

LAB

STATISTICS WITH R PROGRAMMING FOR VISUALIZATION

COURSE CODE: ITA0435

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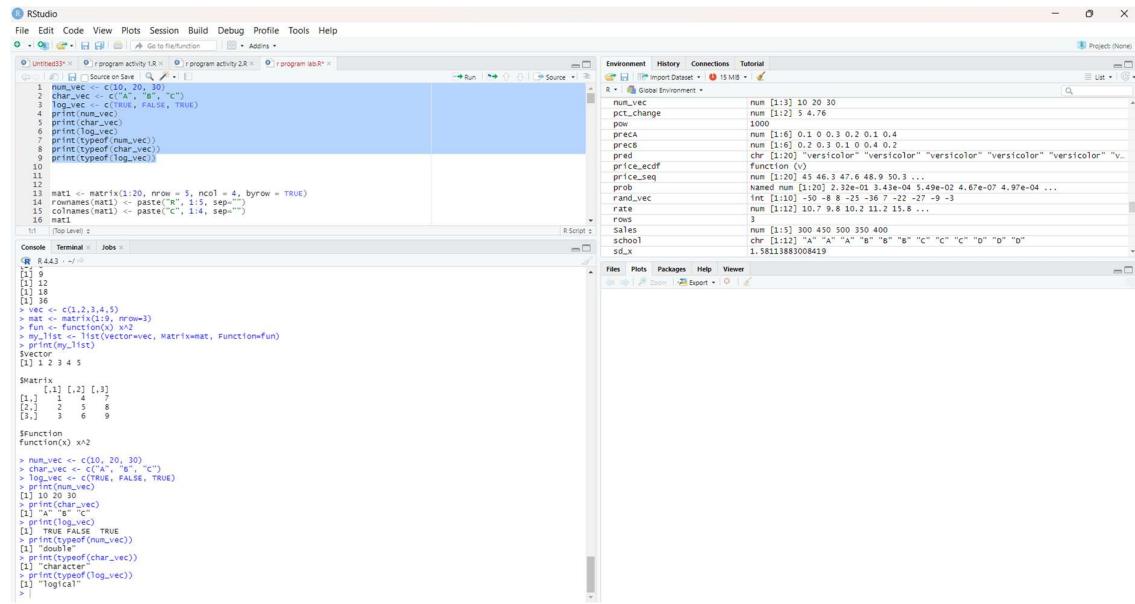
REG NO:192324226

1. Create numeric, character, and logical vectors and display type and content.

CODE:

```
num_vec <- c(10, 20, 30)
char_vec <- c("A", "B", "C")
log_vec <- c(TRUE, FALSE, TRUE)
print(num_vec)
print(char_vec)
print(log_vec)
print(typeof(num_vec))
print(typeof(char_vec))
print(typeof(log_vec))
```

OUTPUT:



The screenshot shows the RStudio interface with the following details:

- Code Editor:** Displays the R script with the code provided above.
- Console:** Shows the output of the code:

```
[1] 9
[1] 12
[1] 18
[1] 16
> vec <- c(1,2,3,4,5)
> mat <- matrix(vec, nrow=3)
> fun <- function(x) x*2
> my_list <- lapply(vec, Matrix=mat, Function=fun)
> print(my_list)
[[1]] 
[1] 2 3 4 5
$Matrix
[,1] [,2] [,3]
[1,]    2    4    7
[2,]    3    6   10
[3,]    4    8   13
$function
function(x) x*2
```
- Environment View:** Shows the following objects and their values:

| Object | Type | Value |
|------------|---------------|---|
| num_vec | numeric | [1:3] 10 20 30 |
| pop_change | numeric | [1:2] 5 7.76 |
| precA | numeric | [1:6] 0.1 0 0.3 0.2 0.1 0.4 |
| precB | numeric | [1:6] 0.2 0.3 0.1 0.4 0.2 |
| prec_ecdf | function | function (x) { |
| price_seq | numeric | [1:20] 45 46.3 47.6 48.9 50.3 ... |
| prob | named numeric | [1:20] 0.2 0.3 0.2 0.1 0.4 0.3 0.2 0.1 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 |
| rate | numeric | [1:12] 10.7 9.8 10.2 11.2 13.8 ... |
| rows | integer | 3 |
| sales | numeric | [1:5] 300 450 500 550 400 |
| school | character | [1:12] "A" "A" "B" "B" "C" "C" "D" "D" |
| sd_X | double | 1.58113883098419 |

2. Create labeled matrices (5×4 , 3×3 , 2×2) filled by row/column.

CODE:

```
mat1 <- matrix(1:20, nrow = 5, ncol = 4, byrow = TRUE)
rownames(mat1) <- paste("R", 1:5, sep="")
colnames(mat1) <- paste("C", 1:4, sep="")
```

```

mat1

mat2 <- matrix(1:9, nrow = 3, ncol = 3)

rownames(mat2) <- paste("R", 1:3, sep="")

colnames(mat2) <- paste("C", 1:3, sep="")

mat2

mat3 <- matrix(1:4, nrow = 2, ncol = 2, byrow = TRUE)

rownames(mat3) <- c("Row1", "Row2")

colnames(mat3) <- c("Col1", "Col2")

mat3

```

OUTPUT:

The screenshot shows the RStudio interface with the following details:

- Environment pane:** Displays objects in the global environment, including:
 - mat1: int [1:5, 1:4] 1 5 9 13 17 2 6 10 14 18 ...
 - mat2: int [1:3, 1:3] 1 2 3 4 5 6 7 8 9
 - mat3: int [1:2, 1:2] 1 3 2 4
 - model: List of 30
 - model_humidity: List of 12
 - model_wind: List of 12
 - monthly_avg: 5 obs. of 5 variables
 - mul: int [1:2, 1:3] 7 16 27 40 55 72
 - obs: List
 - new_row: 1 obs. of 4 variables
 - output: List of 2
 - population_data: 3 obs. of 2 variables
 - prec_max: num [1:2, 1:6] 0.1 0.2 0 0.3 0.3 0.1 0.2 0 0.1 0.4 ...
 - rating_surface: num [1:20, 1:20] 0.201 4.74 4.21 4.18 4.15 4.11 ...
- Console pane:** Shows the R session history, including code execution and output. Key parts of the session include:
 - Creating matrices mat1, mat2, and mat3.
 - Defining row and column names for mat2 and mat3.
 - Displaying the contents of mat3.

3. Write an R program to create and display a 3D array with specified rows, columns, and tables.

CODE:

```

rows <- 3

cols <- 3

tables <- 2

arr <- array(1:(rows * cols * tables),

            dim = c(rows, cols, tables))

print(arr)

```

OUTPUT:

The screenshot shows the RStudio interface. In the top-left, there are three tabs: "program activity 1.R", "program activity 2.R", and "r program labA.R". The "r program labA.R" tab is active, displaying the following R code:

```

28
29 rows <- 3
30 cols <- 3
31 tables <- 2
32 arr <- array(1:(rows * cols * tables),
33             dim = c(rows, cols, tables))
34 print(arr)
35
36
37
38
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40
41 data_vec <- 1:12
42 arr <- array(data_vec,
43               dim = c(1, 12))
44

```

In the bottom-left "Console" tab, the output of the code is shown:

```

R 4.4.3 -->
R> 17 18 19 20
R> mat2 <- matrix(c(1:9, nrow = 3, ncol = 3)
R> rownames(mat2) <- paste("R", 1:3, sep = "")
R> colnames(mat2) <- paste("C", 1:3, sep = "")
R> mat2
     C1 C2 C3
R1 1  4  7
R2 2  5  8
R3 3  6  9
R> mat3 <- matrix(1:14, nrow = 2, ncol = 2, byrow = TRUE)
R> rownames(mat3) <- c("Row1", "Row2")
R> colnames(mat3) <- c("Col1", "Col2")
R> mat3
     Col1 Col2
Row1 1   2
Row2 3   4
> rows <- 3
> cols <- 3
> tables <- 2
> arr <- array(1:(rows * cols * tables),
+               dim = c(rows, cols, tables))
> print(arr)
, , 1
     [,1] [,2] [,3]
[1,] 1   4   7
[2,] 2   5   8
[3,] 3   6   9
, , 2
     [,1] [,2] [,3]
[1,] 1   4   7
[2,] 11  14  17
[3,] 12  15  18
> |

```

4. Create arrays from vectors with dimension names, print specific elements.

CODE:

```

data_vec <- 1:12

arr <- array(data_vec,
             dim = c(2, 3, 2),
             dimnames = list(
               Row = c("R1", "R2"),
               Column = c("C1", "C2", "C3"),
               Table = c("T1", "T2"))
             )
print(arr)

print(arr["R1", "C2", "T1"])

print(arr["R2", "C3", "T2"])

```

OUTPUT:

The screenshot shows the RStudio interface with the following details:

- File Bar:** File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, Help.
- Source Editor:** Contains R code for creating a matrix from vectors and printing its rows and columns.
- Console:** Displays the output of the R code, including the resulting matrix and its transpose.
- Environment Tab:** Shows the global environment with various objects like arr, att_seq, average_values, b, browser, c, data, diag_elements, and div.
- Global Environment:** Shows the same objects listed under the environment tab.
- Help:** Standard RStudio help menu.
- Viewer:** Shows the raw text of the R code.

5. Create and manipulate factor variables (e.g., women's dataset heights, random LETTERS sample).

CODE:

```
data(women)

height_group <- factor(
  ifelse(women$height < 65, "Short",
        ifelse(women$height <= 70, "Medium", "Tall"))
)

print(height_group)
levels(height_group)

set.seed(1)

letters_sample <- sample(LETTERS[1:5], 10, replace = TRUE)

letters_factor <- factor(letters_sample)

print(letters_factor)
levels(letters_factor)
table(letters_factor)
```

OUTPUT:

The screenshot shows the RStudio interface with the following details:

- Code Editor:** Displays R code for generating a sample dataset and creating a factor variable.
- Console:** Shows the output of the R code, including the creation of vectors, matrices, and functions.
- Environment View:** Shows the global environment with variables like `women` (15 obs. of 2 variables), `year_population_data` (5 obs. of 2 variables), and `values` (a vector of 10 values).

```

RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Source On Save Run source ...
/ Source On Save Run source ...
height_group <- factor(
  60   ifelse(women$height < 65, "short",
  61   +   ifelse(women$height >= 70, "Medium", "Tall"))
  62 )
print(height_group)
levels(height_group)
set.seed(123)
letters_sample <- sample(LETTERS[1:5], 10, replace = TRUE)
letters_factor <- factor(letters_sample)
print(letters_factor)
levels(letters_factor)
table(letters_factor)
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```

7. Write R programs for basic tasks: Factors of a number, generate a vector of 10 random integers between -50 and 50, print numbers 1–100 with FizzBuzz logic.

CODE:

```
rand_vec <- sample(-50:50, 10, replace = TRUE)

print(rand_vec)

for(i in 1:100){

  if(i %% 3 == 0 && i %% 5 == 0){

    print("FizzBuzz")

  } else if(i %% 3 == 0){

    print("Fizz")

  } else if(i %% 5 == 0){

    print("Buzz")

  } else {

    print(i)

  }
}
```

OUTPUT:

The screenshot shows the RStudio interface with the code in the Source editor and the output in the Console and Environment panes.

```
83 rand_vec <- sample(-50:50, 10, replace = TRUE)
84 print(rand_vec)
85 [1] 34 -39 23 -44 22 28 34 -14 38
86
87 for(i in 1:100){
88   if(i %% 3 == 0 && i %% 5 == 0){
89     print("FizzBuzz")
90   } else if(i %% 3 == 0){
91     print("Fizz")
92   } else if(i %% 5 == 0){
93     print("Buzz")
94   } else {
95     print(i)
96   }
97 }
98 [1] 1
99 [1] 2
[1] "Fizz"
[1] 4
[1] "Buzz"
[1] "Fizz"
[1] 7
[1] "Fizz"
[1] 8
[1] "Fizz"
[1] "Buzz"
[1] 10
[1] "Fizz"
[1] 12
[1] "Fizz"
[1] 13
[1] "Fizz"
[1] "Buzz"
[1] 16
[1] "Fizz"
[1] 18
[1] "Buzz"
[1] "Fizz"
[1] 22
[1] "Fizz"
[1] 23
[1] "Fizz"
```

The Environment pane shows various global variables and their values:

- rand_vec: int [1:10] 34 -39 23 -44 22 28 34 -14 38
- rate: num [1:12] 10.7 9.8 10.2 11.2 15.8 ...
- rows: num [1:37] 300 450 500 350 400
- Sales: chr [1:12] "A" "A" "B" "B" "C" "C" "D" "D" "E" "E" "F" "F"
- sd_X: 1.58113883008419
- selection: num [1:15] 23 12 45 20 35
- selected_sorted: num [1:15] 15 35 23 20 12
- skew_price: 0.2831375504946
- skew_rating: 0.444805695867977
- students: num [1:12] 25 30 20 22 28 18 20 25 15 28 ...
- sum: ...
- sum_data: num [1:3(10)] 52.3 71.7 76.9
- sum_X: 15L
- tab: "table" int [1:5, 1:5] 0 0 0 1 0 0 0 1 0 0 ...

8. Generate random numbers from a normal distribution; count occurrences.

CODE:

```
set.seed(1)

x <- rnorm(20, mean = 0, sd = 1)
```

```

print(x)

x_round <- round(x, 1)

freq <- table(x_round)

print(freq)

```

OUTPUT:

The screenshot shows the RStudio interface with the following details:

- Code Editor:** Displays the R script with the following code:

```

print(x)

x_round <- round(x, 1)

freq <- table(x_round)

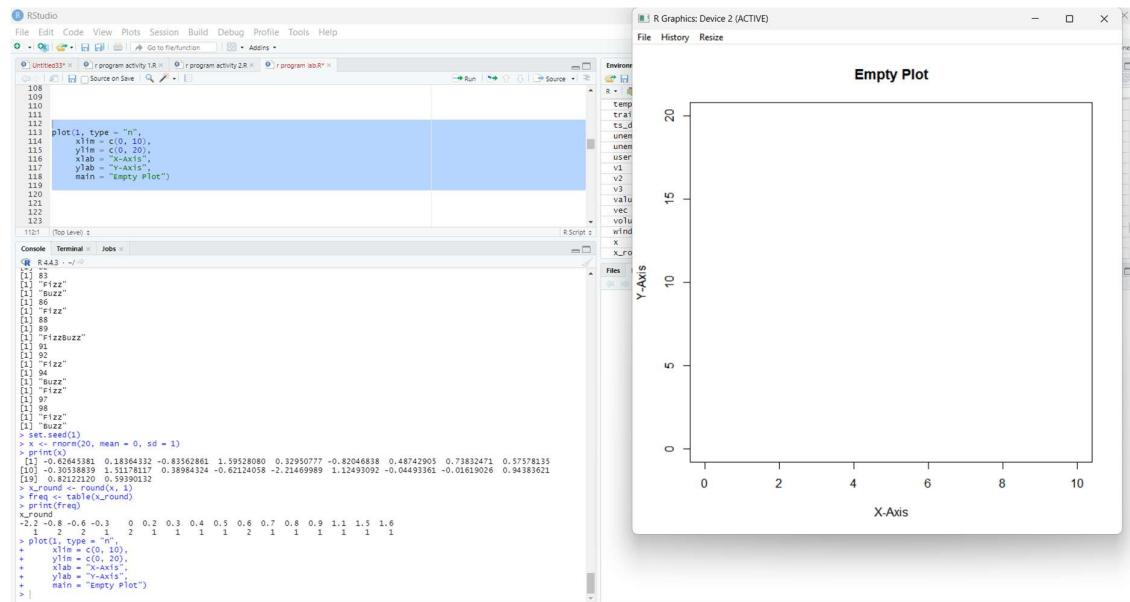
print(freq)

```
- Console:** Shows the output of the script:

```

[1] "27"
[2] "98"
[3] "99"
[4] "100"
[5] "101"
[6] "#> seed(1)
[7] x <- rnorm(20, mean = 0, sd = 1)
[8] print(x)
[9] x_round <- round(x, 1)
[10] freq <- table(x_round)
[11] print(freq)
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```



10. Create and explore a data frame exam_data with name, score, attempts, and qualify fields. Perform extract, add row/column, sort, save to file.

CODE:

```
exam_data <- data.frame(  
  name = c("niki", "navya", "Chandu", "Divya"),  
  score = c(85, 72, 90, 65),  
  attempts = c(1, 2, 1, 3),  
  qualify = c(TRUE, TRUE, TRUE, FALSE))  
  
print(exam_data)  
print(exam_data$score)  
print(exam_data[1:2, ])  
  
new_row <- data.frame(  
  name = "Esha",  
  score = 88,  
  attempts = 1,  
  qualify = TRUE)  
  
exam_data <- rbind(exam_data, new_row)  
exam_data$grade <- c("B", "C", "A", "D", "B")  
  
print(exam_data)
```

```

sorted_data <- exam_data[order(-exam_data$score), ]
print(sorted_data)
write.csv(exam_data, "exam_data.csv", row.names = FALSE)

```

OUTPUT:

The screenshot shows the RStudio interface with the following details:

- Code Editor:** Displays the R code provided above.
- Environment View:** Shows the global environment with various objects and their sizes.
- Console View:** Displays the output of the R code execution, including the creation of the `sorted_data` data frame and its contents.

```

124 exam_data <- data.frame(
125   name = c("nik1", "navya", "chandu", "Divya"),
126   score = c(85, 72, 90, 65),
127   attempts = c(1, 2, 1, 3),
128   qualify = c(FALSE, TRUE, TRUE, FALSE)
129 )
130 print(exam_data)
131 exam_data$grade <- c("B", "C", "A", "D")
132 print(exam_data)
133 sorted_data <- exam_data[order(-exam_data$score), ]
134 new_row <- data.frame(
135   name = "Esha",
136   score = 88,
137   attempts = 1,
138   qualify = TRUE
139 )
140 exam_data <- rbind(exam_data, new_row)
141 exam_data$grade <- c("B", "C", "A", "D", "B")
142 print(exam_data)
143 sorted_data <- exam_data[order(-exam_data$score), ]
144 print(sorted_data)
145 write.csv(exam_data, "exam_data.csv", row.names = FALSE)
146
147
148 [Top Level] z

```

```

> exam_data <- data.frame(
+   name = c("nik1", "navya", "chandu", "Divya"),
+   score = c(85, 72, 90, 65),
+   attempts = c(1, 2, 1, 3),
+   qualify = c(FALSE, TRUE, TRUE, FALSE)
+ )
1 nik1 85 1 FALSE
2 navya 72 2 TRUE C
3 Chandu 90 1 TRUE A
4 Divya 65 3 FALSE D
5 Esha 88 1 TRUE B
> print(exam_data)
  name score attempts qualify grade
1 nik1    85        1   FALSE   B
2 navya   72        2    TRUE   C
3 Chandu  90        1    TRUE   A
4 Divya   65        3   FALSE   D
5 Esha    88        1    TRUE   B
> print(sorted_data)
  name score attempts qualify grade
1 Chandu  90        1    TRUE   A
2 Esha    88        1    TRUE   B
3 nik1    85        1   FALSE   B
4 navya   72        2    TRUE   C
5 Divya   65        3   FALSE   D
> write.csv(exam_data, "exam_data.csv", row.names = FALSE)
>

```