127				
[361]	-1.605018266	0.374095875	1.511082210	0.383587594	-1.244265844	-1.11
9350322	1.260148516	-2.451461096				
[369]	0.098990208	1.342061333	0.575022769	-1.028549141	-2.185260871	0.60
1978395	1.064107598	-3.420182356				
[377]	-1.064441925	-0.315474220	-1.191197774	-2.906444217	0.873531932	0.43
5598169	1.390570963	1.052637686				
[385]	1.131817389	-1.122396375	2.243123477	-1.108810210	-0.376939255	-1.09
4049070	0.676465003	-2.072444087				
[393]	-2.952980072	-1.733601519	2.541414826	-1.408016991	-0.904561550	1.01
3603065	1.190655067	0.783768941				
[401]	-0.041346691	-3.428786411	1.255444619	0.446196792	0.890068359	-0.06
1714372	-1.465377380	-0.580728506				
[409]	-2.435734307	-0.601369210	0.101486379	-0.900598516	-0.162110635	0.63
7918222	1.058720506	0.812458954				
[417]	-0.015721666	0.961063130	0.934464599	0.059114215	0.249811227	-0.28
8511717	0.985203863	1.962127218				
[425]	-3.271781082	0.741342234	1.982873795	0.357718898	-1.892575171	-3.16
2984341	1.127853389	-2.991612702				
[433]	0.477860732	-1.276710916	1.295048452	-0.900028552	-0.639744203	0.97
1176922	-0.575224933	-1.066429549				
[441]	-2.004491780	-0.945631187	1.074115541	-0.042114063	0.431105701	-1.74
7435280	-0.629659088	-0.392221803				
[449]	-0.489213167	0.703218734	-0.041305760	1.534024810	0.942095249	1.30
5404827	-0.074743009	-1.288912304				
[457]	-1.880987143	1.018577148	-1.743417373	0.525502638	-0.282247149	0.66
1390613	1.467297359	0.660096978				
[465]	-0.730678144	-2.501114946	-0.240121414	1.206961303	-0.122389417	-1.41
4121432	1.578950914	-1.780168899				
[473]	-0.613244511	-0.090095234	1.379110753	1.288840097	0.689298139	-0.42
2310162	1.299011519	1.125474075				
[481]	0.424664278	0.702773906	0.008538431	-0.362734228	0.861434591	1.45
6977872	-1.473659609	0.592223933				
[489]	0.202230874	-2.449653448	-0.669277167	0.207261192	-3.187812330	-1.57
0551426	1.193612042	0.846565869				
[497]	0.997581144	-2.839341919	1.469610530	0.273807866	0.587776293	0.34
3800441	-0.689478142	2.048574287				
[505]	-0.535791637	0.727709690	1.304045278	0.648517571	1.812971264	1.04
6879714	-0.836301038	-0.658787991				
[513]	0.771001162	1.146318038	1.928955363	0.256594939	0.804239916	1.15
7540139	1.171926355	1.732972326				
[521]	-1.354477478	0.929237421	-0.860887766	0.798830043	1.185347467	-1.15
0257736	1.726978084	1.120745269				
[529]	-1.339746556	1.138393610	1.414437451	0.876373017	-0.162318832	0.27
1367405	-2.738029715	-0.091663186				
[537]	-2.991236675	1.707548241	0.178242634	-1.595790568	0.506659573	-1.50
6043181	-1.285683679	0.243620926				
[545]	-1.318280939	0.168529203	0.588126756	-1.213417381	-0.618505583	-0.25
2927477	1.272428101	-1.275156250				
[553]	-3.276158804	0.322549566	-0.536973345	0.687516163	-1.135138991	-0.91
2647683	1.468767498	-1.589209789				
[561]	-0.346714086	0.188580145	2.029806672	1.412630784	0.341711974	1.01
9488772	-0.866931380	0.892785071				
[569]	-3.323311627	0.711553285	-0.215143734	0.222354399	0.171714269	-0.24
2100920	0.126947395	-2.366260589				

[577]	0.733512097	0.842631663	0.096019534	0.859774673	0.293462481	-0.17
8604462	1.088444853	-0.974131320				
[585]	0.896449250	0.765114617	0.585712764	-2.206069723	-2.976740322	0.46
4113624	1.262231295	-0.623600008				
[593]	-0.046320896	0.913777612	1.345206146	-1.392450621	-0.322637564	-1.81
4111742	-0.509469707	-0.359358548				
[601]	1.834841532	-1.419360956	-1.254008747	-0.276287348	1.293970634	-0.12
7166641	0.619666687	0.798766978				
[609]	-0.636043357	-2.804028599	1.379612180	-0.308564996	1.700677241	0.51
8263924	1.501920474	0.887389313				
[617]	-0.103149805	-1.933067331	-0.527136480	1.504208198	0.623900019	1.96
0415008	0.404418761	-1.085359284				
[625]	-3.507392490	-1.817490014	-0.554828082	-2.238368802	-1.257404256	0.73
1357136	-0.229697559	-0.516114842				
[633]	-1.037509231	0.767057993	1.017088487	2.035863533	1.466797865	0.70
9647631	0.692892542	-0.780112077				
[641]	1.424217571	1.354487526	0.538840289	-1.049729876	0.188099574	-0.45
8596590	-3.178695989	0.727446360				
[649]	-0.869691363	-2.108792812	-1.025070774	1.083894103	0.526972971	0.10
6547585	-1.579128575	0.065329357				
[657]	0.362530777	-0.177879268	0.598067693	0.418378237	-2.902964529	-1.23
0015642	1.243788376	0.859241204				
[665]	1.654441086	-0.292713246	1.368412168	-0.659675458	-0.190981199	-1.23
9029629	0.520093303	0.382524528				
[673]	-1.080826985	-0.268560449	-2.160340763	0.800037634	0.966701327	-0.50
0732388	-1.696270774	0.499792694				
[681]	0.084230184	1.154382836	-0.731843360	0.679340328	-1.310150122	1.45
6904777	2.066599285	0.848466379				
[689]	1.273738663	0.892292380	1.743700198	-1.989868837	1.036180508	1.21
0608773	0.533118397	-0.249391121				
[697]	0.697966169	0.690692543	0.213663152	-1.056586184	-1.909022558	-0.95
4658182	0.503572421	0.132231545				
[705]	-0.192053690	1.036734221	-2.563733572	0.719381064	-0.144036597	0.91
2270536	0.252931707	-0.684606751				
[713]	0.136546310	-0.737521649	-3.995057539	0.403012092	0.545256731	-0.88
1191625	0.975659441	-0.295213590				
[721]	0.094592538	-0.919723252	0.106698207	-1.299295889	1.182820530	0.46
6544476	0.460641236	1.117911893				
[729]	-2.379598710	1.276309417	1.302119593	0.652201964	0.960109684	1.31
2218520	1.292043938	-1.326227574				
[737]	-1.479578319	-1.111836490	1.106182705	1.091951949	0.635498360	-3.04
1335367	-1.496481562	-2.603776947				
[745]	-1.677375775	-0.293546413	1.074951565	-2.617511762	-0.581796000	0.11
9321105	0.462492662	0.694623823				
[753]	3.049980309	0.577345739	0.610029980	-2.089980114	-0.161876417	0.66
5944831	-2.040609880	0.428826248				
[761]	-0.118533283	-1.631148320	-0.237885343	0.015757724	0.556103411	-0.25
4237024	-1.907949301	-0.169166448				
[769]	0.896046442	1.104786805	-3.880338858	-1.806915487	-1.160531838	1.48
8108118	-2.906441123	-2.002030974				
[777]	1.255015121	1.172039821	-0.903007564	-2.204968495	1.314794885	1.06
5786785	0.264396426	0.913158107				
[785]	1.262887991	0.094824595	0.817248085	-2.336743504	1.208718320	-1.96
7371922	-0.630803993	1.037714783				
[793]	1.750661157	1.060593112	0.345906410	-0.669580728	2.015411488	0.47
6849284	-0.092840055	0.874742084				
[801]	0.502614487	-1.494061418	0.712997018	-0.615738226	-2.092470529	1.20
2090305	-2.355768143	1.013557580				
[809]	0.278271263	1.442868021	-0.554104808	-1.967516548	-2.306238589	-0.49
4975233	0.090958740	1.323404706				
[817]	-1.694717488	0.443213958	0.987312263	0.886539334	0.209260156	-1.76
4583449	-0.080849348	1.050100682				
[825]	-1.294323856	0.871036310	0.852224049	0.634126880	0.918854147	0.41
7536233	-0.624551328	1.020767232				

```

[833] -1.088651944 0.978270876 0.647594872 0.632415006 1.976245376 -1.04
8172325 2.020071014 -0.879779154
[841] -0.593110595 -0.337341915 0.391539946 1.326394378 0.845217248 -1.31
1688564 0.218156670 1.576609572
[849] 0.435458968 -1.794870287 0.193258943 -3.299758216 1.544260981 1.28
7126204 -1.345361400 1.366509702
[857] 1.112169475 0.063993033 -1.547828834 1.029721549 1.185256107 -0.63
6884579 -0.498717142 0.846163046
[865] -1.694006753 -0.930261463 -1.625781834 -2.565543396 1.143691500 -2.90
0696534 -0.188629805 0.774776820
[873] 0.769710196 1.366970161 2.205826944 2.912812860 1.476151058 -0.53
1774967 -1.512547826 0.255021570
[881] 0.863329108 0.493868424 0.566730435 2.571738400 -1.402021735 0.97
4544158 1.879496181 -1.817146074
[889] 0.282595032 2.140026931 -3.186542503 1.011376168 1.101740089 0.82
1801343 -2.154799129 0.281011823
[897] 1.284042243 -1.958870135 -1.667331648 -2.888220529 1.352165617 -1.72
9894773 0.946347812 0.119271676
[905] -3.589861627 0.205507718 0.320568170 -1.157182430 1.218452381 1.08
1773710 0.936087694 1.052826050
[913] 1.265668267 -0.253877062 -0.117743653 1.278727250 -1.175011090 0.69
3400158 -0.245288304 -2.167305191
[921] 1.003050594 1.058588976 0.948234680 0.721555833 0.796882461 -1.99
6086917 1.459244489 0.474921323
[929] 0.213835796 0.913024261 0.825876322 -0.261549249 1.311149791 0.57
2968919 1.135871854 1.388433823
[937] -2.460102481 -0.446967250 -0.746971777 0.348847161 0.320911276 1.58
6772180 0.377149133 -0.525933102
[945] 1.896676090 -2.824252329 -0.462978817 -1.677706981 0.297657326 1.56
3448209 1.761526611 1.245765405
[953] 0.739778837 -0.962039268 0.435410396 -0.382159830 -2.897456049 -1.98
0587913 0.859705214 1.369469220
[961] 0.714977119 0.705616525 -0.250102356 0.223683709 1.776657658 0.65
6231086 -2.135907972 -0.207573580
[969] 1.608540593 0.274435098 -1.191804496 -2.807291532 0.971948342 0.44
3529382 -0.033995378 -1.567980309
[977] -0.371907292 0.397392501 0.364272767 0.728723037 -1.152437211 0.43
7515868 0.314790710 1.831260375
[985] 0.725716171 1.153724997 -0.126986304 -1.142008579 -0.445127086 -0.89
8134615 -1.142960124 0.796077351
[993] -0.619061781 0.326989090 -1.759930469 0.652537049 1.165257302 1.69
4508000 1.195786083 0.416643969
[ reached getOption("max.print") -- omitted 470 entries ]

```

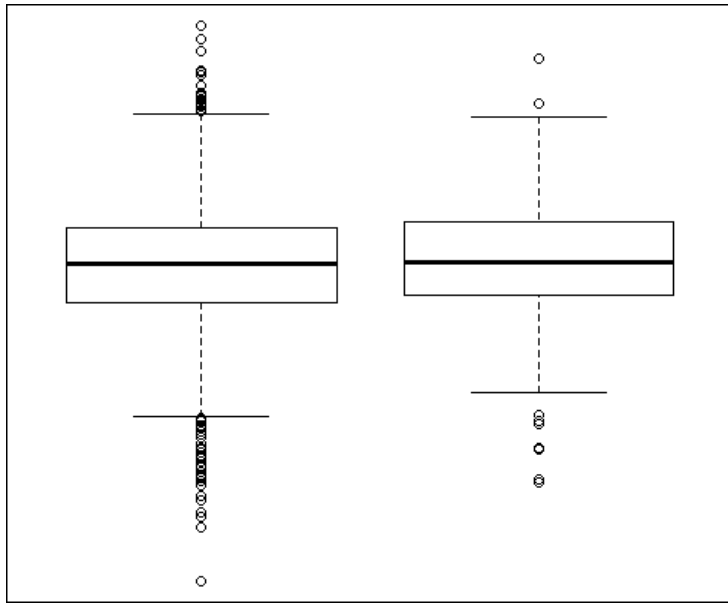
```
> #The aboved two gives us the same thing. predict is a good function to know
```

```

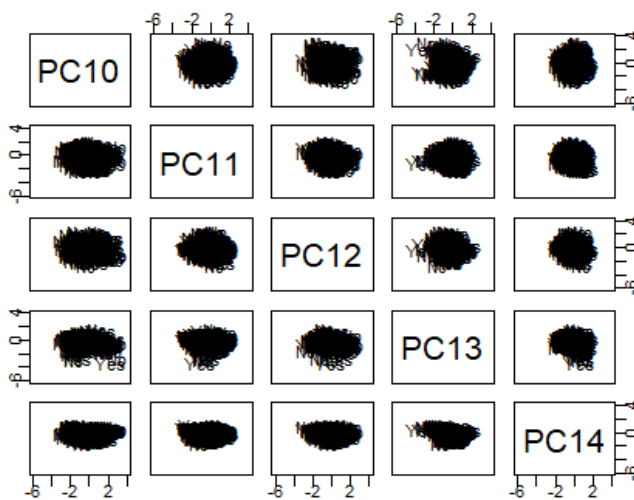
> out <- sapply(10:14, function(i){plot(attr$Attrition,attr_pca_done$x[,i],xlab=paste("PC",i,sep=""),ylab="Attrition")})
> out

```

	[,1]	[,2]	[,3]	[,4]	[,5]
stats	Numeric,10	Numeric,10	Numeric,10	Numeric,10	Numeric,10
n	Numeric,2	Numeric,2	Numeric,2	Numeric,2	Numeric,2
conf	Numeric,4	Numeric,4	Numeric,4	Numeric,4	Numeric,4
out	Numeric,59	Numeric,31	Numeric,233	Numeric,66	Numeric,68
group	Numeric,59	Numeric,31	Numeric,233	Numeric,66	Numeric,68
names	Character,2	Character,2	Character,2	Character,2	Character,2



```
> pairs(attr_pca_done$x[,10:14], ylim = c(-6,4),xlim = c(-6,4),panel=function
(x,y,...){text(x,y,attr$Attrition)})
```



```
> # K-means, k=2, 3, 4, 5, 6
> # Centers (k's) are numbers thus, 10 random sets are chosen
> (kmeans2_attr_std <- kmeans(attr_std,2,nstart = 10))
K-means clustering with 2 clusters of sizes 482, 988
```

Cluster means:

	Age	DailyRate	DistanceFromHome	HourlyRate	MonthlyIncome	MonthlyRate
1	0.5608866	0.006781204	0.006450863	-0.05740890	0.8210216	0.00111
4956	-0.008405938	-0.0351402				
2	-0.2736309	-0.003308239	-0.003147081	0.02800718	-0.4005389	-0.00054
3936	0.004100873	0.0171433				
	TotalWorkingYears	TrainingTimesLastYear	YearsAtCompany	YearsInCurrentRole	YearsSinceLastPromotion	YearsWithCurrManager

1	0.9133144	0.0011713194	0.9868202	1.0086744
0.8437371		0.9632583		
2	-0.4455643	-0.0005714331	-0.4814244	-0.4920861
-0.4116207		-0.4699297		

Clustering vector:

```
[1] 2 1 2 2 2 2 2 2 1 1 2 2 2 2 2 1 2 2 1 2 2 2 1 2 2 1 2 2 1 1 2 2 2 2
2 2 2 2 2 2 2 2 1 1 1 1 2 1 2 2 2 2 2 2 2 1 1 2
[59] 2 2 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 2 1 2 2 2 2 2 1 2 1 2 2 1 1 1 2 1
1 1 2 2 2 1 2 2 2 2 2 1 2 1 1 2 2 2 1 2 1 2 2 2
[117] 1 1 2 1 2 2 2 1 1 2 1 2 2 1 2 2 2 1 2 2 2 1 2 2 2 1 2 2 2 2 2 1 2 2 1
2 1 1 1 2 2 2 1 2 2 2 2 2 2 2 1 1 1 2 2 2 2 2 1
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2 1 1 2 1 2 2 2 2 1 2 1 2 1 1 2 2 1 1 1 2 2 1
[233] 2 1 2 1 2 1 2 2 2 2 2 2 1 1 2 2 1 2 2 2 1 2 2 2 2 1 2 2 2 2 1 2 1 2 2 2
2 1 1 1 2 2 2 2 1 2 2 1 1 2 2 1 1 2 2 1 2 2 2 2
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1 1 2 2 1 2 2 2 2 1 2 2 2 2 2 2 2 1 1 2 1 2 2 2
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2 1 2 1 1 1 1 2 2 2 1 2 2 2 2 2 2 2 2 2 2 2 1 2
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2 2 2 1 1 2 2 1 2 1 1 1 2 2 2 1 2 2 2 2 2 2 2
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2 1 2 2 1 1 2 2 2 2 2 1 1 2 2 2 2 2 2 2 2 2 1 2
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2 1 2 2 2 1 2 2 2 2 2 1 2 2 2 2 2 2 2 2 2 2 2
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2 1 2 2 1 2 2 2 1 2 2 2 2 1 1 2 2 1 2 2 1 2 2 1
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2 2 2 2 2 1 2 1 2 2 2 2 1 2 1 1 2 2 1 1 1 1 1
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1 2 1 1 2 2 2 2 2 1 2 2 2 2 1 1 1 1 2 2 2 1 2
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1 2 2 2 1 2 2 2 1 2 2 1 2 2 1 2 2 2 2 2 2 2 1 2 1
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1 2 1 1 2 2 2 2 1 1 2 1 2 1 1 1 2 1 1 2 2 1 1
[929] 1 2 2 2 1 2 2 2 2 1 2 2 2 2 2 1 1 1 2 1 2 2 2 1 1 2 2 1 1 2 2 1 2 2 1
1 1 2 1 2 1 1 2 2 2 2 1 1 2 2 1 2 2 2 2 1 2 2
[987] 2 2 2 2 2 2 1 1 2 2 2 1
[ reached getOption("max.print") -- omitted 470 entries ]
```

within cluster sum of squares by cluster:

```
[1] 7087.951 9563.508
(between_ss / total_ss = 19.0 %)
```

Available components:

```
[1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
"betweenss"    "size"         "iter"
[9] "ifault"
> # k-means, k=2, 3, 4, 5, 6
>
> # Centers (k's) are numbers thus, 10 random sets are chosen
>
>
>
> (kmeans2_attr_std <- kmeans(attr_std,2,nstart = 10))
K-means clustering with 2 clusters of sizes 988, 482
```

Cluster means:

Age	DailyRate	DistanceFromHome	HourlyRate	MonthlyIncome	Monthly
Rate	NumCompaniesWorked	PercentSalaryHike			

```

1 -0.2736309 -0.003308239 -0.003147081 0.02800718 -0.4005389 -0.00054
3936 0.004100873 0.0171433
2 0.5608866 0.006781204 0.006450863 -0.05740890 0.8210216 0.00111
4956 -0.008405938 -0.0351402
TotalWorkingYears TrainingTimesLastYear YearsAtCompany YearsInCurrentRole Y
earsSinceLastPromotion YearsWithCurrManager
1 -0.4455643 -0.0005714331 -0.4814244 -0.4920861
-0.4116207 -0.4699297
2 0.9133144 0.0011713194 0.9868202 1.0086744
0.8437371 0.9632583

```

Clustering vector:

```

[1] 1 2 1 1 1 1 1 1 2 2 1 1 1 1 1 2 1 1 2 1 1 1 2 1 1 2 1 1 2 2 1 1 1 1 1
1 1 1 1 1 1 1 1 2 2 2 2 1 2 1 1 1 1 1 1 1 2 2 1
[59] 1 1 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 2 1 2 1 1 2 2 2 1 2
2 2 1 1 1 2 1 1 1 1 2 2 1 1 1 2 1 2 1 1 1
[117] 2 2 1 2 1 1 1 2 2 1 2 1 1 2 1 1 1 2 1 1 1 2 1 2 1 1 1 1 1 1 2 1 1 2
1 2 2 2 1 1 1 2 1 1 1 1 1 1 2 2 2 1 1 1 1 1 2
[175] 1 1 1 1 2 1 1 1 1 1 1 1 2 2 2 2 2 1 1 1 2 1 1 1 1 1 1 2 1 1 1 1 1 1 1
1 2 2 1 2 1 1 1 1 2 1 2 1 2 2 1 1 2 2 2 1 1 2
[233] 1 2 1 2 1 2 1 1 1 1 1 2 2 1 1 2 1 1 1 2 1 1 1 1 2 2 1 1 1 2 1 2 1 1 1
1 2 2 2 1 1 1 1 2 1 1 2 2 1 2 2 1 2 1 2 1 1 1
[291] 2 1 1 1 1 2 1 1 1 2 1 1 2 1 2 2 2 2 2 1 1 1 2 1 2 2 1 2 2 1 2 1 1 1 1 2
2 2 1 1 2 1 1 1 1 2 1 1 1 1 1 1 2 2 1 2 1 1 1
[349] 1 1 1 1 1 2 1 2 1 1 1 2 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 2 1 1 2 1 1 1
1 2 1 2 1 1 1 2 1 2 1 2 1 1 1 2 1 2 2 1 2 1 1
[407] 2 1 2 1 1 2 2 1 1 1 1 2 1 1 1 1 1 1 2 1 2 2 2 1 2 1 1 1 1 2 2 1 1 1 1 1
1 2 1 2 2 2 2 1 1 2 2 1 1 1 1 1 1 1 1 1 1 1 1
[465] 1 1 2 2 2 1 1 1 2 1 1 2 1 1 1 2 1 1 1 1 1 1 1 2 1 1 1 1 1 1 2 1 1 1 1 2 1
1 1 1 2 2 1 1 2 1 2 2 2 1 1 1 2 1 1 1 1 1 1 1
[523] 1 2 2 1 2 1 1 2 1 2 2 2 2 2 1 1 2 1 1 1 1 1 2 2 1 1 1 1 1 1 2 1 1 1 1 1
1 2 1 1 2 2 1 1 1 1 1 2 2 1 1 1 1 1 1 1 1 2 1
[581] 1 1 1 1 2 1 1 1 2 1 2 1 2 1 2 1 1 1 1 1 1 2 1 1 1 2 1 1 2 2 1 2 2 1 1 1
1 2 1 1 1 1 2 1 1 2 1 1 2 1 1 1 1 1 1 1 2 1 1
[639] 1 1 1 2 1 1 1 1 1 2 1 2 1 2 1 2 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1
1 2 1 1 2 1 1 1 2 1 1 1 1 2 2 1 1 2 1 1 2 1 2
[697] 2 1 1 2 1 2 2 1 2 1 1 2 1 1 2 1 1 1 2 1 2 1 2 1 1 2 1 2 1 1 1 1 2 2 2
1 1 1 1 1 2 1 2 1 1 1 1 2 1 2 2 1 1 2 2 2 2 2
[755] 1 2 2 2 2 1 2 1 1 1 1 1 2 1 2 1 2 2 1 2 2 2 1 1 1 2 1 2 1 1 1 2 2 1 1 1
2 1 2 2 1 1 1 1 1 2 1 1 1 1 2 2 2 2 1 1 1 1 1
[813] 2 2 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 1 1 1 1 1 1 1 1 1 2 2 2 1 1 1 1 1 1 2
2 1 1 1 2 1 1 1 2 1 1 2 1 1 2 1 1 1 1 1 2 1 2
[871] 2 1 1 1 2 2 1 1 1 2 1 1 2 2 1 1 2 1 2 2 2 2 1 1 2 1 2 1 2 1 2 1 1 1 1 1
2 1 2 2 1 1 1 1 2 2 1 2 1 2 2 2 1 2 2 1 1 2 2
[929] 2 1 1 1 2 1 1 1 1 2 1 1 1 1 1 2 2 2 1 2 1 1 2 2 1 1 2 2 2 1 1 2 1 1 2
2 2 1 2 1 2 2 1 1 1 1 2 2 1 2 2 1 1 1 2 1 1
[987] 1 1 1 1 1 1 1 1 2 2 1 1 1 2
[ reached getOption("max.print") -- omitted 470 entries ]

```

within cluster sum of squares by cluster:

```

[1] 9563.508 7087.951
(between_ss / total_ss = 19.0 %)

```

Available components:

```

[1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
"betweenss"    "size"         "iter"
[9] "ifault"
> # Computing the percentage of variation accounted for. Two clusters
>
> perc.var.2 <- round(100*(1 - kmeans2_attr_std$betweenss/kmeans2_attr_std$to
tss),1)
>
> names(perc.var.2) <- "Perc. 2 clus"

```

```
>
> perc.var.2
Perc. 2 clus
      81
> # Computing the percentage of variation accounted for. Three clusters
>
> (kmeans3_attr_std <- kmeans(attr_std,3,nstart = 10))
K-means clustering with 3 clusters of sizes 367, 705, 398
```

Cluster means:

	Age	DailyRate	DistanceFromHome	HourlyRate	MonthlyIncome	MonthlyRate
1	0.5013783	-0.07679400	0.01893852	-0.02292678	0.7731900	-0.005035
529		-0.0942477	-0.020767791			
2	-0.6413051	-0.06732578	-0.01639876	-0.02736942	-0.5304961	-0.074517
134		-0.5051990	-0.001439503			
3	0.6736539	0.19007053	0.01158465	0.06962204	0.2267312	0.136639
746		0.9817944	0.021700073			
	TotalWorkingYears	TrainingTimesLastYear	YearsAtCompany	YearsInCurrentRole	YearsSinceLastPromotion	YearsWithCurrManager
1	0.9127463	0.01828053	1.2848957	1.2422918		
1.1686594		1.2140545				
2	-0.6577604	0.01483008	-0.3659833	-0.3459337		
-0.3628676		-0.3143688				
3	0.3234753	-0.04312604	-0.5365289	-0.5327584		
-0.4348652		-0.5626331				

Clustering vector:

```
[1] 3 1 3 2 3 2 3 2 1 1 2 2 2 2 2 1 2 2 1 2 2 3 1 2 2 1 2 2 1 3 2 3 2 3 2
[59] 2 2 1 1 1 1 1 3 2 3 2 2 3 2 2 2 2 2 1 3 3 3 2 2 3 1 2 3 2 3 1 1 1 2 2
[117] 1 1 3 2 2 1 3 2 2 2 1 3 3 3 2 2 2 1 2 3 2 3 2
[175] 3 3 2 2 1 2 3 2 2 2 3 2 1 1 1 3 1 2 2 3 1 2 2 2 3 2 2 3 2 3 3 2 2 2 3
[233] 3 3 2 1 3 1 2 2 3 2 3 1 1 3 2 1 3 3 3 1 2 3 2 2 1 1 2 2 2 1 2 1 2 2 2
[291] 3 2 2 2 2 1 2 1 2 3 1 2 2 1 1 3 1 3 3 2 2 1 2 1 1 2 3 1 2 1 2 2 3 2 2
[349] 3 2 2 2 3 3 1 2 2 2 2 3 1 1 2 2 1 2 3 3
[407] 3 2 3 3 2 1 1 2 2 2 2 1 2 2 2 2 2 1 3 1 1 1 3 3 2 3 2 3 1 1 3 2 3 3 3
[465] 3 3 1 1 1 3 2 3 3 1 2 2 2 1 2 2 2 2 2 2 1 2 3 2 2 3 2 1 3 3 2 2 2 3 2
[523] 2 1 1 2 1 2 1 1 1 3 2 2 2 1 1 1 3 2 2 1 3 2 3 3 2 1 1 2 3 3 2 2 3 3 2 3 2 3
[581] 2 2 2 3 1 2 2 3 3 2 1 2 1 2 2 1 2 3 2 2 1 3 3 2 1 2 2 1 1 3 2 3 2 2 2
[639] 2 3 2 2 2 3 2 2 3 1 3 1 3 1 2 1 3 2 2 2 2 2 3 3 2 2 1 2 2 3 2 3 2 2 3
[697] 2 2 2 1 3 1 1 2 2 1 2 3 1 3 2 2 1 2 3 3 2 1 3 2 2 2 1 2 3 2 2 2 2 3 1 2
[755] 2 3 3 2 3 2 1 3 2 2 2 2 1 2 1 2 3 3 3 1 1 3 2 2 1 3 2 2 2 2 1 1 2 3 2
[813] 3 1 1 2 3 1 2 2 2 3 2 2 3 2 2 2 2 2 2 2 2 3 2 2 2 1 1 1 3 3 2 2 2 2 3 1
[871] 3 2 2 2 1 1 2 3 1 2 2 1 1 3 2 1 3 1 2 3 1 2 2 1 2 2 3 1 3 2 3 2 2 3
[929] 2 2 2 3 2 2 2 2 3 1 3 2 2 2 2 3 1 3 2 3 2 2 1 1 2 3 1 1 1 3 2 1 2 2 1
[987] 2 3 3 3 3 2 3 2 3 1 2 2 2 1
[ reached getOption("max.print") -- omitted 470 entries ]
```

within cluster sum of squares by cluster:

```
[1] 5205.277 6049.267 4071.095  
(between_SS / total_SS = 25.5 %)
```

Available components:

```
[1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"  
"betweenss"    "size"         "iter"  
[9] "ifault"
```

```
>  
> perc.var.3 <- round(100*(1 - kmeans3_attr_std$betweenss/kmeans3_attr_std$totss),1)
```

```
>  
> names(perc.var.3) <- "Perc. 3 clus"
```

```
>  
> perc.var.3  
Perc. 3 clus  
74.5
```

```
> # Computing the percentage of variation accounted for. Four clusters
```

```
>  
> (kmeans4_attr_std <- kmeans(attr_std,4,nstart = 10))
```

K-means clustering with 4 clusters of sizes 370, 560, 156, 384

Cluster means:

	Age	DailyRate	DistanceFromHome	HourlyRate	MonthlyIncome	MonthlyRate
te NumCompaniesWorked PercentSalaryHike						
1	0.7707463	0.22961595	0.008257502	0.03633025	0.2669399	0.098029
93		0.9613245	0.009213117			
2	-0.7192085	-0.11199075	-0.020883872	0.03636112	-0.6095477	-0.037908
53		-0.4054590	-0.022606422			
3	1.0047487	-0.10884912	-0.068027703	0.03341739	1.7607150	-0.028025
79		0.1176866	-0.006455403			
4	-0.1019796	-0.01370473	0.050135454	-0.10160815	-0.0835745	-0.027787
16		-0.3827921	0.026712984			
TotalWorkingYears TrainingTimesLastYear YearsAtCompany YearsInCurrentRole Y						
earsSinceLastPromotion YearsWithCurrManager						
1	0.39270390	-0.05607256	-0.5390915		-0.5548597	
-0.4306548		-0.5829055				
2	-0.78847463	0.01576328	-0.5723273		-0.6147893	
-0.4572541		-0.6265538				
3	1.78479174	-0.11283401	2.0923377		1.3928232	
1.6166931		1.4170866				
4	0.04640063	0.07687895	0.5040689		0.8653638	
0.4250011		0.8996866				

Clustering vector:

```
[1] 1 4 1 2 1 4 1 2 4 4 2 4 2 2 2 4 2 2 3 2 2 1 4 2 2 3 4 4 3 1 2 1 2 1 2  
2 2 2 1 2 2 2 2 4 4 3 4 2 4 2 1 2 1 2 2 3 4 2  
[59] 4 4 4 4 3 3 3 1 2 1 2 2 1 2 2 4 2 4 4 1 1 1 4 2 1 4 2 1 2 1 4 4 3 4 4  
3 4 1 2 2 3 1 2 2 2 4 1 1 1 2 2 2 3 4 1 2 1 1  
[117] 4 4 2 3 4 4 1 3 4 2 3 2 2 4 1 1 2 4 4 1 1 4 2 4 1 1 1 2 4 2 2 3 2 2 4  
4 4 4 4 4 1 1 4 2 2 2 2 1 2 1 4 4 1 2 2 2 4 4  
[175] 1 1 2 2 3 2 1 2 2 2 1 4 3 3 4 1 3 2 2 1 3 4 2 1 1 4 2 4 2 1 1 4 2 2 1  
1 4 4 4 4 2 1 2 2 3 1 4 2 4 4 2 1 4 4 4 2 1 3  
[233] 1 1 2 3 4 3 2 2 1 2 1 4 3 1 2 4 1 1 1 3 2 1 2 2 4 3 2 2 2 4 2 3 2 2 4  
2 3 4 3 4 2 2 2 1 4 2 3 1 3 4 4 4 4 1 1 2 2  
[291] 1 4 2 2 3 2 1 4 2 1 3 2 2 4 4 4 1 1 2 2 3 2 4 3 4 1 4 2 4 2 4 1 2 4  
4 3 1 2 1 2 2 1 1 4 2 4 2 4 4 1 4 4 4 4 2 1 1  
[349] 1 2 2 2 1 4 2 4 1 2 2 4 1 4 2 2 1 1 4 1 2 2 2 1 1 2 2 1 1 2 1 1 2 2 2  
2 4 2 3 1 2 1 3 1 1 1 4 1 1 2 4 2 3 3 2 4 2 2  
[407] 1 2 1 1 2 3 4 2 2 2 2 3 2 2 4 2 2 4 1 3 4 3 1 1 2 1 4 1 4 4 1 2 1 2 1  
1 4 2 4 3 4 4 3 4 2 4 4 2 2 1 1 2 1 4 2 2 4 2
```

```

[465] 1 1 3 4 4 1 2 1 1 3 2 2 2 3 2 2 2 2 2 2 4 2 1 2 2 1 2 4 1 1 2 2 2 1 2
2 2 2 3 4 2 2 4 2 3 4 4 1 2 2 4 2 2 2 4 4 1 2
[523] 2 4 4 2 3 4 1 4 4 4 3 1 3 1 4 3 1 4 1 1 2 3 4 2 1 1 2 2 1 1 2 1 2 1
2 4 1 2 3 4 2 4 2 1 4 2 2 2 2 2 2 2 1 2 2 4 2
[581] 2 2 4 1 3 2 2 1 1 2 4 2 3 4 4 3 2 1 2 2 4 1 1 2 4 2 2 4 4 1 4 4 4 2 4
2 3 1 2 4 2 4 2 1 1 1 2 1 1 2 2 2 1 2 2 3 4 2
[639] 2 1 2 4 2 1 2 2 1 4 1 3 1 4 4 3 1 2 2 2 4 2 1 2 2 2 4 2 2 1 2 1 2 2 1
2 1 4 4 3 1 2 2 3 2 2 1 4 4 4 2 2 4 1 4 4 2 3
[697] 4 2 2 3 1 3 4 2 4 4 1 4 4 2 4 2 2 1 1 2 3 1 4 1 2 3 2 1 2 2 2 2 1 4 4
2 2 2 2 1 3 1 3 2 2 1 1 1 1 4 3 1 2 3 3 4 3 3
[755] 2 1 4 4 1 2 3 1 2 2 2 2 3 2 4 2 1 1 1 4 3 1 2 2 4 1 4 2 2 4 4 4 2 1 4
3 2 4 4 2 2 2 4 2 2 3 2 1 2 2 1 4 1 4 4 4 3 1
[813] 1 3 3 2 1 4 2 2 2 1 2 2 1 2 2 2 2 2 2 2 1 2 2 2 4 3 3 1 1 2 2 4 2 1 4
4 2 1 2 1 4 2 1 4 2 2 3 2 2 3 2 2 1 1 1 1 2 1
[871] 4 2 2 4 4 3 2 1 1 4 2 4 4 4 1 2 4 1 4 4 1 4 2 2 3 2 4 1 3 1 4 1 2 2 1
4 2 3 4 2 2 2 3 2 3 2 3 1 4 2 3 4 4 2 1 3 3
[929] 4 2 4 1 4 3 2 3 1 2 2 4 4 4 1 2 1 4 4 4 3 2 1 3 3 3 1 4 4 4 2 3
4 4 2 3 2 4 4 2 1 2 2 2 3 3 2 3 4 2 2 2 4 2 4
[987] 1 1 1 1 1 2 1 2 1 4 2 4 2 3
[ reached getOption("max.print") -- omitted 470 entries ]

```

within cluster sum of squares by cluster:

```

[1] 3753.165 4326.294 2322.362 3710.699
(between_SS / total_SS = 31.4 %)

```

Available components:

```

[1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
"betweenss"    "size"         "iter"
[9] "ifault"

```

```

>
> perc.var.4 <- round(100*(1 - kmeans4_attr_std$betweenss/kmeans4_attr_std$totss),1)
>

```

```

> names(perc.var.4) <- "Perc. 4 clus"
>

```

```

> perc.var.4

```

```

Perc. 4 clus
68.6

```

```

> # Computing the percentage of variation accounted for. Five clusters
>

```

```

> (kmeans5_attr_std <- kmeans(attr_std,5,nstart = 10))

```

K-means clustering with 5 clusters of sizes 362, 121, 464, 385, 138

Cluster means:

	Age	DailyRate	DistanceFromHome	HourlyRate	MonthlyIncome	MonthlyRate
1	0.29439958	0.12871318	-0.07860849	0.085796939	-0.34473854	-0.0042
2	1.42504729	0.15367721	0.01601076	0.005353989	1.72713466	0.2180
3	-0.80816195	-0.09282987	0.02676321	0.023482118	-0.61613188	-0.0173
4	-0.09401635	-0.01885408	0.06916728	-0.103630113	-0.08568613	-0.0314
5	0.95782658	-0.10766111	-0.09078668	-0.019597347	1.70062617	-0.0339
	0.06190082	-0.02160939				
	TotalWorkingYears	TrainingTimesLastYear	YearsAtCompany	YearsInCurrentRole	YearsSinceLastPromotion	YearsWithCurrManager
1	-0.19463320	-0.06075160	-0.5888511	-0.6168071		
2	1.65396859	-0.06870235	-0.3331776	-0.2776906		
	-0.2557445	-0.4236271				

3	-0.84002580	0.03529737	-0.5578441	-0.6027906
-0.4541967		-0.6300570		
4	0.05219558	0.07708356	0.5108114	0.8629518
0.4172976		0.9067233		
5	1.73915719	-0.11413105	2.2873612	1.4807475
1.7856938		1.5211290		

Clustering vector:

```
[1] 1 4 1 3 1 4 1 3 4 4 3 4 3 3 4 3 3 5 1 3 1 4 3 3 5 4 4 5 2 1 1 3 1 3
3 1 3 1 3 3 3 3 4 4 5 4 1 4 3 1 3 1 3 1 5 4 3
[59] 4 4 4 4 5 5 5 2 3 2 1 3 2 3 3 4 3 4 4 2 2 1 3 3 2 4 3 2 3 1 4 4 5 4 4
5 4 2 3 3 5 1 1 3 3 4 1 2 2 3 3 3 5 4 2 3 1 1
[117] 4 4 1 5 4 4 1 5 4 3 5 3 3 4 1 2 3 4 4 1 2 4 3 4 1 1 1 3 4 1 3 2 1 3 4
4 4 4 4 4 1 1 4 1 3 1 3 2 3 2 4 4 1 3 3 3 4 4
[175] 1 1 3 3 5 3 1 3 3 1 1 4 5 5 4 2 5 3 3 1 5 4 1 1 1 4 1 4 3 1 1 4 3 3 1
1 4 4 4 2 1 2 1 3 5 1 4 1 4 4 3 1 4 4 4 3 1 5
[233] 1 2 1 5 4 5 3 1 3 1 4 5 1 3 4 1 1 1 5 3 1 3 3 4 5 1 3 3 4 3 5 3 3 4
3 5 4 5 4 3 1 3 2 1 4 3 2 2 5 4 4 3 4 1 1 3 3
[291] 2 4 3 4 3 5 3 4 1 1 5 3 3 4 4 4 4 2 1 3 3 5 3 4 5 4 2 4 3 4 3 4 1 1 4
4 5 1 3 2 3 3 2 1 4 1 4 3 4 4 1 4 4 4 4 3 1 1
[349] 2 3 3 3 2 4 1 4 1 3 1 4 1 4 3 3 1 1 4 2 3 3 3 1 1 3 3 2 4 1 1 2 3 3 3
3 4 1 5 1 1 5 1 2 1 4 1 1 3 3 4 3 5 2 3 4 3 3
[407] 2 1 2 1 3 5 4 3 3 3 5 3 1 4 1 3 4 2 5 4 5 1 2 3 1 4 1 4 4 1 3 1 3 1
1 4 3 4 5 4 4 5 4 1 4 4 3 3 1 1 3 2 4 3 3 4 3
[465] 1 2 5 4 4 1 3 1 1 5 3 3 3 5 3 3 3 3 3 1 4 3 1 3 3 2 1 4 2 1 3 3 3 2 3
3 3 3 5 4 3 3 4 3 5 4 2 1 3 3 4 3 3 3 4 4 1 3
[523] 1 4 4 1 5 4 2 4 4 4 4 5 2 5 1 4 5 1 4 1 1 3 5 4 3 1 1 1 3 1 2 3 1 3 1
1 4 1 3 5 4 3 4 3 1 3 2 4 3 3 3 1 3 1 3 3 4 3
[581] 1 3 1 4 5 3 3 1 2 3 4 1 5 4 4 5 1 1 1 1 4 1 1 3 4 3 3 4 4 2 4 4 4 3 4
3 5 1 1 4 3 4 3 1 2 2 1 2 1 3 1 1 1 3 3 5 4 3
[639] 3 1 3 4 3 1 3 1 2 4 1 5 1 4 4 5 1 3 3 1 4 3 1 1 3 3 4 1 3 1 1 1 3 3 1
3 2 4 4 5 1 3 3 5 1 3 1 4 4 4 3 3 4 1 4 4 3 5
[697] 4 3 3 5 1 5 4 3 4 4 2 4 4 3 4 1 3 1 2 3 5 1 4 1 3 2 3 2 3 3 3 2 4 4
3 3 3 3 1 5 3 3 2 1 2 1 4 5 1 1 5 5 4 5 4
[755] 3 2 4 4 2 3 5 1 1 3 3 1 2 3 4 3 2 2 1 4 2 1 3 3 4 1 4 3 3 4 4 4 3 2 4
5 1 4 4 3 3 3 4 3 1 5 3 1 3 3 2 4 2 4 4 4 5 1
[813] 2 5 5 3 1 4 3 3 3 2 3 3 1 3 3 3 3 3 3 1 3 3 3 4 5 5 1 1 1 3 4 3 1 4
4 3 1 3 2 4 3 1 4 3 3 2 3 3 5 3 3 1 1 1 2 3 2
[871] 4 3 3 4 4 5 3 1 1 4 3 4 4 4 1 3 4 2 4 4 2 4 3 3 2 3 4 1 2 2 4 1 3 3 2
4 3 5 4 3 3 3 5 5 3 2 3 5 2 4 3 5 4 3 1 5 5
[929] 4 3 4 1 4 3 3 4 2 5 1 3 3 4 4 4 4 2 3 1 4 4 4 5 3 1 5 5 2 1 4 4 4 3 5
4 4 3 5 1 4 4 1 2 3 3 3 5 5 3 5 4 1 3 3 4 3 4
[987] 1 2 1 1 1 3 1 3 2 4 3 4 3 5
[ reached getOption("max.print") -- omitted 470 entries ]
```

within cluster sum of squares by cluster:

```
[1] 3047.750 1186.244 3451.050 3732.063 2002.454
(between_ss / total_ss = 34.7 %)
```

Available components:

```
[1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
"betweenss"    "size"         "iter"
[9] "ifault"
>
> perc.var.5 <- round(100*(1 - kmeans5_attr_std$betweenss/kmeans5_attr_std$totss),1)
>
> names(perc.var.5) <- "Perc. 5 clus"
>
> perc.var.5
Perc. 5 clus
65.3
> # Computing the percentage of variation accounted for. Six clusters
```

```
> (kmeans6_attr_std <- kmeans(attr_std,6,nstart = 10))
K-means clustering with 6 clusters of sizes 315, 204, 117, 367, 133, 334
```

Cluster means:

	Age	DailyRate	DistanceFromHome	HourlyRate	MonthlyIncome	MonthlyRate
1	0.29572817	0.06720409	-0.37970677	0.083120684	-0.33509590	-0.05149656
2	-0.25566270	0.03786530	1.67053208	0.038629426	-0.32910387	0.24140707
3	1.44167150	0.14005703	-0.03745321	-0.018189835	1.75468907	0.18300839
4	-0.86588529	-0.05984460	-0.36052931	0.076390996	-0.66450191	-0.05898106
5	0.98035288	-0.09522849	-0.02745725	-0.003152513	1.75533922	-0.04414310
6	-0.06671192	-0.03189258	-0.24201442	-0.178297661	-0.06644952	-0.08060037

	TotalWorkingYears	TrainingTimesLastYear	YearsAtCompany	YearsInCurrentRole	YearsSinceLastPromotion
1	-0.21096808	-0.02409561	-0.5941230	-0.6284252	-0.4562689
2	-0.35912815	-0.27018326	-0.2701731	-0.2188648	-0.2712331
3	1.70405369	-0.05648465	-0.3375473	-0.2826621	-0.2359724
4	-0.88690899	0.09436436	-0.5835152	-0.6340835	-0.4624483
5	1.76916941	-0.11260971	2.3500845	1.4931387	1.7313523
6	0.09143376	0.14868735	0.5489399	0.9275301	0.4973464

Clustering vector:

```
[1] 1 6 1 4 1 6 1 2 2 2 4 6 2 2 2 6 4 4 5 1 4 1 6 4 4 5 6 6 5 3 1 1 4 1 4
4 1 4 1 4 4 4 2 6 6 5 2 2 6 4 1 4 1 4 2 5 6 2
[59] 6 6 6 2 5 5 5 3 4 3 1 4 3 4 4 6 4 6 6 3 3 1 6 4 3 6 4 3 4 1 6 6 5 2 6
6 6 3 4 4 5 2 1 4 4 6 1 3 3 4 4 4 5 6 3 4 1 1
[117] 6 6 1 5 2 2 1 5 6 4 5 2 4 6 2 3 2 6 2 1 3 6 2 6 1 2 1 2 6 1 4 3 1 4 6
6 6 6 6 1 1 6 1 4 1 2 2 4 3 6 6 1 4 4 4 6 6
[175] 1 1 4 5 4 1 2 2 1 2 6 5 5 6 3 5 4 2 1 5 2 1 2 1 2 1 2 4 1 2 2 4 2 1
1 6 6 2 6 1 3 2 4 5 1 6 1 6 6 4 1 6 6 6 4 1 5
[233] 1 3 2 5 6 5 4 4 1 2 2 2 5 1 4 6 1 1 1 5 2 2 2 4 6 5 1 2 4 6 4 3 4 4 2
4 5 6 5 6 4 1 4 1 2 6 4 3 3 5 6 6 4 6 2 1 4 4
[291] 3 6 4 6 4 5 4 6 1 1 5 4 2 6 6 2 6 2 1 4 4 5 4 6 5 6 3 6 4 6 4 6 1 1 2
6 5 1 4 3 4 4 3 1 6 1 6 4 6 6 1 6 6 6 6 2 1 1
[349] 3 4 4 4 2 6 2 6 1 4 1 6 1 6 4 4 1 1 6 3 2 4 4 1 1 4 4 3 6 1 1 3 4 4 4
4 6 1 5 1 1 1 5 1 3 1 6 1 1 4 6 4 5 3 4 6 2 4
[407] 3 1 3 2 4 5 6 2 4 4 4 5 2 1 6 2 4 6 3 5 6 5 1 3 2 1 6 1 6 6 1 4 2 2 1
1 6 4 6 5 6 6 5 6 1 6 6 2 2 1 1 4 2 6 2 4 6 2
[465] 1 3 5 6 6 1 2 1 1 5 2 2 4 5 2 4 4 4 2 6 4 1 4 4 3 1 6 3 1 4 4 2 3 4
4 4 4 5 6 2 4 6 4 6 6 3 1 4 4 6 4 4 4 6 6 1 4
[523] 1 6 6 1 5 6 3 6 6 6 6 5 3 5 1 6 5 1 6 1 1 2 5 2 4 1 1 1 4 1 3 4 1 4 1
1 2 1 4 5 6 2 6 4 2 4 3 6 2 4 2 1 4 1 4 4 6 4
[581] 4 4 6 1 5 4 4 1 3 4 6 2 5 6 2 5 1 1 1 2 6 1 1 4 2 1 4 6 6 3 6 6 6 4 6
4 5 1 1 6 2 6 4 1 3 3 1 3 2 4 1 1 1 4 4 5 2 4
[639] 4 1 4 6 4 1 4 1 3 6 2 5 1 6 2 5 1 4 2 1 6 4 1 1 4 4 6 1 4 1 1 1 4 4 1
4 3 6 2 5 1 2 4 5 1 4 1 6 6 6 4 6 1 6 6 4 6
[697] 6 4 2 5 1 5 6 4 6 6 3 6 6 4 6 1 4 1 3 4 5 1 2 1 2 3 4 3 4 2 4 4 3 6 6
4 4 4 4 1 5 1 5 4 4 3 1 3 1 6 5 1 2 5 5 6 5 5
[755] 4 3 2 6 3 2 5 1 1 4 4 1 3 1 2 4 3 3 1 6 3 3 4 4 6 1 2 4 2 6 6 6 4 3 6
5 1 6 2 4 4 4 6 2 2 5 4 1 4 4 3 6 3 6 2 6 5 1
[813] 3 5 5 4 1 6 2 4 4 3 4 4 2 4 4 4 4 4 1 4 2 4 4 4 6 5 5 1 1 2 4 6 4 2 6
6 4 1 4 3 6 4 1 6 4 4 3 2 4 5 4 4 1 2 1 3 2 3
```

```

[871] 2 4 2 6 6 5 4 1 1 6 4 6 6 6 1 4 6 3 6 6 3 6 4 4 3 4 2 1 3 3 6 1 4 4 3
6 4 5 6 2 4 4 4 5 5 4 3 4 5 3 6 4 5 6 4 1 5 6
[929] 6 4 6 1 6 4 4 6 3 5 2 4 2 6 6 6 6 3 2 1 2 6 6 6 4 1 5 5 3 1 6 6 6 4 5
6 6 4 5 1 6 6 1 3 4 4 4 5 5 2 6 2 1 2 4 6 2 2
[987] 2 3 2 1 1 4 2 2 3 6 4 2 4 5
[ reached getOption("max.print") -- omitted 470 entries ]

```

within cluster sum of squares by cluster:

```

[1] 2496.832 1801.395 1137.594 2452.579 1929.518 3105.339
(between_ss / total_ss = 37.2 %)

```

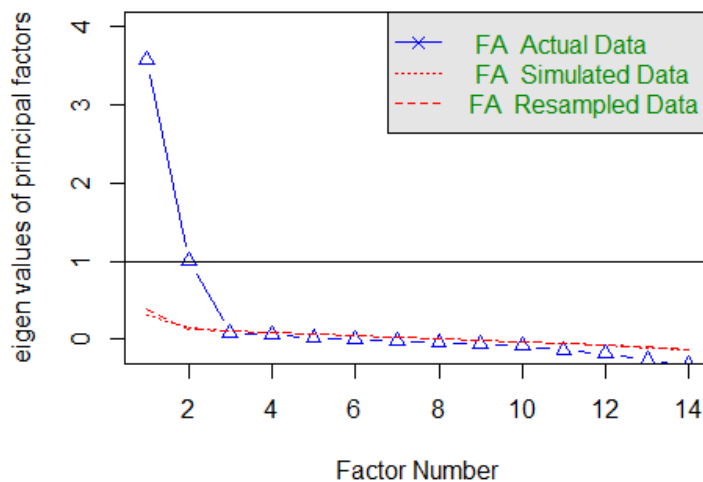
Available components:

```

[1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
"betweenss"    "size"         "iter"
[9] "ifault"
>
> perc.var.6 <- round(100*(1 - kmeans6_attr_std$betweenss/kmeans6_attr_std$totss),1)
>
> names(perc.var.6) <- "Perc. 6 clus"
>
> perc.var.6
Perc. 6 clus
62.8
> #Factor Analysis
> #parallel analysis suggest factor recommendation
> parallel<-fa.parallel(attr_pca[,1:14],fm='minres',fa='fa')
Parallel analysis suggests that the number of factors = 2 and the number of
components = NA

```

Parallel Analysis Scree Plots



```

> #The gap between simulated data and actual data tends to be between 3 and 4
> threefactor<-principal(attr_pca[,1:14],nfactors=3,rotate='varimax')
> print(threefactor)
Principal Components Analysis
Call: principal(r = attr_pca[, 1:14], nfactors = 3, rotate = "varimax")
Standardized loadings (pattern matrix) based upon correlation matrix
      RC1    RC2    RC3    h2    u2 com
Age      0.31  0.76  0.07 0.683 0.32 1.3
DailyRate -0.04 0.06 0.23 0.056 0.94 1.2
DistanceFromHome 0.07 -0.12 0.68 0.475 0.52 1.1

```

HourlyRate	-0.03	0.03	0.37	0.139	0.86	1.0
MonthlyIncome	0.54	0.61	-0.02	0.664	0.34	2.0
MonthlyRate	-0.04	0.11	-0.01	0.013	0.99	1.3
NumCompaniesWorked	-0.20	0.69	0.08	0.522	0.48	1.2
PercentSalaryHike	0.00	-0.07	0.48	0.233	0.77	1.0
TotalWorkingYears	0.63	0.68	0.03	0.860	0.14	2.0
TrainingTimesLastYear	0.00	-0.07	-0.43	0.193	0.81	1.1
YearsAtCompany	0.93	0.07	-0.05	0.865	0.14	1.0
YearsInCurrentRole	0.86	-0.06	0.00	0.747	0.25	1.0
YearsSinceLastPromotion	0.73	0.01	-0.04	0.541	0.46	1.0
YearsWithCurrManager	0.86	-0.08	-0.02	0.744	0.26	1.0

	RC1	RC2	RC3
SS loadings	3.71	1.95	1.08
Proportion Var	0.26	0.14	0.08
Cumulative Var	0.26	0.40	0.48
Proportion Explained	0.55	0.29	0.16
Cumulative Proportion	0.55	0.84	1.00

Mean item complexity = 1.2

Test of the hypothesis that 3 components are sufficient.

The root mean square of the residuals (RMSR) is 0.08
with the empirical chi square 1591.36 with prob < 6e-299

Fit based upon off diagonal values = 0.91> class(threefactor)

[1] "psych" "principal"

> #Display factor values

> threefactor\$values

[1] 4.0167738 1.6502052 1.0685042 1.0521201 1.0094108 0.9924579 0.9533497 0.9174969 0.7224654 0.5306975

[11] 0.4698454 0.2832233 0.1933840 0.1400658

> #Display factor loadings

> threefactor\$loadings

Loadings:

	RC1	RC2	RC3
Age	0.307	0.765	
DailyRate			0.225
DistanceFromHome		-0.122	0.675
HourlyRate			0.371
MonthlyIncome	0.538	0.612	
MonthlyRate		0.106	
NumCompaniesWorked	-0.199	0.689	
PercentSalaryHike			0.477
TotalWorkingYears	0.630	0.680	
TrainingTimesLastYear			-0.434
YearsAtCompany	0.926		
YearsInCurrentRole	0.862		
YearsSinceLastPromotion	0.734		
YearsWithCurrManager	0.859		

	RC1	RC2	RC3
SS loadings	3.707	1.951	1.078
Proportion Var	0.265	0.139	0.077
Cumulative Var	0.265	0.404	0.481

> #communalities

> threefactor\$communality

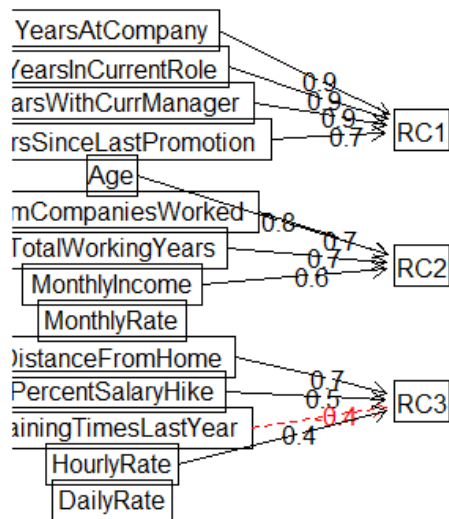
	Age	DailyRate	DistanceFromHome
HourlyRate	0.68318561	0.05613449	0.47529954
MonthlyIncome		MonthlyRate	NumCompaniesWorked
PercentSalaryHike			

```

0.23285647      0.66447336      0.01269573      0.52164264
TotalWorkingYears TrainingTimesLastYear      YearsAtCompany
YearsInCurrentRole      0.85983230      0.19335717      0.86479626
0.74651548
YearsSinceLastPromotion      YearswithCurrManager
0.54136294      0.74383547
> #Rotated factor scores
> head(threefactor$scores)
      RC1      RC2      RC3
[1,] -0.5982509  1.2242118  0.4724958
[2,]  0.5308061 -0.1775199  0.4632603
[3,] -1.4124116  0.6169246  0.2028231
[4,] -0.1259390 -0.4919472 -0.9774844
[5,] -1.0834488  0.5907171 -1.4763255
[6,]  0.3852668 -1.0510701 -0.3112959
> #round threefactor values
> round(threefactor$values,3)
[1] 4.017 1.650 1.069 1.052 1.009 0.992 0.953 0.917 0.722 0.531 0.470 0.283
0.193 0.140
> #Visualize the relationship and factor recommendations for simple structure
> fa.diagram(threefactor)

```

Components Analysis



```

> colnames(threefactor$loadings)<- c("No.OfYears","PerformanceMetric","salary
Metric")
> colnames(threefactor$loadings)
[1] "No.OfYears"      "PerformanceMetric" "salaryMetric"
> plot(threefactor)

```

Principal Component Analysis

