

Course Name :Basic Statistics using GUI-R (RKWard)

Module : Introduction to Statistics

Lecture : 1

काशी हिन्दू
विश्वविद्यालय

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https://bhu.ac.in/Site/FacultyProfile/1_5?FA000562

Pre-Requisites

- Just an Open and eager mind



AGENDA

Maths or Stats
Meaning
Nature
Uses
Limitations
Misuse
Fallacies

References



Maths and Stats

Aspect	Mathematics	Statistics
Abstract vs. Applied	Deals with abstract concepts and theoretical frameworks	Applied in nature, involves real-world data analysis
Theoretical vs. Practical	More theoretical and foundational	Practical and applied, used in various fields
Tools and Techniques	Relies on abstract reasoning, proofs, formal structures	Uses probability theory, hypothesis testing, regression
Goal	Understand abstract structures and relationships	Make informed decisions, draw conclusions from data

Meaning

- Statistics is a science which provides tools for analysis and interpretation to be used on raw data collected for the purpose of decision making in various fields of scientific inquiry.
- It involves four important terms—population, sample, parameter and statistics.
- It deals with the collection, classification and tabulation of numerical facts as the basis for explanation, description and comparison of phenomena.

Source: B1

Nature

- Observe, record and enumerate facts relating to a social phenomenon.
- Organise, classify and analyse numerical facts.
- Provides the basis for explanation, description and comparison of different phenomena.
- Helps interpretation, prediction and decision-making about a scientific inquiry.
- Facilitates the accomplishment of the ultimate objectives of scientific enquiry.

Source B1

Uses

- Drawing a representative sample and fixing its size.
- Summarising or describing the data collected.
- Systematic arrangement, mathematical analysis and interpretation of the observed data.
- Comparing individuals or groups of individuals in various ways.
- Determining whether certain aspects of behaviour are related.

Summarizing, Comparing

Source B1

Uses

- Predicting future behaviour from current information.
- Exploring the cause-and-effect relationships between two or more properties or events.
- Assessing the probability of the results occurring by chance.
- Estimating the probability of errors in the inference.
- Application in psychological problems, educational problems, scientific research, employment surveys, market research, industrial or organisational development, etc.

Causation, Association, Prediction

Source B1

Limitations

- Statistics do not study qualitative phenomenon.
- Statistics do not study individuals.
- Statistical laws are not exact.
- Statistics cannot be applied indiscriminately.
- Statistical relation does not necessarily mean a causal relationship.
- Statistics are liable to be misused.

Source : B1

Misuse

Misuse of statistics can involve the use of:

- Extremely small or biased samples
- Unexpected comparisons
- Misleading graphs and presentations

Source : B1

Fallacies

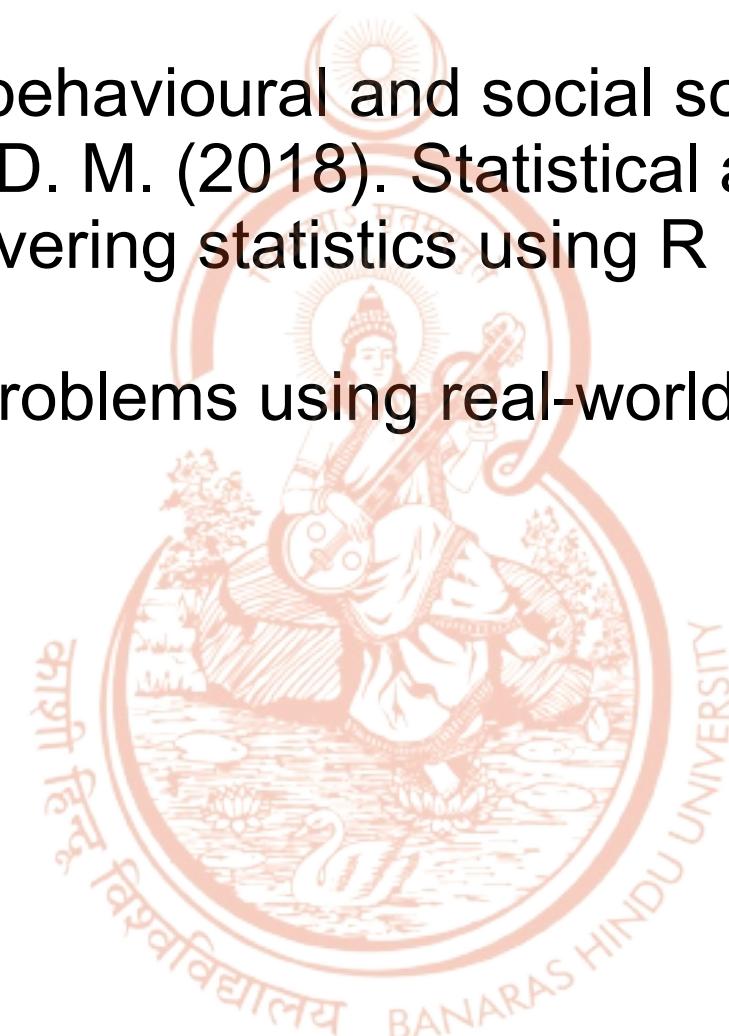
Sources of fallacies are:

- Collection of data
- Definition of terms
- Selection of units
- Classification
- Choice of methods
- Comparisons

Source : B1

References

- B1. Mohanty, B., & Misra, S. (2016). Statistics for behavioural and social sciences.
- B2. Pandya, K., Joshi, P., Balsari, S., & Nachane, D. M. (2018). Statistical analysis in simple steps using R
- B3. Field, A. P., Miles, J., & Field, Z. (2012). Discovering statistics using R
- B4. Harris, J. K. (2019). Statistics with R: solving problems using real-world data. SAGE Publications.

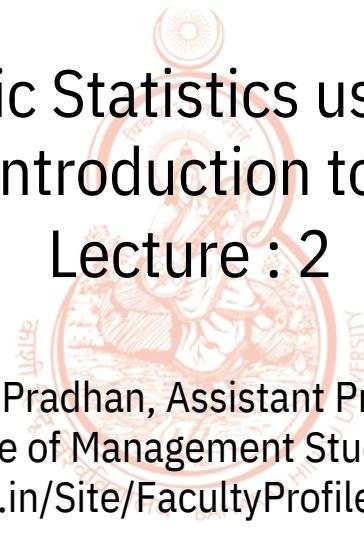


Let go Live

<https://rkward.kde.org/>

<https://rkward.kde.org/Screenshots.html>





Course Name :Basic Statistics using GUI-R (RKWard)

Module : Introduction to RKWard, R

Lecture : 2

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Last Class

- Stats → Definition, Nature, Uses, Limitations



Transition from Paper Based to Software-Based Statistics

Efficiency & Speed:

Conduct complex analyses faster.

Minimize errors with automated calculations.

Accessibility:

Access and analyze data from anywhere.

Collaborate seamlessly with team members.

Advanced Analytics:

Unlock capabilities like machine learning.

Visualize data dynamically for deeper insights.

Integration & Collaboration:

Integrate statistical tools with other data science applications.

Facilitate collaboration through easy data sharing.

Future Trends:

Embrace cloud computing for flexible and scalable solutions.

Anticipate further automation and AI-driven insights.



AGENDA

Variable

Introduction to Spreadsheet –Tabular Form of Data

Ocean of Statistical Packages

R and Stats

GUI and Command Line

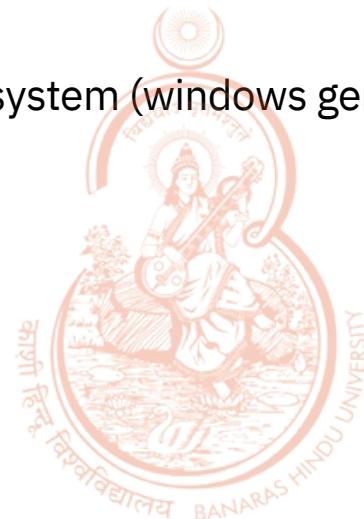
References



Steps for Installation

[RKWard \(\[kde.org\]\(http://kde.org\)\)](http://kde.org)

Find downloader for your operating system (windows generally)



Variable

Variables are used to store and manipulate information within a program. Each variable has a unique name. The process of creating a variable involves declaring its type and assigning an initial value.



Spreadsheet

Spreadsheets are powerful tools for processing and managing variables, especially when dealing with tabular data. In a spreadsheet, variables are typically represented by columns, and each row corresponds to a specific data entry or observation.

The screenshot shows a LibreOffice Calc spreadsheet window titled "test-1.csv - LibreOffice Calc". The interface includes a menu bar with File, Insert, Layout, Data, Review, View, Extension, Tools, and a toolbar with various icons for file operations and text styling. The active cell is A1. The table has 14 rows of data, starting with a header row. The columns are labeled from A to K, corresponding to the following data fields:

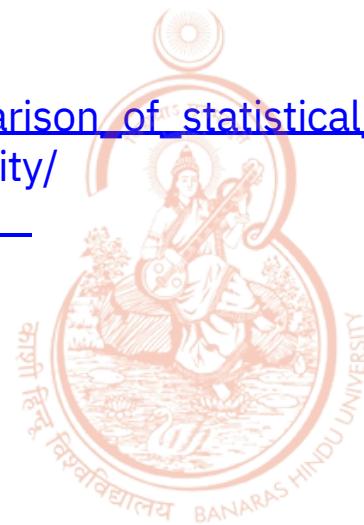
	A	B	C	D	E	F	G	H	I	J	K	
Header		Loudness	Range	True_Desk	True_Peak	dBTP	Reference	Will_clip	Clin_preset	Coin	New_Peak	New_Peak_dBTP
1	stencil.flac	-5.16 LUFS	5.65 dB	1.057608	0.49	dBTP	-18.00 LUFS	N	N	-12.84 dB	0.241255	-12.35 dBTP
2	02.We Rise.flac	-5.10 LUFS	4.29 dB	1.07017	0.59	dBTP	-18.00 LUFS	N	N	-12.90 dB	0.240216	-12.37 dBTP
3	03.final phase.flac	-4.85 LUFS	2.89 dB	1.076115	0.64	dBTP	-18.00 LUFS	N	N	-13.15 dB	0.240216	-12.37 dBTP
4	04.BLACKEOY.flac	-4.77 LUFS	2.04 dB	1.02001	0.51	dBTP	-18.00 LUFS	N	N	-11.53 dB	0.292104	-10.05 dBTP
5	05.when chance strikes.flac	-6.47 LUFS	2.82 dB	1.101115	0.84	dBTP	-18.00 LUFS	N	N	-12.20 dB	0.275067	-11.21 dBTP
6	06.Love with You.flac	-5.80 LUFS	2.95 dB	1.120597	0.99	dBTP	-18.00 LUFS	N	N	-12.30 dB	0.290602	-10.73 dBTP
7	07.Edge of the Universe.flac	-5.70 LUFS	2.90 dB	1.197767	1.57	dBTP	-18.00 LUFS	N	N	-12.13 dB	0.280005	-11.06 dBTP
8	08.under a starlit sky.flac	-5.87 LUFS	2.04 dB	1.131236	1.07	dBTP	-18.00 LUFS	N	N	-12.35 dB	0.29415	-10.63 dBTP
9	09.divine criminal.flac	-5.65 LUFS	3.46 dB	1.219337	1.72	dBTP	-18.00 LUFS	N	N	-12.55 dB	0.273816	-11.25 dBTP
10	10.killing bites.flac	-5.45 LUFS	1.95 dB	1.161245	1.30	dBTP	-18.00 LUFS	N	N	-11.74 dB	0.298631	-10.50 dBTP
11	11.crossroads.flac	-6.26 LUFS	12.52 dB	1.154105	1.24	dBTP	-18.00 LUFS	N	N	-11.48 dB	0.275399	-11.20 dBTP
12	12.sky -crossroads version-.flac	-6.52 LUFS	5.44 dB	1.033227	0.28	dBTP	-18.00 LUFS	N	N	-13.16 dB	0.242051	-12.32 dBTP
13	13.clockwork planet.flac	-4.84 LUFS	3.48 dB	1.101112	0.84	dBTP	-18.00 LUFS	N	N	-12.00 dB	0.275399	-11.20 dBTP

Ocean of Statistical Package

There are many statistical packages

https://en.wikipedia.org/wiki/Comparison_of_statistical_packages

<https://r4stats.com/articles/popularity/>



R or Excel

Free and Open Source

Strong User Community

Highly extensible, flexible

Implementation of high end statistical methods

Flexible graphics and intelligent defaults



Spread Sheet Programs

Can also help in Stats

Like G sheets, Excel ,

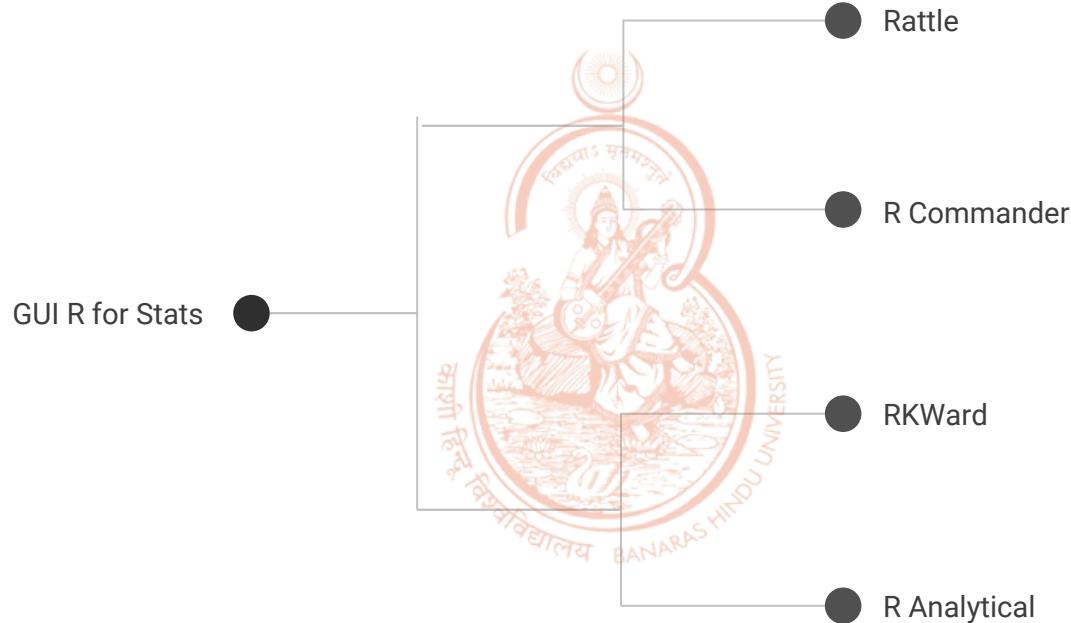
Libre Calc, etc.

To enhance their utility

we need Macros or

Google App Script

R-GUI For Stats



R World

- P. Kuhnert & B. Venables, An Introduction to R: Software for Statistical Modeling & Computing
- J.H. Maindonald, Using R for Data Analysis and Graphics
- B. Muenchen, R for SAS and SPSS Users
- W.J. Owen, The R Guide
- D. Rossiter, Introduction to the R Project for Statistical Computing for Use at the ITC
- W.N. Venables & D. M. Smith, An Introduction to R

R home page <http://www.r-project.org>

Basic R Terms

Console – Space to write commands and see output

Working Directory – Space to save and read file

Package – collection Predefined/userdefined functions ,packagename::Functionname()

Script – List of commands/ operations saved to re-run them

Workspace – Place where all variables/ functions are displayed and can be saved.

RK teaching in RKWard

```
install.packages(c("R2HTML","car","e1071","Hmisc","plyr","ggplot2","prob","ez","multcomp", "remotes"),dependencies=TRUE, repos =  
"https://cloud.r-project.org/")  
remotes::install_github("cran/prob")  
remotes::install_github("rkward-community/rk.Teaching")
```

Addition of “Teaching tab”

For ubuntu users

```
sudo apt install kibibtex kate libcurl4-openssl-dev  
libxml2-dev libfontconfig1-dev cmake  
sudo add-apt-repository ppa:rkward-devel/rkward-stab  
echo "deb https://ppa.launchpad.net/rkward-devel/rkward-stable/ubuntu/jammy main" | sudo tee /etc/apt/sources.list.d/rkward.list  
  
sudo apt update  
sudo apt-get install rkward
```



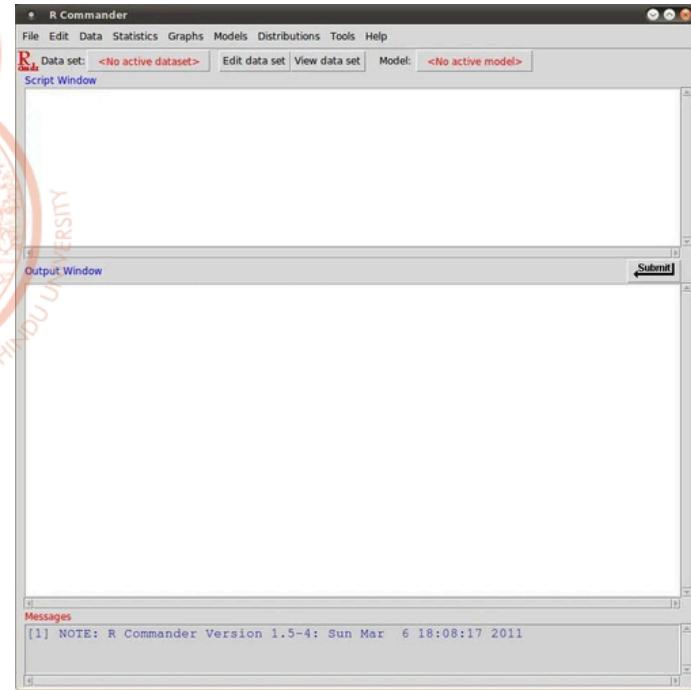
Rcmdr (R Commander)

graphical user interface (GUI) for R

Dropdown Menus

In R Console type
library("Rcmdr")

This Open "Rcmdr"



Rattle

```
if (!requireNamespace("BiocManager", quietly = TRUE))install.packages("BiocManager")
BiocManager::install("RGtk2")
```

```
install.packages(c("RGtk2","rattle"))
rattle::rattle()
```



https://www.youtube.com/watch?v=9Gvg_catDJA&t=425s

R Analytic Flow

<https://r.analyticflow.com/en/download/>



Command Line and GUI

Some commands in windows console
Type cmd

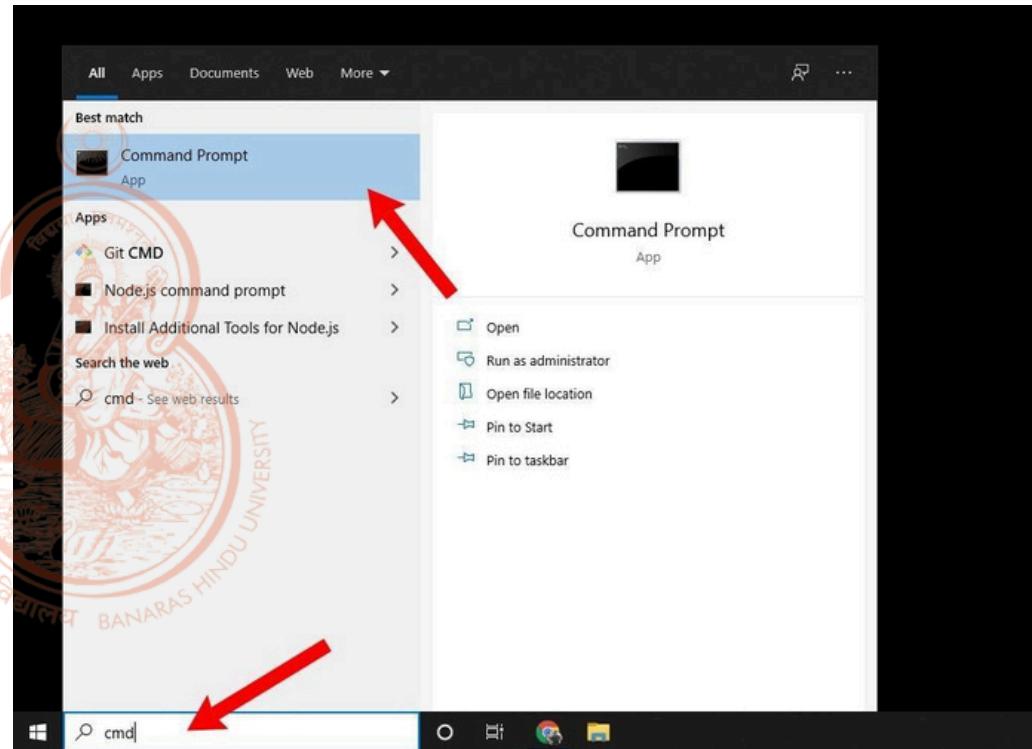
List Files in the Current Directory: `dir`

List Files in a Specific Directory: `dir C:\Path\To\Directory`

Move up one level : `cd..`

Creating New Directory : `mkdir C:\path\to\new_directory`

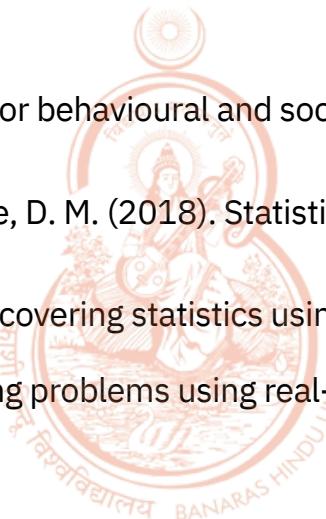
GUI- Just click mouse



Let's go to RKWard Interface



References

- 
- B1. Mohanty, B., & Misra, S. (2016). Statistics for behavioural and social sciences.
 - B2. Pandya, K., Joshi, P., Bulsari, S., & Nachane, D. M. (2018). Statistical analysis in simple steps using R
 - B3. Field, A. P., Miles, J., & Field, Z. (2012). Discovering statistics using R
 - B4. Harris, J. K. (2019). Statistics with R: solving problems using real-world data. SAGE Publications.

[https://drive.google.com/drive/folders/1gvMCW0uInKJGsVMHIWrWTpIQ13jH
pG?usp=drive_link](https://drive.google.com/drive/folders/1gvMCW0uInKJGsVMHIWrWTpIQ13jHpG?usp=drive_link)



Course Name :Basic Statistics using GUI-R (RKWard)

Module : Introduction to Statistics

Lecture : 3

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Last Class

- Introduction to Spreadsheet, RKWard



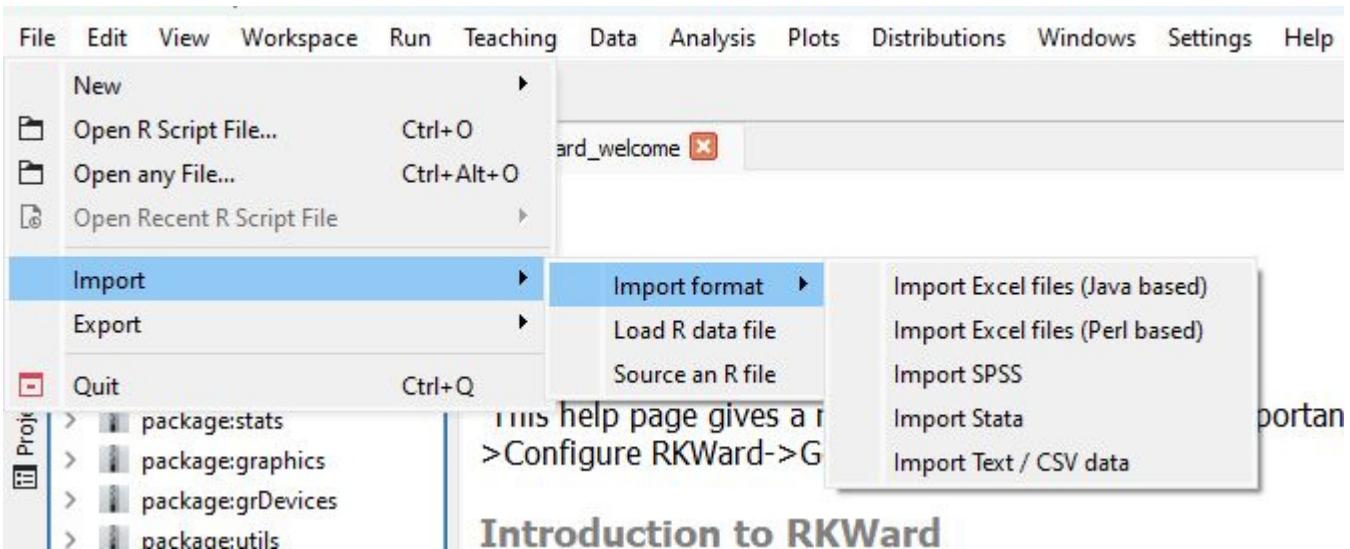
AGENDA

Importing
Data Work
Space
Command Log
Demonstratio
n Data-Types
References



Link to datafiles-

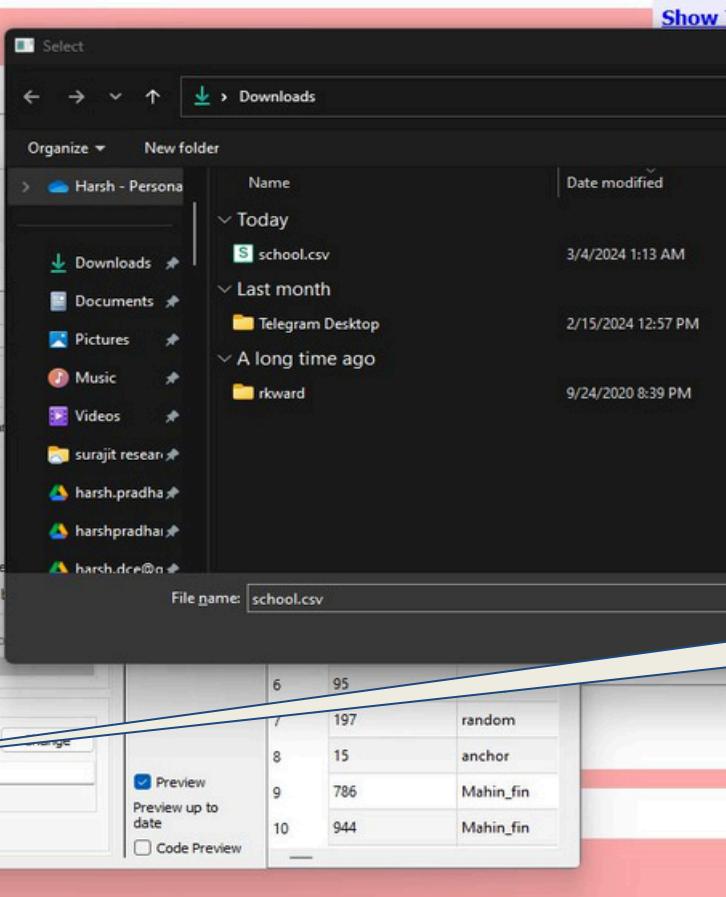
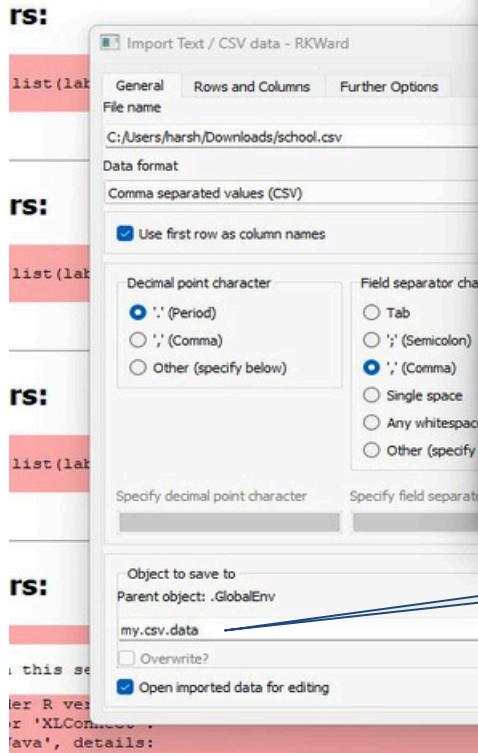
https://drive.google.com/drive/folders/1gvMCW0uInKJGsVMHIWrfWTPaIQ13jHpG?usp=drive_link



Introduction to RKWard

```
list(label = NA_character_) :
```

Show



Name of
dataset

Open Create Save

Search

Workspace

Show Hidden Objects

Name Label

My Workspace

my.csv.data

Age2cat CSE_1 CSE_10 CSE_11 CSE_12 CSE_2 CSE_3 CSE_4 CSE_5 CSE_6 CSE_7

	1	2	3	4	5	6
Name	slno	companyname	key	Study	Mode_4_catg	Mode_2
Label						
Type	String	String	String	Numeric	Numeric	Numeric
Format						
Levels						
	1	493	random	114	2	3
	2	557	Shapoorji-non	4422621136	0	3
	3	666	Bhel_har	bhelh_29	0	1
	4	682	Bhel_har	bhelh_31	0	1

The command in Background

• File name: C:/Users/harsh/Downloads/school.csv

```
## Compute
imported <- read.csv (file="C:/Users/harsh/Downloads/school.csv", na.strings = "NA", nrows = -1, skip = 0, check.names = TRUE, strip.white = FALSE, blank.lines.skip = TRUE)

# copy from the local environment to globalenv()
.GlobalEnv$my.csv.data <- imported

rk.edit (.GlobalEnv$my.csv.data)
## Print result
rk.header ("Import text / csv data", parameters=list("File name"="C:/Users/harsh/Downloads/school.csv",
    "Object to save to"="my.csv.data"))
})
.rk.rerun.plugin.link(plugin="rkward::import_csv", settings="allow_escapes.state=0\nblanklineskip.state=1\ncheckname.state=1\ncolclass.string=\ncolname.string=\ncommentchar.te
.rk.make.hr()
class(my.csv.data)

[1] "data.frame"
```

A circular watermark of the Banaras Hindu University logo is centered over the code. The logo features a central figure, likely Lord Krishna, playing a flute, surrounded by a circular border with text in Devanagari script. Below the circle, the text "BANARAS HINDU UNIVERSITY" is written in English.

Command log R Console Help search Current Project Search and Replace

Ready.

```
>Loading required package: XLConnect  
--- Please select a CRAN mirror  
Warning: package 'XLConnect' was built under R version 3.5.2  
Error: package or namespace .onLoad failed in loadNamespace  
  call: fun(libname, pkgname)  
  error: JAVA_HOME cannot be set  
Error in readWorksheetFromFile(x, sheet = 1, header = TRUE, colClasses =  
  could not find function "
```

Run again



```
> class(my.csv.data)
[1] "data.frame"
> dim(my.csv.data)
[1] 590 180
>
```

Command log > R Console Help search Current Project Search and Replace

eady.

```
> base::mean (x, ...)  
6   11   12   12   8    7   27  
> x=mean(my.csv.data$
```

Objects on search path

- my.csv.data[["slno"]]
- my.csv.data[["companynam
- my.csv.data[["key"]]
- my.csv.data[["Study"]]
- my.csv.data[["Mode_4_catg"]]
- my.csv.data[["Mode_2"]]
- my.csv.data[["Name"]]

```
> x=mean(my.csv.data$JP_01)  
> x  
[1] 4.072881  
>
```

File Teaching Data Analysis Plots Distributions Window

- Charts
- Concordance
- Data
- Descriptive statistics**
- Distributions
- Frequency distribution
- Non-parametric tests
- Parametric tests
- Probability
- Regression
- Simulations

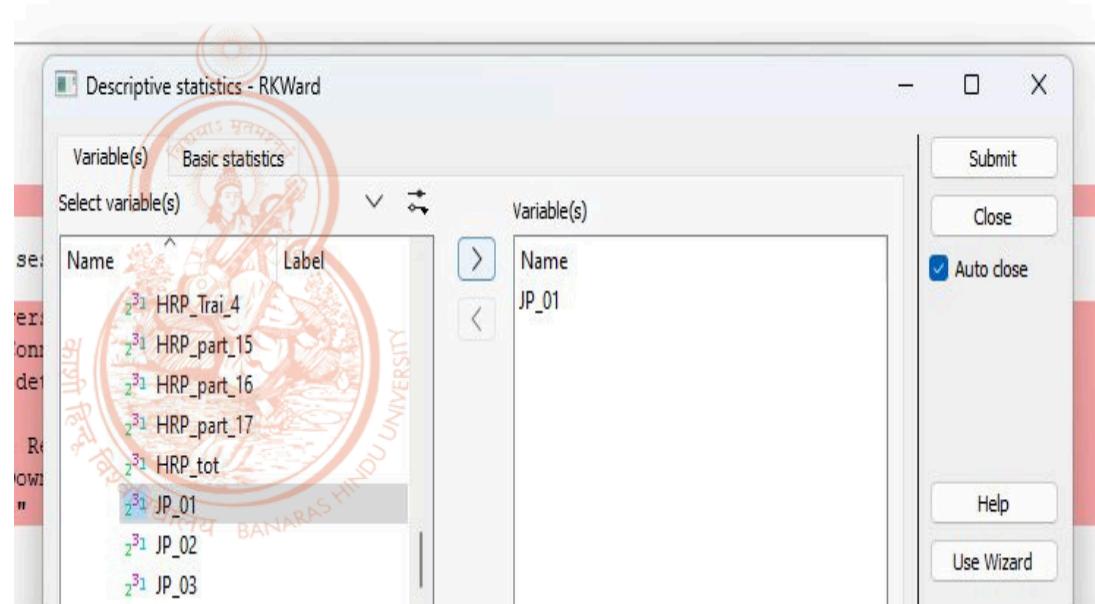
err

1]], ".rk.meta") < tribute on NULL

nings, or err

Loading required package: XLConnect

--- Please select a CRAN mirror for use



Variable(s) Basic statistics

General

Minimum Maximum

Central tendency

Arithmetic mean Median Mode

Dispersion

Variance Corrected variance
 Standard deviation Corrected standard deviation
 Coefficient of variation
 Range Interquartile range

Shape

Coefficient of skewness Coefficient of kurtosis

Quantiles

Quartiles

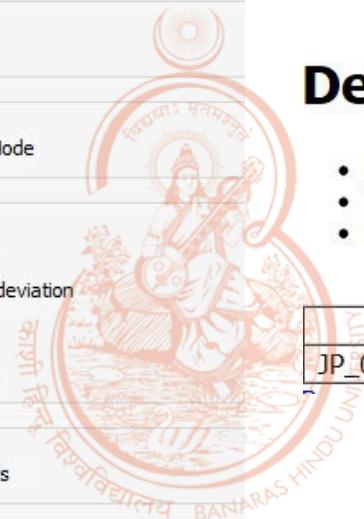
Percentiles

Enter the relative frequencies separated by commas. e.g. 0.25,0.5,0.75 for the quartiles

Descriptive statistics of JP_01

- Data frame: my.csv.data
- Variable(s): JP_01
- Ommit missing values: Yes

	Min	Max	Mean	Median	Missing	Valid
JP_01	1	5	4.0729	4	0	590



Workspace

The screenshot shows the RKWard application window titled "[Unnamed Workspace] - my.csv.data - RKWard". The menu bar includes File, Edit, View, Workspace, Run, Teaching, Data, Analysis, Plots, Distribution, and Help. The "Workspace" menu is currently active, with its submenu open. The submenu contains "Save Workspace" (Ctrl+Alt+S), "Save Workspace As" (Ctrl+Alt+Shift+S), and an "Export" option. The "Export" option is highlighted with a blue selection bar. On the left, there is a sidebar with tabs for Workspace, Files, and Projects. The Workspace tab is selected, showing a tree view with "My Workspace" expanded, containing "my.csv.data" and "x". The "Other Environments" tab is also visible. Below the tree view, there are fields for "Label" (String), "Type" (String), and "Format".

The screenshot shows the RKWard application window titled "data workspace.RData - my.csv.data - RKWard". The menu bar is identical to the first screenshot. The "Workspace" menu is active, with its submenu open. The "Save Workspace As" option is highlighted with a blue selection bar. On the right side of the interface, there is a preview panel titled "rkward_welcome" which displays a table with one row. The table has columns for "Name" (containing "slno") and "Label" (containing "1").

Data Types

5 Mode_4_catg	6 Mode_2	7 Name	8 age	9 age3gr	10 Age2cat	Gender
Numeric	Numeric	String	Numeric	1	Numeric	Numeri
				1: Numeric 2: Factor 3: String 4: Logical		
3	0	Manish Gupta	30	2	1	0
3	0	rajendra joglekar	5	3	2	

Variable View

Data View

Data Types

Data Types

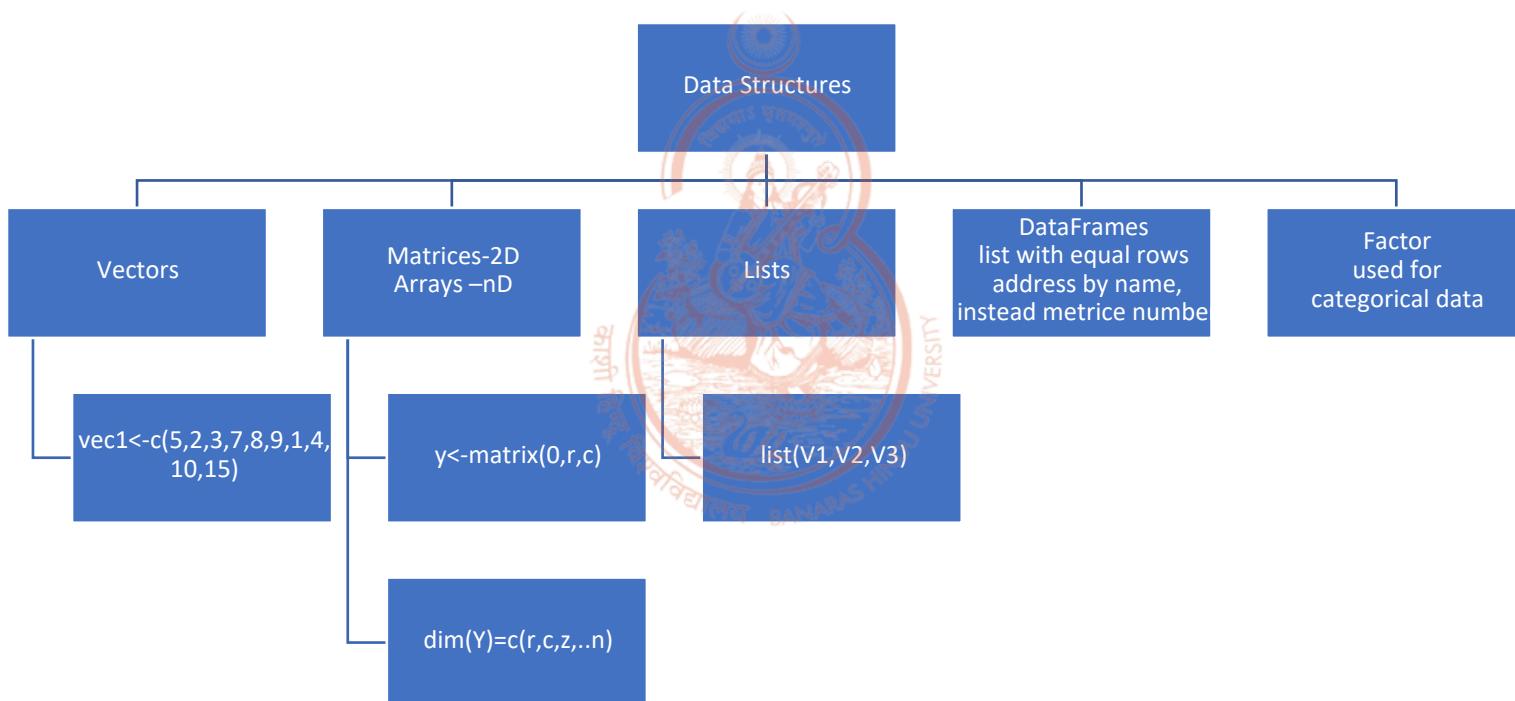
Statistical Data Types	Alternative name	R Data Types	Description
Nominal	Name	String	Represents categories or labels without any inherent order. Example: Gender (Male, Female)
Ordinal	Order	Factor	Represents categories with a meaningful order but the intervals between them are not defined. Example: Education level (High School, Bachelor's, Master's)
Interval	Range	Numeric	Represents data where the differences between values are meaningful but there is no true zero point. Example: Tax slab
Ratio	Scalar	Numeric	Represents data with a true zero point and both differences and ratios between values are meaningful. Example: Height
	Binary	Logical	Represents binary data with two possible values: TRUE or FALSE. Typically used for categorical or boolean information

Other Data Types in R

Numeric	15.2
Integer	18
Complex	2+3i
Character/String	"cc"
Logical	TRUE

x=15.6; y=as.integer(18) ; z=7+5i ; c="i am ok";
b=TRUE

Data Structure in R

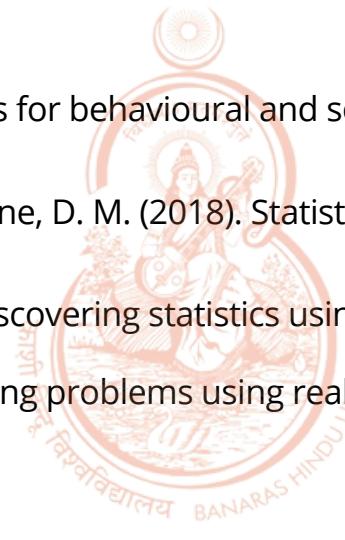


Next

Lets get some graphs



References

- 
- B1. Mohanty, B., & Misra, S. (2016). Statistics for behavioural and social sciences.
 - B2. Pandya, K., Joshi, P., Bulsari, S., & Nachane, D. M. (2018). Statistical analysis in simple steps using R
 - B3. Field, A. P., Miles, J., & Field, Z. (2012). Discovering statistics using R
 - B4. Harris, J. K. (2019). Statistics with R: solving problems using real-world data. SAGE Publications.

Link for working directory

<https://drive.google.com/drive/u/2/folders/18Mjo6qV6fPwgXSu6WMW4ubIYOQVtTaJT>

Workspace
Files

rkward_welcome

my.csv.data

Debugger Frames

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Name	slno	companyn...	key	Study	Mode_4_catg	Mode_2	Name	age	age3gr	Age2cat	Gender	age29_34	age35pl	finance	manf
Label															
Type	String	String	String	Numeric	Numeric	Numeric	String	Numeric	Numeric	Numeric	Numeric	Numeric	Numeric	Numeric	Numeric
Format															
Levels															
1	493	random	114		2	3	0	Manish Gupta	30	2	1	1	1	0	1
2	557	Shapoorji-n...	4422621136		0	3	0	rajendra jo...	53	3	2	1	0	1	0
3	666	Bhel_har	bhelh_29		0	1	0	0	30	2	1	1	1	0	0
4	682	Bhel_har	bhelh_31		0	1	0	hemendra ...	29	1	1	1	0	0	0
5	681	Bhel_har	bhelh_35		0	1	0	shiva kant	37	3	2	1	0	1	0
6	95	bhelivp	bhelivp_30		0	1	0	0	26	1	1	1	0	0	0
7	197	random	epm_29		2	1	0	Swati Murthy	34	2	2	0	1	0	0
8	15	anchor	epma_17		0	1	0	Bryon gons...	32	2	2	1	1	0	0
9	786	Mahin_fin	MF_11		0	4	1	KANNAN P.G	30	2	1	1	1	0	1
10	944	Mahin_fin	MF_117		0	4	1	0	40	3	2	0	0	1	1
11	945	Mahin_fin	MF_181		0	4	1	0	41	3	2	1	0	1	1
12	745	Mahin_fin	MF_222		0	4	1	Sunil Chou...	26	1	1	1	0	0	1
13	991	sbi_sb	sbi_12		0	2	0	0	64	3	2	1	0	1	1
14	338	random	211		2	3	0	Shan Abdur...	29	1	1	1	0	0	0
15	344	random	4263120694		2	3	0	Sonam Raj ...	27	1	1	0	0	0	0
16	443	random	4380343868		2	3	0	Khushnaz	29	1	1	0	0	0	0
17	522	Shapoorji-n...	42024425CE		0	2	0	Farhilkhan C	45	2	2	1	0	1	0

[Unnamed Workspace] - my.csv.data — RKWard

File Edit View Workspace Run Teaching Data Analysis Plots Distributions Windows Settings Help

Open Create Save Cut Copy Paste | Paste inside selection | Paste inside table | Lock | Unlock

Workspace Files Debugger Frames

rkward_welcome my.csv.data

	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Name	Mode_4_catg	Mode_2	Name	age	age3gr	Age2cat	Gender	age29_34	age35pl	finance	manf	random_gr	email	ED_qual	ED_q_gr
Label										1= manf, 0=...					
Type	Numeric	Numeric	String	Numeric	Numeric	Numeric	Numeric	Numeric	Numeric	Numeric	Numeric	Numeric	String	Numeric	Numeric
Format															
Levels															
1	3	0	Manish Gupta	30	2	1	1	1	0	1	0	2	manish.dce...	3	
2	3	0	rajendra jo...	53	3	2	1	0	1	0	1	2	rajendra_jo...	4	
3	1	0	0	30	2	1	1	1	0	0	0	2	0	4	
4	1	0	hemendra ...	29	1	1	1	0	0	0	0	2	hemendral...	3	
5	1	0	shiva kant	37	3	2	1	0	1	0	1	1	skyadav@b...	4	
6	1	0	0	26	1	1	1	0	0	0	0	1	2 0	3	
7	1	0	Swati Murthy	34	2	2	0	1	0	0	0	1	mswati@g...	5	
8	1	0	Bryon gons...	32	2	2	1	1	0	0	0	1	2 bryan.gons...	3	
9	4	1	KANNAN P.G	30	2	1	1	1	0	1	0	2	kpg41@ya...	3	
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11	4	1	0	41	3	2	1	0	1	1	0	1	0	3	
12	4	1	Sunil Chou...	26	1	1	1	0	0	1	0	2	Chouhan.s...	3	
13	2	0	0	64	3	2	1	0	1	1	0	2	0	3	
14	3	0	Shan Abdur...	29	1	1	1	0	0	0	0	1	Shanarahm...	4	
15	3	0	Sonam Raj ...	27	1	1	0	0	0	0	0	2	0	4	
16	3	0	Khushnaz	29	1	1	0	0	0	0	1	2	khushnarit...	4	
17	3	0	Farahkhan r	AE	3	2	1	1	0	1	1	2	farahkhanr...	4	

Course Name :Basic Statistics using GUI-R (RKWard)
Module : Introduction to Basic Maths For Stats
Lecture : 4

Harsh Pradhan, Assistant Professor,
Institute of Management Studies, BHU
https://bhu.ac.in/Site/FacultyProfile/1_5?FA000562

Last Class

- Import File in RKWard
- Processing Dataset

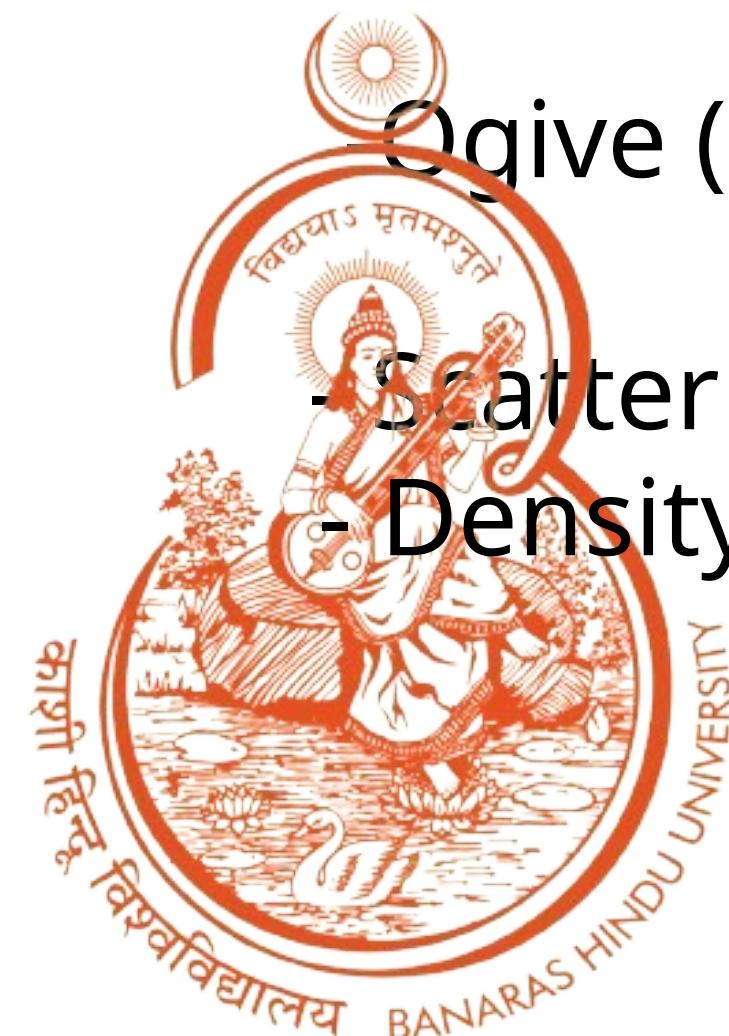


AGENDA

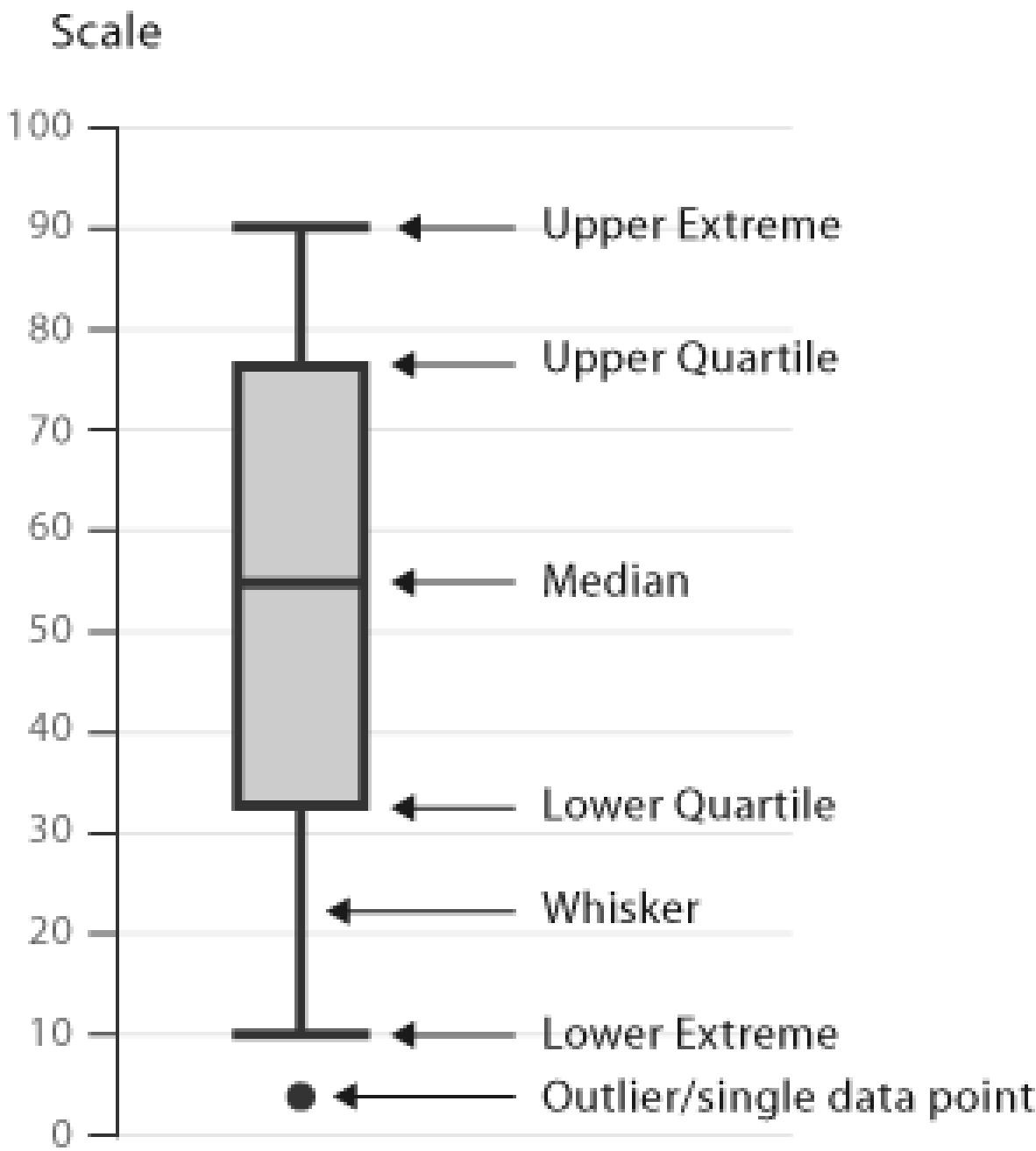
Plots

- Histogram
 (Histogram)
- Piechart
- Box chart

- Ogive (Cumulative Freq
- Scatter Plot
- Density chart



Box Plot



References

- B1. Mohanty, B., & Misra, S. (2016). Statistics for behavioural and social sciences.
- B2. Pandya, K., Joshi, P., Balsari, S., & Nachane, D. M. (2018). Statistical analysis in simple steps using R
- B3. Field, A. P., Miles, J., & Field, Z. (2012). Discovering statistics using R
- B4. Harris, J. K. (2019). Statistics with R: solving problems using real-world data. SAGE Publications.

