# 20INMCAL204- Laboratory Report

Naveen Prince[1,1,1,], Siju K.S[1,1], Jobin Jose[1,1]

[a]*Department of Computer Applications RB402*
[b]*Department of Mathematics AB304*

**Abstract**

Experiments listed in the Lab Manual are successfully executed in the R version 4.1.0. Details of the experiments with input & ouput are summerized in the form of a report. Experiments are arranged in the form of sections. This report is prepared using the R-package `rticles` (**?**).

**Contents**

*Corresponding author
[1]Student, 20INMCAL204.
[2]Course Faculty, 20INMCAL204.

# 1. Experiment 4: Statistical Summary and measure of normality of a dataset

## *1.1. Aim*

1. To create the statistical summary of a data
2. To study normality of the data

## *1.2. Packages used and syntax of R methods*

For statistical summary of a given dataset, the `rbase` package will be used. To calculate skewness and kurtosis of dataset, the `ACSWR` is used.

> *Note:* The functions `skewness` and `kurtosis` from the `e1071` package are more generic functions. Another resouse is `moments` package.

## *1.3. Algorithm*

- Step 1: Load the dataset
- Step 2: Load necessary packages
- Step 3: Calculate statistical summaries
- Step 4: Calculate the `skewness` and `kurtosis` of the numerical data
- Step 5: Report the results

## *1.4. R code*

```
#loading package
library(ACSWR)
#loading data
data(yb)
#view structure of data
str(yb)
```

```
## 'data.frame':    8 obs. of  2 variables:
##  $ Preparation_1: int  31 20 18 17 9 8 10 7
##  $ Preparation_2: int  18 17 14 11 10 7 5 6
```

```
# creating statistical summary

summary(yb)
```

```
##  Preparation_1   Preparation_2
##  Min.   : 7.00   Min.   : 5.00
##  1st Qu.: 8.75   1st Qu.: 6.75
##  Median :13.50   Median :10.50
##  Mean   :15.00   Mean   :11.00
##  3rd Qu.:18.50   3rd Qu.:14.75
##  Max.   :31.00   Max.   :18.00
```

```
range(yb$Preparation_1); range(yb$Preparation_2) # list out ranges of data
```

```
## [1]  7 31
```

```
## [1]  5 18
```

```r
#skewness and kurtosis of preparation_1
skewcoeff(yb$Preparation_1); kurtcoeff(yb$Preparation_1)
```

```
## [1] 0.8548652
```

```
## [1] 2.727591
```

```r
#skewness and kurtosis of preparation_2
skewcoeff(yb$Preparation_2); kurtcoeff(yb$Preparation_2)
```

```
## [1] 0.2256965
```

```
## [1] 1.6106
```

### *1.5. Results & discussions*

A distribution is normal then `mean=median=mode` and the skewness is 0 and kurtosis is 2. In this experiment statistical summaries of two variables are created. From the skewness and kurtosis measures, both the variables are positively skewed and `preparation_1` is lepto-kurtic and `preparation_2` is meso-kurtic. Based on the statistical summary and skewness and kurtosis measures, both the variables are different from a normal distribution.

## 2. Experiment 5- Implementation of Bayes Theorem

### *2.1. Aim*

1. To calculate Bayes posterior probability using Bayes theorem

### *2.2. Packages used and syntax of R methods*

Bayes posterior probability can be directly calculated using mathematical method or using the package `LaplacesDemon`.

### *2.3. Algorithm*

- Step 1: Load the package, prior probabilities and conditionals
- Step 2: Calculate the Bayes posterior probability using the formula-$P(B_j|A) = \frac{P(A|B_j)P(B_j)}{\sum_{j=1}^{m} P(A|B_j)P(B_j)}$
- Step 3: Calculate the same prior probability using `LaplaceDemon` package
- Step 4: Report the results

*Case:* Classical Problem from Hoel, Port, and Stone (1971). Suppose there are three tables with two drawers each. The first table has a gold coin in each of the drawers, the second table has a gold coin in one drawer and a silver coin in the other drawer, while the third table has silver coins in both of the drawers. A table is selected at random and a drawer is opened which shows a gold coin.

*Observation:*The problem is to compute the probability of the other drawer also showing a gold coin. The Bayes formula can be easily implemented in an R program.

### *2.4. R code*

```r
#loading data
prob_GC <- c(1,1/2,0)
priorprob_GC <- c(1/3,1/3,1/3)
```

```r
#calculating postrior probability
post_GC <- prob_GC*priorprob_GC
post_GC/sum(post_GC)
```

```
## [1] 0.6666667 0.3333333 0.0000000
```

```r
# do the same using LaplacesDemon` package
library(LaplacesDemon)
BayesTheorem(prob_GC, priorprob_GC)
```

```
## [1] 0.6666667 0.3333333 0.0000000
## attr(,"class")
## [1] "bayestheorem"
```

*2.5. Results & discussions*

The Bayes theorem is used to calculate posterior probability of the Mathematical model of the given case. Also the result is verified using the `LaplacesDemon` package.