PES University, Bengaluru

UE18CS312 - Data Analytics

Session: Aug – Dec 2020
Weeks 1-3 – Code Snippets for Worksheet 1 (for Unit 1)

Dataset: BKB.csv
Source: Business Analytics, U. Dinesh Kumar
Libraries : *ggplot2, dplyr, plyr, corrplot ,e1071*
R Basics: The R Project for Statistical Computing: R
Relevant Courses/Content: Chapters 1-6 of the prescribed textbook
Udemy
CRAN
R Programming for Data Science Roger D Peng

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Code Snippets

Getting started

1. Read the BKB.csv dataset

```
path <- "BKB.csv"
data <- read.csv(path)
```

2. Find a basic summary of the data

```
summary(data)
```

Expected Output

```
> summary(data)
  Applicant.ID              Loan.Type       Gender     Marital.Status        Accomodation.Type No.of.years.in.the.current.address
 Min.   :   1.0   Home Improvement: 352   Female: 340   Married:3483   Company Provided:  88    Min.   : 0.0
 1st Qu.: 966.8   Home Loan       :3512   Male  :3524   Others :  42   Family Other    : 976    1st Qu.: 2.0
 Median :1932.5                           Single : 339   Owned          :1029    Median : 6.0
 Mean   :1932.5                                         Rented         :1771    Mean   :10.6
 3rd Qu.:2898.2                                                                  3rd Qu.:15.0
 Max.   :3864.0                                                                  Max.   :92.0
 No..of.Years.in.the.current.job Monthly.Salary   Balance.in.Savings.Account Loan.Amount.Requested      Term        Down.Payment
 Min.   : 0.00                   Min.   :     0   Min.   :      0           Min.   :  50000       Min.   : 15.0   Min.   :       0
 1st Qu.: 5.00                   1st Qu.: 12201   1st Qu.:   1500           1st Qu.: 400000       1st Qu.:180.0   1st Qu.:  200000
 Median :10.00                   Median : 19000   Median :   6358           Median : 600000       Median :180.0   Median :  300000
 Mean   :10.93                   Mean   : 22619   Mean   :  31583           Mean   : 609055       Mean   :160.2   Mean   :  427471
 3rd Qu.:15.00                   3rd Qu.: 28500   3rd Qu.:  25000           3rd Qu.: 800000       3rd Qu.:180.0   3rd Qu.:  500000
 Max.   :65.00                   Max.   :500000   Max.   :5388413           Max.   :1000000       Max.   :180.0   Max.   :17000000
 EMI.Affordable
 Min.   :     84
 1st Qu.:   7696
 Median :  10774
 Mean   :  12882
 3rd Qu.:  15000
 Max.   :1200000
```

When applied to a data frame, the summary() function is essentially applied to each column and the results for all columns are shown together. For a continuous (numeric) variable like "Monthly.Salary", it returns the 5-number summary. If there are any missing values (denoted by "NA"), it would also provide a count for them. In this example, there are no missing values, so there is no display for the number of NA's .For a categorical variable like "Gender", it returns the levels and the number of data in each level

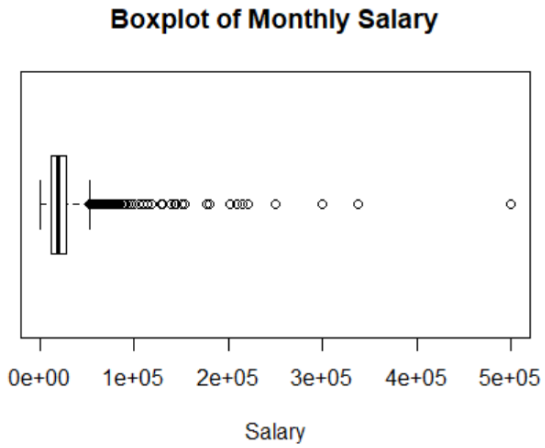
Descriptive Statistics

3. **Are there any outliers in these variables? Plot a box and whisker plot to find out.**

Given below is a sample for the Monthly.Salary attribute

```
boxplot(data$Monthly.Salary,horizontal=TRUE,xlab="Salary",main="Boxplot of Monthly Salary")
```

Expected Output

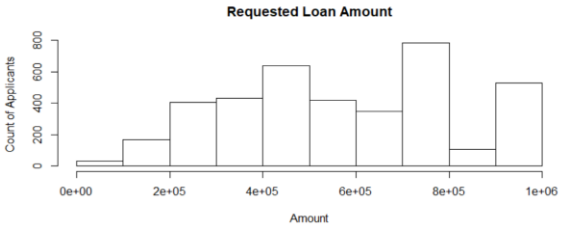


We can find numerous outliers from the above box plot

4. **Visualise the Loan Amount attribute (Histogram is suggested, why?)**

```
hist(data$Loan.Amount.Requested)
```

Expected Output



Since it a continuous variable, histogram is appropriate for initial analysis

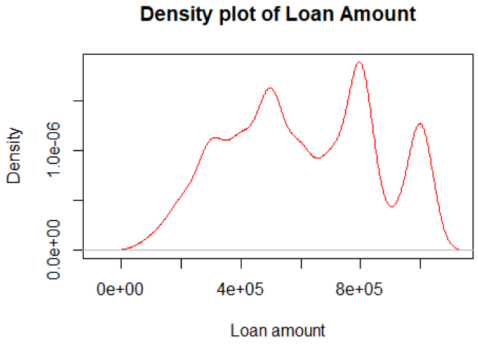
- Try changing the bin width of the histogram by modifying the ***breaks*** attribute

  hist(data$Loan.Amount.Requested,breaks=15)

  hist(data$Loan.Amount.Requested,breaks=c(0,200000,400000,600000,800000,1000000))

- You can see that since the bin width influences the nature of the distribution of a histogram, in order to find the modality of the distribution, **density plots** can also be used.

  plot(density(data$Loan.Amount.Requested),col="red",main="Density plot of Loan Amount",xlab="Loan amount")



- Which other visualisation is suitable for the Loan Amount Variable?

  Other interesting alternatives could be Frequency polygon and box plot. However, there are a myriad of alternatives that you can always explore!

Confidence Interval and Hypothesis Testing

5. **Suppose the mean weight of King Penguins found in an Antarctic colony last year was 15.4 kg. In a sample of 35 penguins at the same time this year in the same colony, the mean penguin weight is 14.6 kg. Assume the population standard deviation is 2.5 kg. At .05 significance level, can we reject the null hypothesis that the mean penguin weight does not differ from last year?**

```
xbar = 14.6          # sample mean
mu0 = 15.4           # hypothesized value
sigma = 2.5          # population standard deviation
n = 35               # sample size
z = (xbar - mu0)/(sigma/sqrt(n)) # test statistic
```

Expected Output

```
z
[1] -1.893146
```

The test statistic -1.8931 lies between the critical values -1.9600 and 1.9600. Hence, at .05 significance level, we do not reject the null hypothesis that the mean penguin weight does not differ from last year

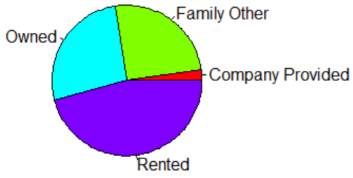
Visualizations

6. Visualize the distribution of Accomodation.Type attribute (PieChart is suggested)

```
val <- count(data, "Accomodation.Type")
lbls = val$Accomodation.Type
pie(val$freq, labels = val$Accomodation.Type, main="Pie Chart of
Countries",col=rainbow(length(lbls)))
```

Expected Output

Pie Chart of Accomodation variations



Since there are multiple variables (but not too many) pie chart is suitable

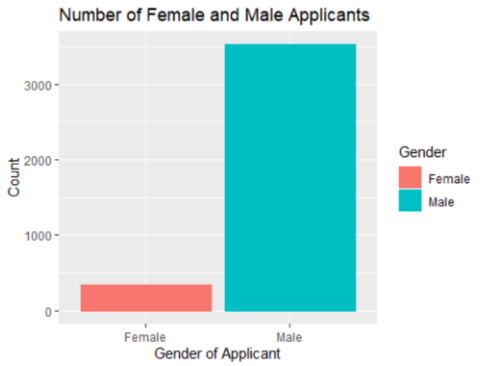
- Print and analyse the val variable
  The val variable gives a count of each of the different category values
- The basic pie function can be customised by adding in percentages to represent the sectors, gradient color scheme and many more

7. Visualize the Gender attribute (Bar Graph is suggested)

```
gender <- count(data, "Gender")
ggplot(gender, aes(x = Gender, y = freq,color=Gender,fill= Gender )) +
geom_bar(stat="identity")+ ylab("Count") +  xlab("Gender of Applicant")+ ggtitle("Number of
Female and Male Applicants")
```

Since there are only 2 categories bar graph proves to be useful

Expected Output

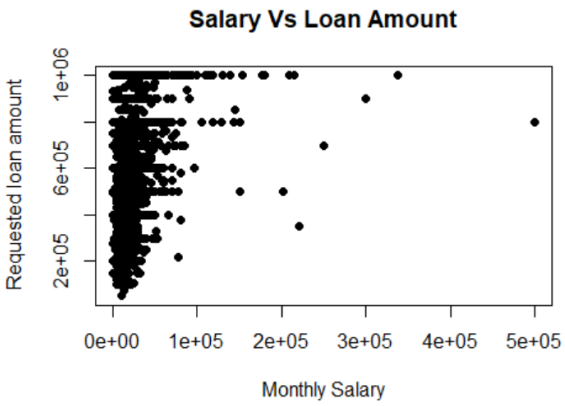


- Does it look like a biased study?
  Yes indeed! We can see the large gap indicating that the study is not representative based on gender terms.

8. Find variation of Monthly Salaries with respect to EMI amount (Scatter Plot is suggested)

```
plot(data$Monthly.Salary, data$Loan.Amount.Requested, main="Salary Vs Loan Amount",
xlab="Monthly Salary", ylab="Requested loan amount", pch=19)
```

Expected Output



- Explore pch attribute
  Varying the value of the pch attribute changes the shape of the marker. Some options are solid circle, square, filled circle etc.

- Is there a significant trend in the plot? Does lower income imply lower loan amount requested?
  We observe no significant trend in the plot. However, there are very few individuals with a very high income and the loan amount does not seem to be

strongly dependent on salary because we observe low salaried individuals also taking up higher loans.

- Try plotting scatter plot matrices where you can visualize multiple variables at once

Summary Statistics and Grouping Conditions

9. Descriptive Statistics for the dataset

```
sum(data$Monthly.Salary)
length(data$Monthly.Salary)
mean(data$Monthly.Salary)
median(data$Monthly.Salary)
range(data$Monthly.Salary)
var(data$Monthly.Salary)
sd(data$Monthly.Salary)
```

Expected Output

```
> sum(data$Monthly.Salary)
[1] 87399756
> length(data$Monthly.Salary)
[1] 3864
> mean(data$Monthly.Salary)
[1] 22618.98
> median(data$Monthly.Salary)
[1] 19000
> #Now looking at the variance and standard deviation
> var(data$Monthly.Salary)
[1] 391379845
> sd(data$Monthly.Salary)
[1] 19783.32
```

- Look at functions such as **seq**, **rep** to create custom sequences of numbers
- R does not have a basic function for the Mode. Try writing one by yourself.

```
my_mode <- function(x) {
  uniqueval <- unique(x)
  tab<-tabulate(match(x, uniqueval))
  uniqueval[tab==max(tab)]
}
```

- How can we use skew and kurtosis to check whether the data is bimodal?

10. Find the mean monthly salary for females

```
mean(data[data$Gender=="Male",]$Monthly.Salary)
```

Expected Output

[1] 22902.99

- Try finding the **median** of Monthly Salary for Males
  median(data[data$Gender=="Male",]$Monthly.Salary)

- What is the significance of the "," ?
  Data frames, as they are called in R, have rows and columns just like your excel sheet has.

Each cell is determined by 2 numbers, its row and column number. The same applies here. So when you run data[1,2] it will return the cell formed from the intersection of the 1st row and the 2nd column.
When you run data[condition,] you're actually asking R to check and return those rows that satisfy your condition. In other words R is returning the whole row (with all cells not just a single cell; depending on how many columns you have).

11. Find the mean monthly salaries, grouped by the Gender attribute. Explore the dplyr package

```
table_summary <- data %>%
  group_by(Gender) %>%
  summarise(means = mean(Monthly.Salary))
print(table_summary)
```

Expected Output

```
> print(table_summary)
# A tibble: 2 x 2
  Gender  means
  <fct>   <dbl>
1 Female 19675.
2 Male   22903.
```

This is a much easier way than using multiple statements for each summary

- Try to get mean, median and range of salaries for both Males and Females using the group_by clause
  HINT : You'll have to use comma separated values

```
table_summary <- data %>%
  group_by(Gender) %>%
  summarise(means = mean(Monthly.Salary),medians = median(Monthly.Salary),Range
= max(Monthly.Salary)-min(Monthly.Salary))
```

- To make this pretty you could use knitr::kable

```
knitr::kable(table_summary)
```

Expected Output

Gender	means
Female	19675.38
Male	22902.99

12. Find the Skewness and kurtosis for the Monthly Salary attribute

```
skewness(data$Monthly.Salary)
kurtosis(data$Monthly.Salary)
```

Expected Output

```
> skewness(data$Monthly.Salary)
[1] 7.947816
> kurtosis(data$Monthly.Salary)
[1] 131.3245
```

- Is the attribute left skewed?
  The positive value indicates that the monthly salary distribution is skewed towards the right

- What about it's kurtosis? platykurtic? Leptokurtic?
  Positive excess kurtosis would indicate a fat-tailed distribution, and is said to be ***leptokurtic***

Correlation and Data Reduction

13. Find the value of correlation between Loan amount and Down payment

```
cor(data$Loan.Amount.Requested,data$Down.Payment)
```

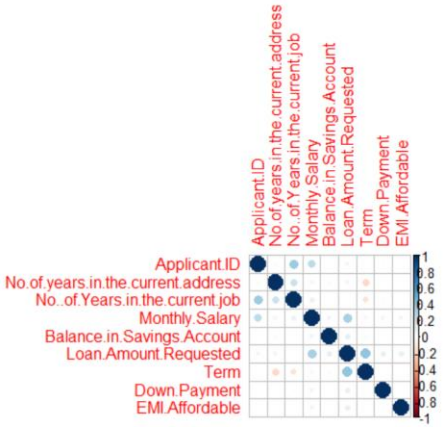
Expected Output

[1] 0.1055291

14. Explore the corrplot package to plot a correlogram between the various attributes

```
data %>% select_if(is.numeric)->data_num
c <- cor(data_num)
corrplot(c, method = "circle")
```

Expected Output



15. Perform PCA on the data

```
data %>% select_if(is.numeric)->data_num
data_num.pca <- prcomp(data_num[,-c(1)], center = TRUE,scale. = TRUE)
summary(data_num.pca)
```

Expected Output

Importance of components:

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8
Standard deviation	1.2921	1.1398	0.9952	0.9881	0.9752	0.9320	0.86866	0.70032
Proportion of Variance	0.2087	0.1624	0.1238	0.1221	0.1189	0.1086	0.09432	0.06131
Cumulative Proportion	0.2087	0.3711	0.4949	0.6169	0.7358	0.8444	0.93869	1.00000

We use data_num since it contains all the numeric attributes of data. Each of these PCs explains a percentage of the total variation in the dataset. We see that PC4 explains almost 98% of the variation in the dataset. Call str() to have a more detailed look at your PCA object

```
str(data_num.pca)
```

- More here : More about PCA

16. Visualizing PCA

```
ggbiplot(data_num.pca)
```

- First, install and include the ggbiplot package
- For PC3, PC4 etc, look at the choices parameter given in the below link
- Detailed info here : More about PCA

*****