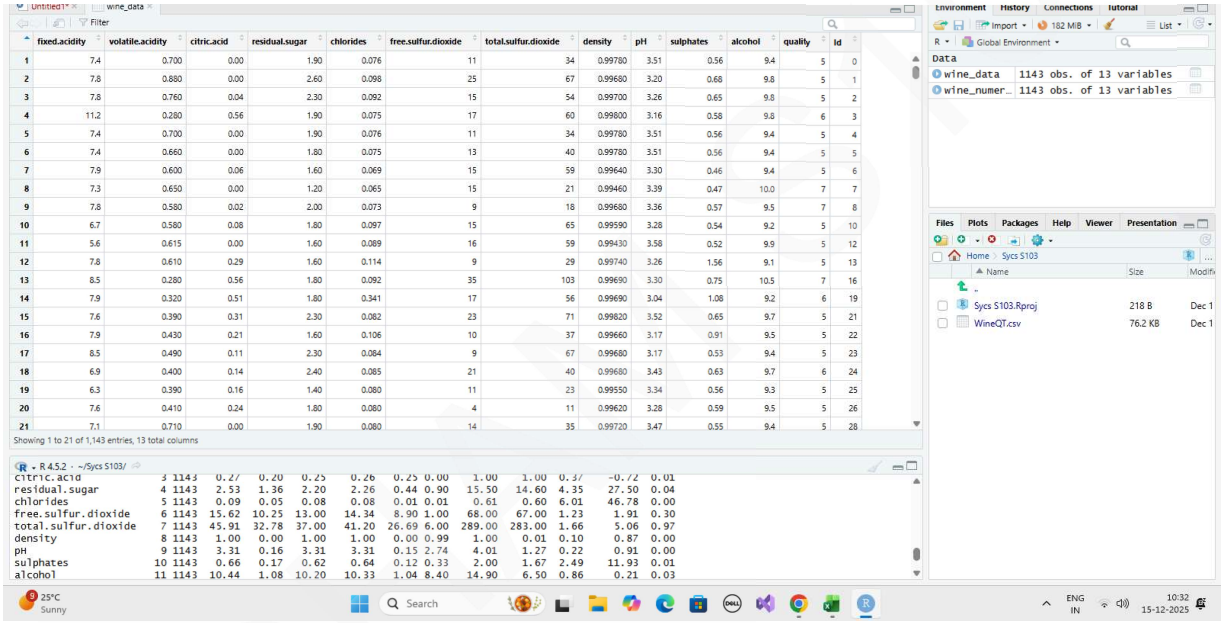
SHETH L.U.J. AND SIR M.V. COLLEGE
SUBJECT:Data Analysis with R

Aim: **1** Generating descriptive statistics using summary() or describe() (R),**2** Generating frequency tables using table() or count(),**3** Creating cross-tabulations and two-way tables using table() , **4** Performing one-sample t-tests using t.test(),**5** Performing independent two-sample t-tests using t.test() with grouping ,**6** Performing paired t-tests using t.test(paired=TRUE)

MODULE 2 1 TO 6

Outputs

1st:



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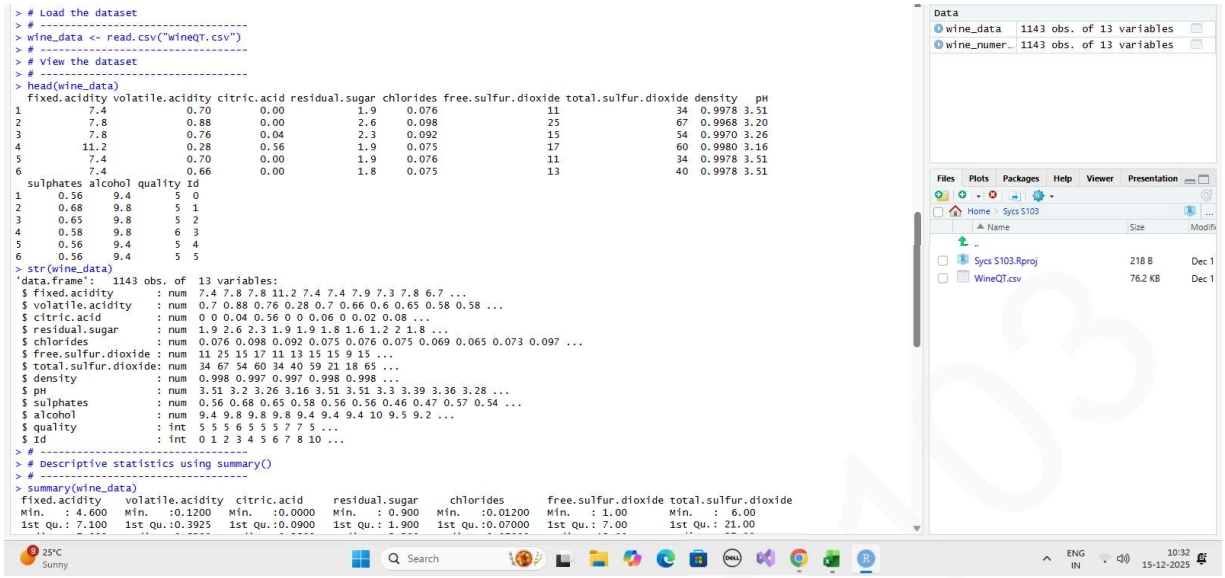
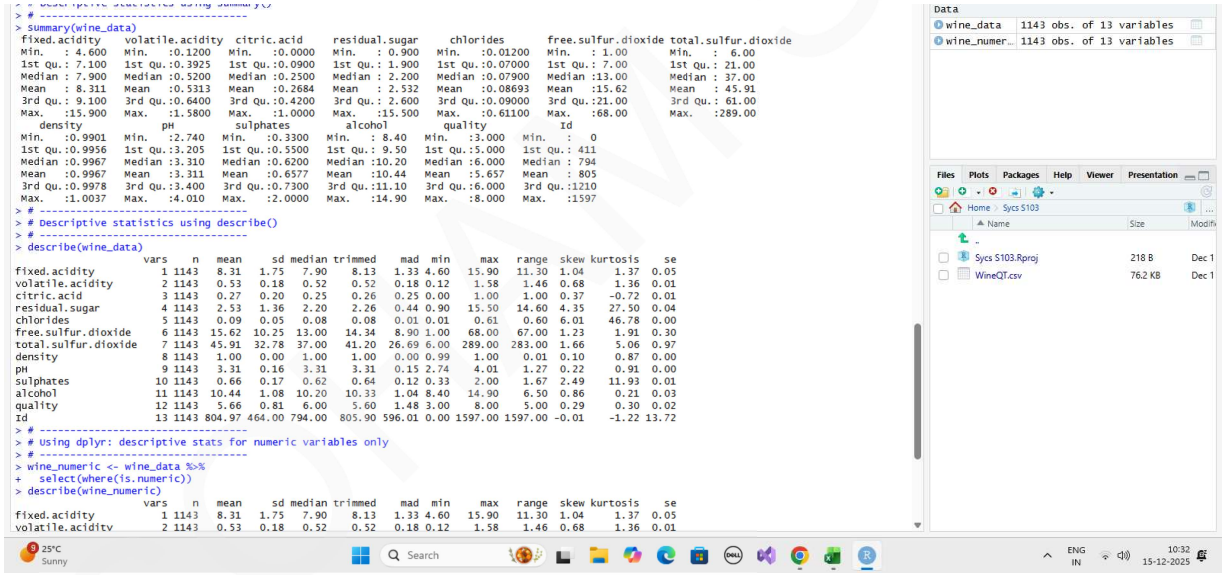


```
> # Load the dataset
> # ------------------------------------
> wine_data <- read.csv("WineQT.csv")
> # ------------------------------------
> # View the dataset
> # ------------------------------------
> head(wine_data)
  fixed.acidity volatile.acidity citric.acid residual.sugar chlorides free.sulfur.dioxide total.sulfur.dioxide density   pH
1           7.4             0.70        0.00            1.9     0.076                  11                   34  0.9978 3.51
2           7.8             0.88        0.00            2.6     0.098                  25                   67  0.9968 3.20
3           7.8             0.76        0.04            2.3     0.092                  15                   54  0.9970 3.26
4          11.2             0.28        0.56            1.9     0.075                  17                   60  0.9980 3.16
5           7.4             0.70        0.00            1.9     0.076                  11                   34  0.9978 3.51
6           7.4             0.66        0.00            1.8     0.075                  13                   40  0.9978 3.51
  sulphates alcohol quality Id
1      0.56     9.4       5  0
2      0.68     9.8       5  1
3      0.65     9.8       5  2
4      0.58     9.8       6  3
5      0.56     9.4       5  4
6      0.56     9.4       5  5
> str(wine_data)
'data.frame':   1143 obs. of  13 variables:
 $ fixed.acidity       : num  7.4 7.8 7.8 11.2 7.4 7.4 7.9 7.3 7.8 6.7 ...
 $ volatile.acidity    : num  0.7 0.88 0.76 0.28 0.7 0.66 0.6 0.65 0.58 0.58 ...
 $ citric.acid         : num  0 0 0.04 0.56 0 0 0.06 0 0.02 0.08 ...
 $ residual.sugar      : num  1.9 2.6 2.3 1.9 1.9 1.8 1.6 1.2 2 1.8 ...
 $ chlorides           : num  0.076 0.098 0.092 0.075 0.076 0.075 0.069 0.065 0.073 0.097 ...
 $ free.sulfur.dioxide : num  11 25 15 17 11 13 15 15 9 15 ...
 $ total.sulfur.dioxide: num  34 67 54 60 34 40 59 21 18 65 ...
 $ density             : num  0.998 0.997 0.997 0.998 0.998 ...
 $ pH                  : num  3.51 3.2 3.26 3.16 3.51 3.51 3.3 3.39 3.36 3.28 ...
 $ sulphates           : num  0.56 0.68 0.65 0.58 0.56 0.56 0.46 0.47 0.57 0.54 ...
 $ alcohol             : num  9.4 9.8 9.8 9.8 9.4 9.4 9.4 10 9.5 9.2 ...
 $ quality             : int  5 5 5 6 5 5 5 7 7 5 ...
 $ Id                  : int  0 1 2 3 4 5 6 7 8 10 ...
> # ------------------------------------
> # Descriptive statistics using summary()
> # ------------------------------------
> summary(wine_data)
 fixed.acidity    volatile.acidity  citric.acid     residual.sugar     chlorides       free.sulfur.dioxide total.sulfur.dioxide
 Min.   : 4.600   Min.   :0.1200   Min.   :0.0000   Min.   : 0.900   Min.   :0.01200   Min.   : 1.00       Min.   :  6.00
 1st Qu.: 7.100   1st Qu.:0.3925   1st Qu.:0.0900   1st Qu.: 1.900   1st Qu.:0.07000   1st Qu.: 7.00       1st Qu.: 21.00
```



```
> # ------------------------------------
> summary(wine_data)
 fixed.acidity    volatile.acidity  citric.acid     residual.sugar     chlorides       free.sulfur.dioxide total.sulfur.dioxide
 Min.   : 4.600   Min.   :0.1200   Min.   :0.0000   Min.   : 0.900   Min.   :0.01200   Min.   : 1.00       Min.   :  6.00
 1st Qu.: 7.100   1st Qu.:0.3925   1st Qu.:0.0900   1st Qu.: 1.900   1st Qu.:0.07000   1st Qu.: 7.00       1st Qu.: 21.00
 Median : 7.900   Median :0.5200   Median :0.2500   Median : 2.200   Median :0.07900   Median :13.00       Median : 37.00
 Mean   : 8.311   Mean   :0.5313   Mean   :0.2684   Mean   : 2.532   Mean   :0.08693   Mean   :15.62       Mean   : 45.91
 3rd Qu.: 9.100   3rd Qu.:0.6400   3rd Qu.:0.4200   3rd Qu.: 2.600   3rd Qu.:0.09000   3rd Qu.:21.00       3rd Qu.: 61.00
 Max.   :15.900   Max.   :1.5800   Max.   :1.0000   Max.   :15.500   Max.   :0.61100   Max.   :68.00       Max.   :289.00
    density             pH          sulphates         alcohol          quality            Id
 Min.   :0.9901   Min.   :2.740   Min.   :0.3300   Min.   : 8.40   Min.   :3.000   Min.   :   0
 1st Qu.:0.9956   1st Qu.:3.205   1st Qu.:0.5500   1st Qu.: 9.50   1st Qu.:5.000   1st Qu.: 411
 Median :0.9967   Median :3.310   Median :0.6200   Median :10.20   Median :6.000   Median : 794
 Mean   :0.9967   Mean   :3.311   Mean   :0.6577   Mean   :10.44   Mean   :5.657   Mean   : 805
 3rd Qu.:0.9978   3rd Qu.:3.400   3rd Qu.:0.7300   3rd Qu.:11.10   3rd Qu.:6.000   3rd Qu.:1210
 Max.   :1.0037   Max.   :4.010   Max.   :2.0000   Max.   :14.90   Max.   :8.000   Max.   :1597
> # ------------------------------------
> # Descriptive statistics using describe()
> # ------------------------------------
> describe(wine_data)
                      vars    n   mean    sd median trimmed   mad  min     max   range  skew kurtosis   se
fixed.acidity            1 1143   8.31  1.75   7.90    8.13  1.33 4.60   15.90   11.30  1.04     1.37 0.05
volatile.acidity         2 1143   0.53  0.18   0.52    0.52  0.18 0.12    1.58    1.46  0.68     1.36 0.01
citric.acid              3 1143   0.27  0.20   0.25    0.26  0.25 0.00    1.00    1.00  0.37    -0.72 0.01
residual.sugar           4 1143   2.53  1.36   2.20    2.26  0.44 0.90   15.50   14.60  4.35    27.50 0.04
chlorides                5 1143   0.09  0.05   0.08    0.08  0.01 0.01    0.61    0.60  6.01    46.78 0.00
free.sulfur.dioxide      6 1143  15.62 10.25  13.00   14.34  8.90 1.00   68.00   67.00  1.23     1.91 0.30
total.sulfur.dioxide     7 1143  45.91 32.78  37.00   41.20 26.69 6.00  289.00  283.00  1.66     5.06 0.97
density                  8 1143   1.00  0.00   1.00    1.00  0.00 0.99    1.00    0.01  0.10     0.87 0.00
pH                       9 1143   3.31  0.16   3.31    3.31  0.15 2.74    4.01    1.27  0.22     0.91 0.00
sulphates               10 1143   0.66  0.17   0.62    0.64  0.12 0.33    2.00    1.67  2.49    11.93 0.01
alcohol                 11 1143  10.44  1.08  10.20   10.33  1.04 8.40   14.90    6.50  0.86     0.21 0.03
quality                 12 1143   5.66  0.81   6.00    5.60  1.48 3.00    8.00    5.00  0.29     0.30 0.02
Id                      13 1143 804.97 464.00 794.00  805.90 596.01 0.00 1597.00 1597.00 -0.01    -1.22 13.72
> # ------------------------------------
> # Using dplyr: descriptive stats for numeric variables only
> # ------------------------------------
> wine_numeric <- wine_data %>%
+   select(where(is.numeric))
> describe(wine_numeric)
                      vars    n   mean    sd median trimmed   mad  min     max   range  skew kurtosis   se
fixed.acidity            1 1143   8.31  1.75   7.90    8.13  1.33 4.60   15.90   11.30  1.04     1.37 0.05
volatile.acidity         2 1143   0.53  0.18   0.52    0.52  0.18 0.12    1.58    1.46  0.68     1.36 0.01
```

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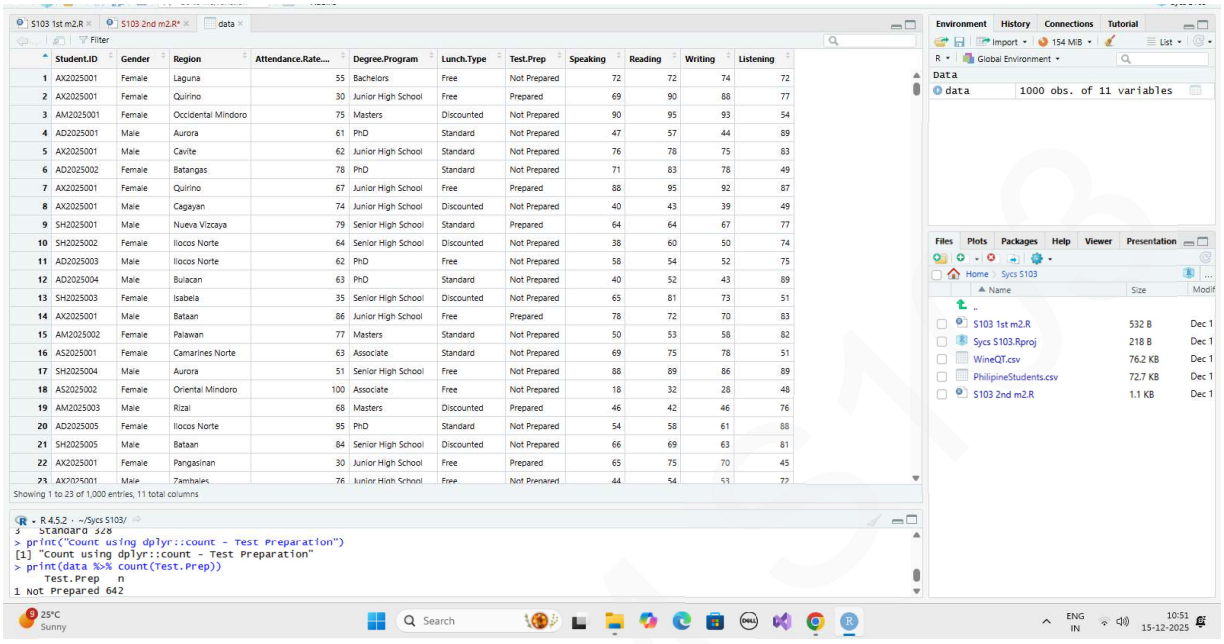
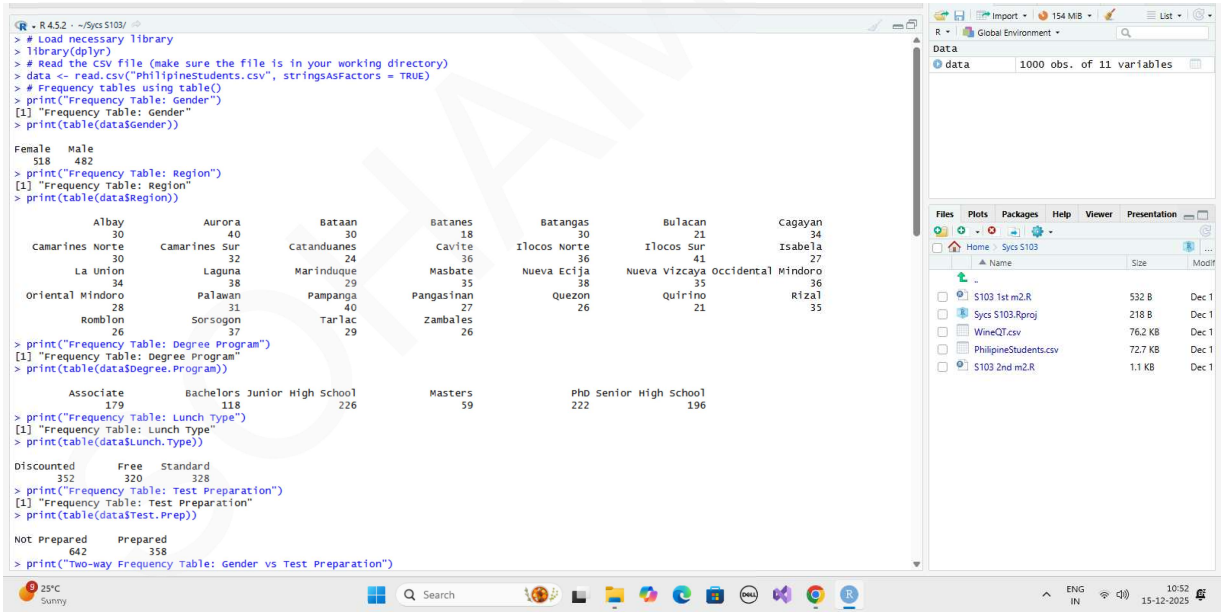
2nd:



	Student.ID	Gender	Region	Attendance.Rate....	Degree.Program	Lunch.Type	Test.Prep	Speaking	Reading	Writing	Listening
1	AX2025001	Female	Laguna	55	Bachelors	Free	Not Prepared	72	72	74	72
2	AX2025001	Female	Quirino	30	Junior High School	Free	Prepared	69	90	88	77
3	AM2025001	Female	Occidental Mindoro	75	Masters	Discounted	Not Prepared	90	95	93	54
4	AD2025001	Male	Aurora	61	PhD	Standard	Not Prepared	47	57	44	89
5	AX2025001	Male	Cavite	62	Junior High School	Standard	Not Prepared	76	78	75	83
6	AD2025002	Female	Batangas	78	PhD	Standard	Not Prepared	71	83	78	49
7	AX2025001	Female	Quirino	67	Junior High School	Free	Prepared	88	95	92	87
8	AX2025001	Male	Cagayan	74	Junior High School	Discounted	Not Prepared	40	43	39	49
9	SH2025001	Male	Nueva Vizcaya	79	Senior High School	Standard	Prepared	64	64	67	77
10	SH2025002	Female	Ilocos Norte	64	Senior High School	Discounted	Not Prepared	38	60	50	74
11	AD2025003	Male	Ilocos Norte	62	PhD	Free	Not Prepared	58	54	52	75
12	AD2025004	Male	Bulacan	63	PhD	Standard	Not Prepared	40	52	43	89
13	SH2025003	Female	Isabela	35	Senior High School	Discounted	Not Prepared	65	81	73	51
14	AX2025001	Male	Bataan	86	Junior High School	Free	Prepared	78	72	70	83
15	AM2025002	Female	Palawan	77	Masters	Standard	Not Prepared	50	53	58	82
16	AS2025001	Female	Camarines Norte	63	Associate	Standard	Not Prepared	69	75	78	51
17	SH2025004	Male	Aurora	51	Senior High School	Free	Not Prepared	88	89	86	89
18	AS2025002	Female	Oriental Mindoro	100	Associate	Free	Not Prepared	18	32	28	48
19	AM2025003	Male	Rizal	68	Masters	Discounted	Prepared	46	42	46	76
20	AD2025005	Female	Ilocos Norte	95	PhD	Standard	Not Prepared	54	58	61	88
21	SH2025005	Male	Bataan	84	Senior High School	Discounted	Not Prepared	66	69	63	81
22	AX2025001	Female	Pangasinan	30	Junior High School	Free	Prepared	65	75	70	45
23	AX2025001	Male	Zambales	76	Junior High School	Free	Not Prepared	44	54	53	72

Showing 1 to 23 of 1,000 entries, 11 total columns

```
> print("Count using dplyr::count - Test Preparation")
[1] "Count using dplyr::count - Test Preparation"
> print(data %>% count(Test.Prep))
     Test.Prep   n
1 Not Prepared 642
```



```
> # Load necessary library
> library(dplyr)
> # Read the CSV file (make sure the file is in your working directory)
> data <- read.csv("PhilipineStudents.csv", stringsAsFactors = TRUE)
> # Frequency tables using table()
> print("Frequency Table: Gender")
[1] "Frequency Table: Gender"
> print(table(data$Gender))

Female   Male
   518    482
> print("Frequency Table: Region")
[1] "Frequency Table: Region"
> print(table(data$Region))

            Albay            Aurora            Bataan           Batanes
               30                40                30                18
  Camarines Norte   Camarines Sur       Catanduanes            Cavite
               30                32                24                36
      La Union           Laguna        Marinduque           Masbate
               34                38                29                35
 Oriental Mindoro          Palawan          Pampanga        Pangasinan
               28                31                40                27
          Romblon         Sorsogon           Tarlac          Zambales
               26                37                29                26
> print("Frequency Table: Degree Program")
[1] "Frequency Table: Degree Program"
> print(table(data$Degree.Program))

        Associate          Bachelors Junior High School           Masters
              179                118                226                 59
              PhD Senior High School
              222                196
> print("Frequency Table: Lunch Type")
[1] "Frequency Table: Lunch Type"
> print(table(data$Lunch.Type))

Discounted       Free   Standard
       352        320        328
> print("Frequency Table: Test Preparation")
[1] "Frequency Table: Test Preparation"
> print(table(data$Test.Prep))

Not Prepared     Prepared
         642          358
> print("Two-way Frequency Table: Gender vs Test Preparation")
```

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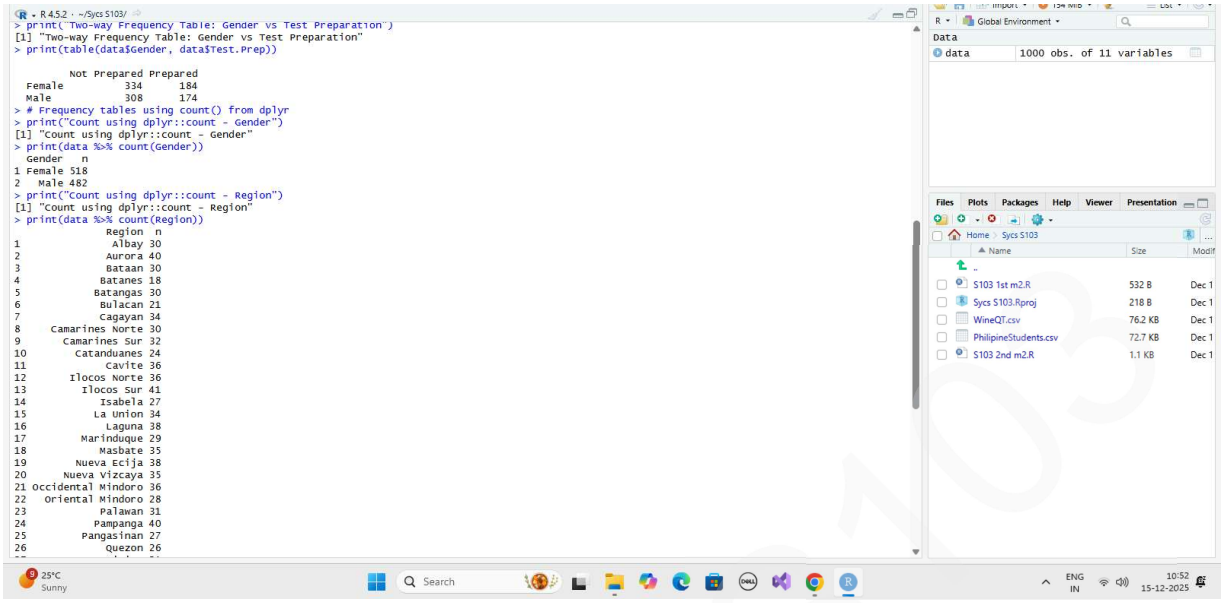
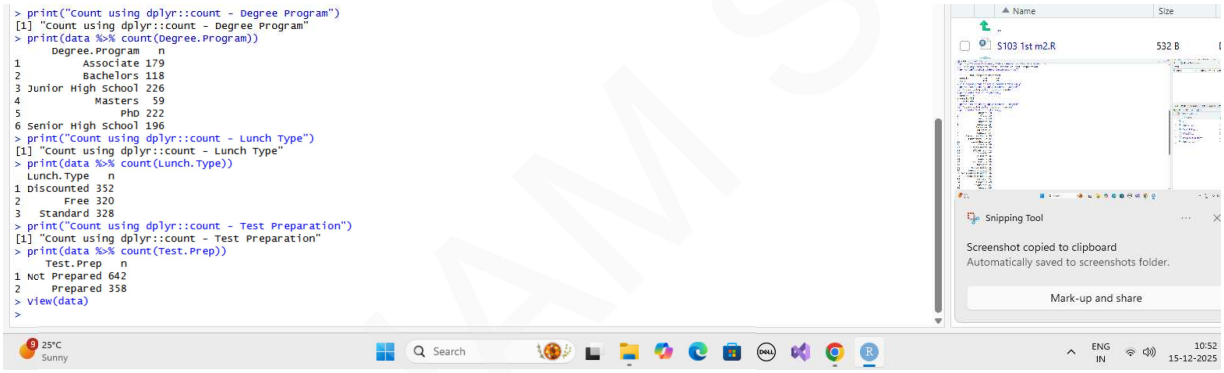


```
> print("Two-way Frequency Table: Gender vs Test Preparation")
[1] "Two-way Frequency Table: Gender vs Test Preparation"
> print(table(data$Gender, data$Test.Prep))

        Not Prepared Prepared
  Female          334      184
  Male            308      174
> # Frequency tables using count() from dplyr
> print("Count using dplyr::count - Gender")
[1] "Count using dplyr::count - Gender"
> print(data %>% count(Gender))
  Gender   n
1 Female 518
2   Male 482
> print("Count using dplyr::count - Region")
[1] "Count using dplyr::count - Region"
> print(data %>% count(Region))
              Region  n
1              Albay 30
2             Aurora 40
3             Bataan 30
4            Batanes 18
5           Batangas 30
6            Bulacan 21
7            Cagayan 34
8     Camarines Norte 30
9       Camarines Sur 32
10       Catanduanes 24
11            Cavite 36
12       Ilocos Norte 36
13         Ilocos Sur 41
14            Isabela 27
15          La Union 34
16            Laguna 38
17        Marinduque 29
18           Masbate 35
19       Nueva Ecija 38
20      Nueva Vizcaya 35
21 Occidental Mindoro 36
22  Oriental Mindoro 28
23           Palawan 31
24          Pampanga 40
25        Pangasinan 27
26             Quezon 26
```



```
> print("Count using dplyr::count - Degree Program")
[1] "Count using dplyr::count - Degree Program"
> print(data %>% count(Degree.Program))
     Degree.Program   n
1         Associate 179
2         Bachelors 118
3 Junior High School 226
4           Masters  59
5               PhD 222
6 Senior High School 196
> print("Count using dplyr::count - Lunch Type")
[1] "Count using dplyr::count - Lunch Type"
> print(data %>% count(Lunch.Type))
  Lunch.Type   n
1 Discounted 352
2        Free 320
3   Standard 328
> print("Count using dplyr::count - Test Preparation")
[1] "Count using dplyr::count - Test Preparation"
> print(data %>% count(Test.Prep))
    Test.Prep   n
1 Not Prepared 642
2    Prepared 358
> view(data)
>
```

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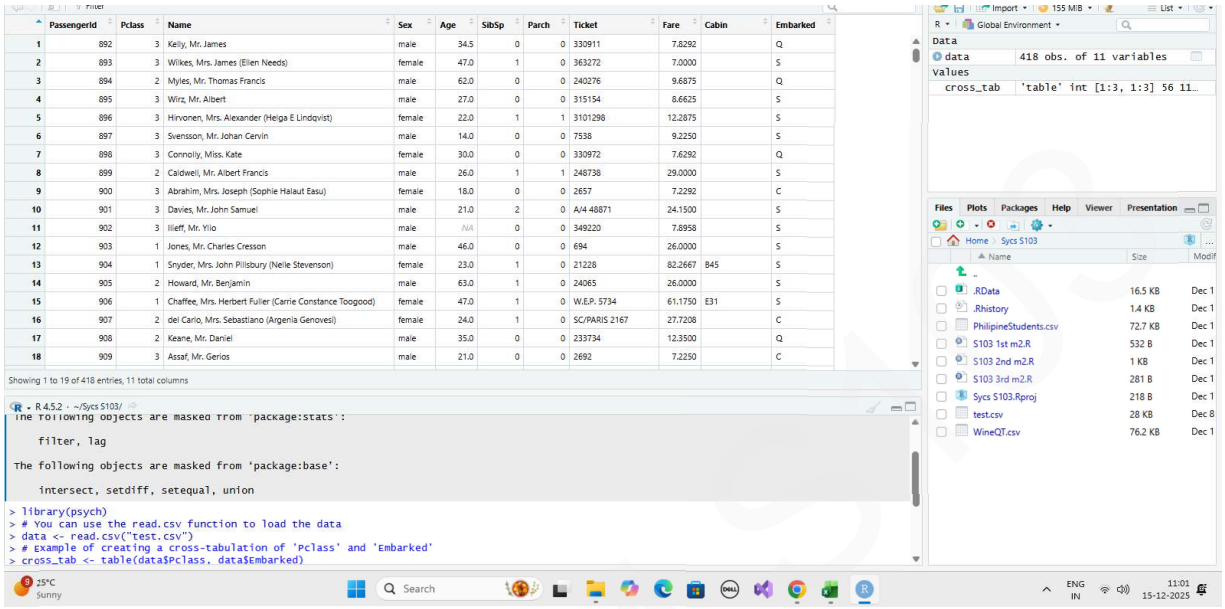
3rd:



	PassengerId	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
1	892	3	Kelly, Mr. James	male	34.5	0	0	330911	7.8292		Q
2	893	3	Wilkes, Mrs. James (Ellen Needs)	female	47.0	1	0	363272	7.0000		S
3	894	2	Myles, Mr. Thomas Francis	male	62.0	0	0	240276	9.6875		Q
4	895	3	Wirz, Mr. Albert	male	27.0	0	0	315154	8.6625		S
5	896	3	Hirvonen, Mrs. Alexander (Helga E Lindqvist)	female	22.0	1	1	3101298	12.2875		S
6	897	3	Svensson, Mr. Johan Cervin	male	14.0	0	0	7538	9.2250		S
7	898	3	Connolly, Miss. Kate	female	30.0	0	0	330972	7.6292		Q
8	899	2	Caldwell, Mr. Albert Francis	male	26.0	1	1	248738	29.0000		S
9	900	3	Abrahim, Mrs. Joseph (Sophie Halaut Easu)	female	18.0	0	0	2657	7.2292		C
10	901	3	Davies, Mr. John Samuel	male	21.0	2	0	A/4 48871	24.1500		S
11	902	3	Ilieff, Mr. Ylio	male	NA	0	0	349220	7.8958		S
12	903	1	Jones, Mr. Charles Cresson	male	46.0	0	0	694	26.0000		S
13	904	1	Snyder, Mrs. John Pillsbury (Nelle Stevenson)	female	23.0	1	0	21228	82.2667	B45	S
14	905	2	Howard, Mr. Benjamin	male	63.0	1	0	24065	26.0000		S
15	906	1	Chaffee, Mrs. Herbert Fuller (Carrie Constance Toogood)	female	47.0	1	0	W.E.P. 5734	61.1750	E31	S
16	907	2	del Carlo, Mrs. Sebastiano (Argenia Genovesi)	female	24.0	1	0	SC/PARIS 2167	27.7208		C
17	908	2	Keane, Mr. Daniel	male	35.0	0	0	233734	12.3500		Q
18	909	3	Assaf, Mr. Gerios	male	21.0	0	0	2692	7.2250		C

Showing 1 to 19 of 418 entries, 11 total columns

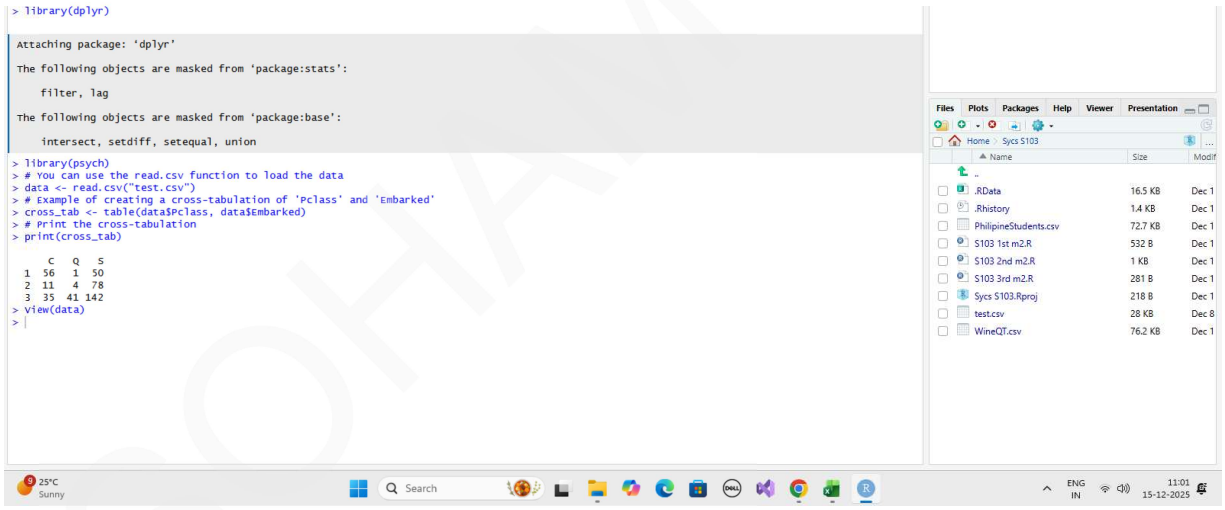
```
The following objects are masked from 'package:stats':

    filter, lag

The following objects are masked from 'package:base':

    intersect, setdiff, setequal, union

> library(psych)
> # You can use the read.csv function to load the data
> data <- read.csv("test.csv")
> # Example of creating a cross-tabulation of 'Pclass' and 'Embarked'
> cross_tab <- table(data$Pclass, data$Embarked)
```



```
> library(dplyr)

Attaching package: 'dplyr'

The following objects are masked from 'package:stats':

    filter, lag

The following objects are masked from 'package:base':

    intersect, setdiff, setequal, union

> library(psych)
> # You can use the read.csv function to load the data
> data <- read.csv("test.csv")
> # Example of creating a cross-tabulation of 'Pclass' and 'Embarked'
> cross_tab <- table(data$Pclass, data$Embarked)
> # Print the cross-tabulation
> print(cross_tab)

     C  Q   S
  1 56  1  50
  2 11  4  78
  3 35 41 142
> view(data)
>
```

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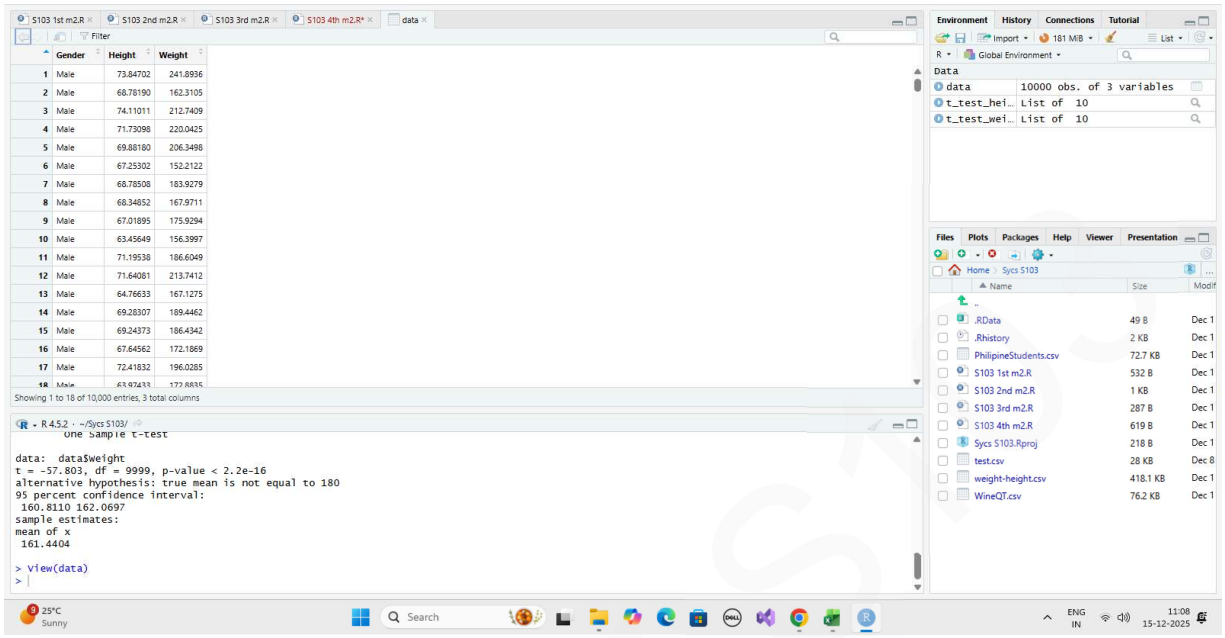
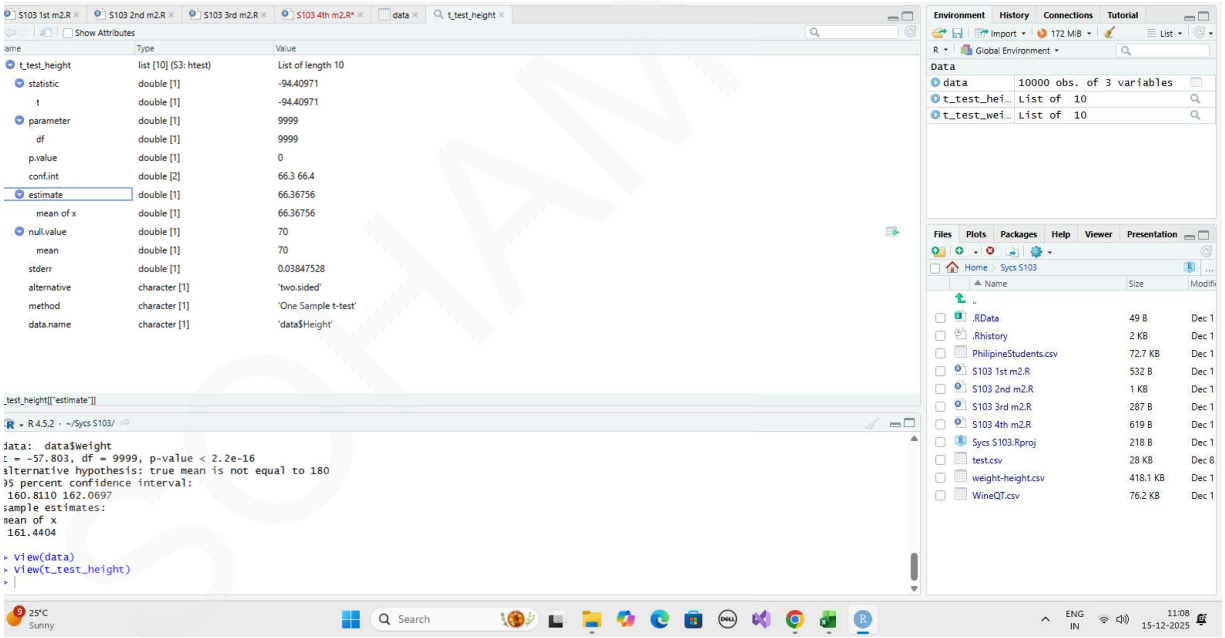
4th:





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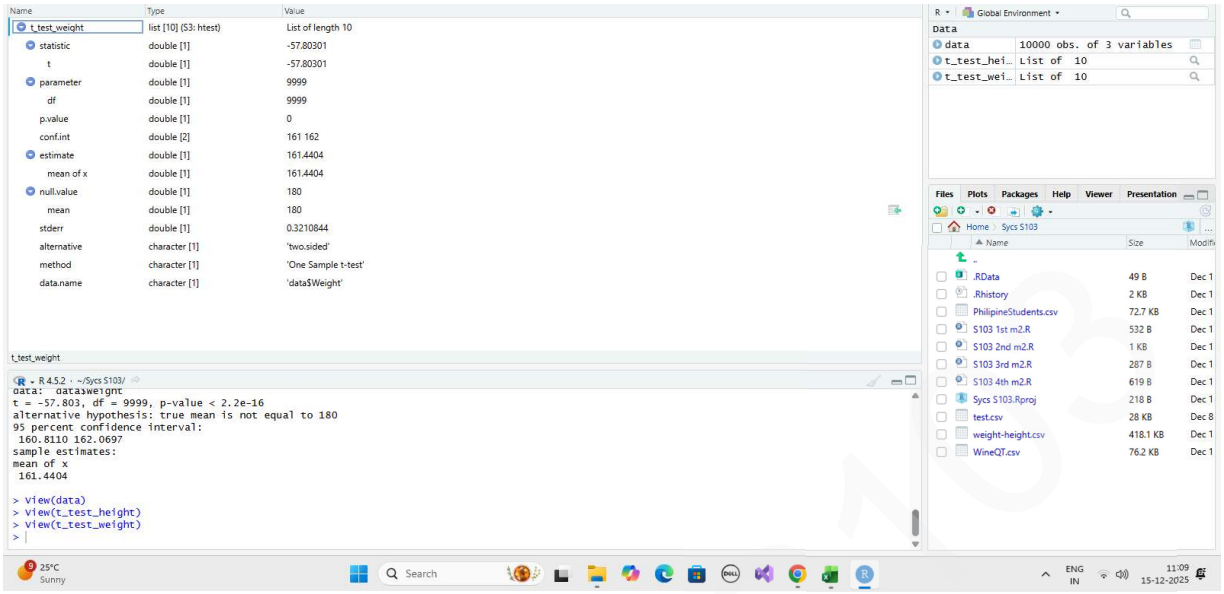

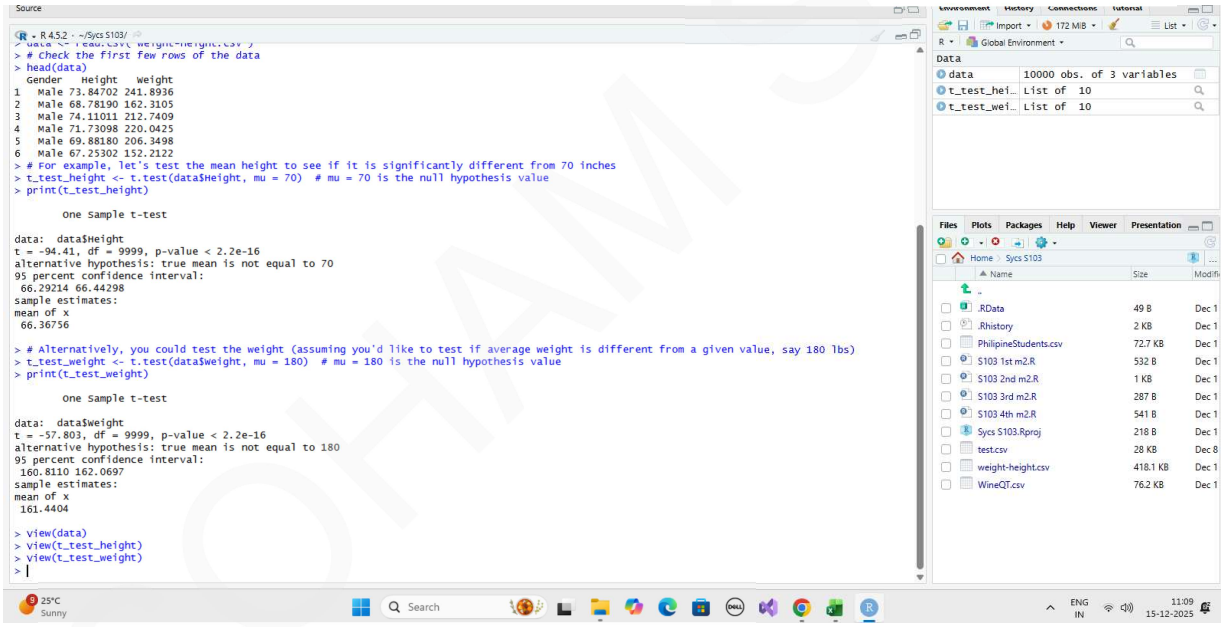

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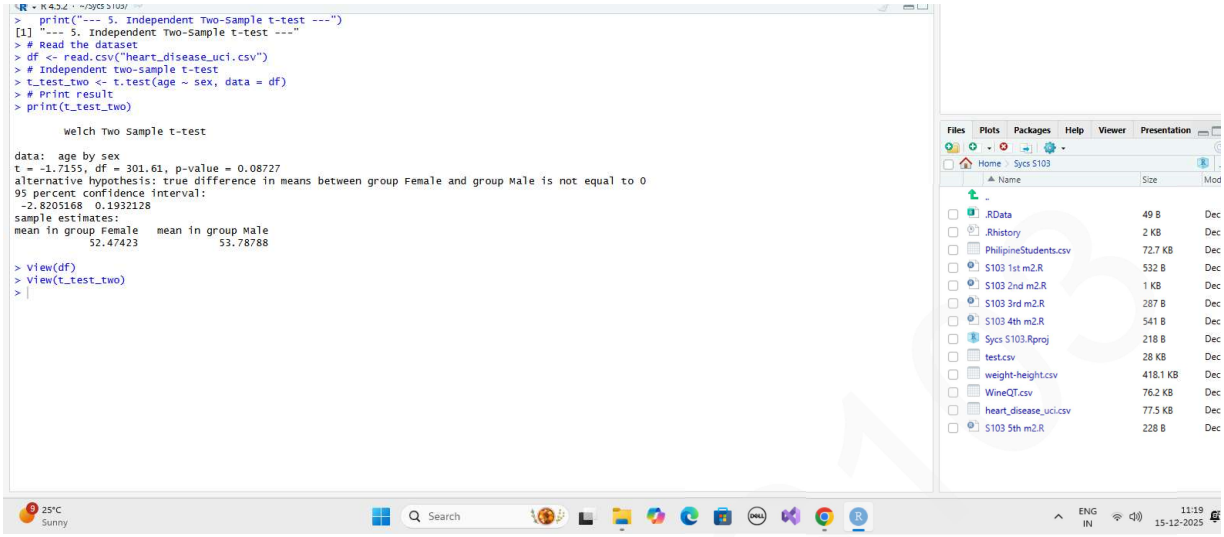
SUBJECT:Data Analysis with R

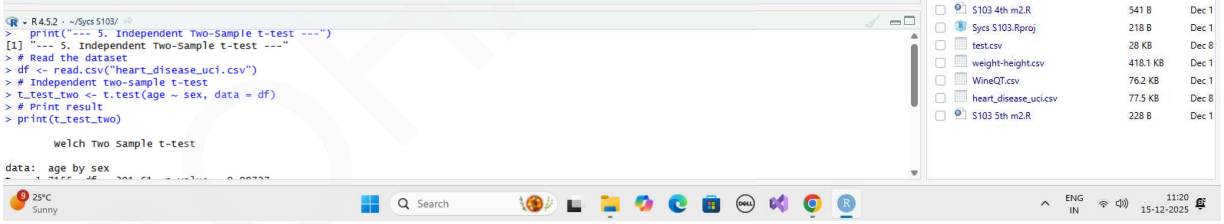
5th:

```
> print("--- 5. Independent Two-Sample t-test ---")
[1] "--- 5. Independent Two-Sample t-test ---"
> # Read the dataset
> df <- read.csv("heart_disease_uci.csv")
> # Independent two-sample t-test
> t_test_two <- t.test(age ~ sex, data = df)
> # Print result
> print(t_test_two)

        Welch Two Sample t-test

data:  age by sex
t = -1.7155, df = 301.61, p-value = 0.08727
alternative hypothesis: true difference in means between group Female and group Male is not equal to 0
95 percent confidence interval:
 -2.8205168  0.1932128
sample estimates:
mean in group Female   mean in group Male
            52.47423             53.78788

> view(df)
> view(t_test_two)
>
```



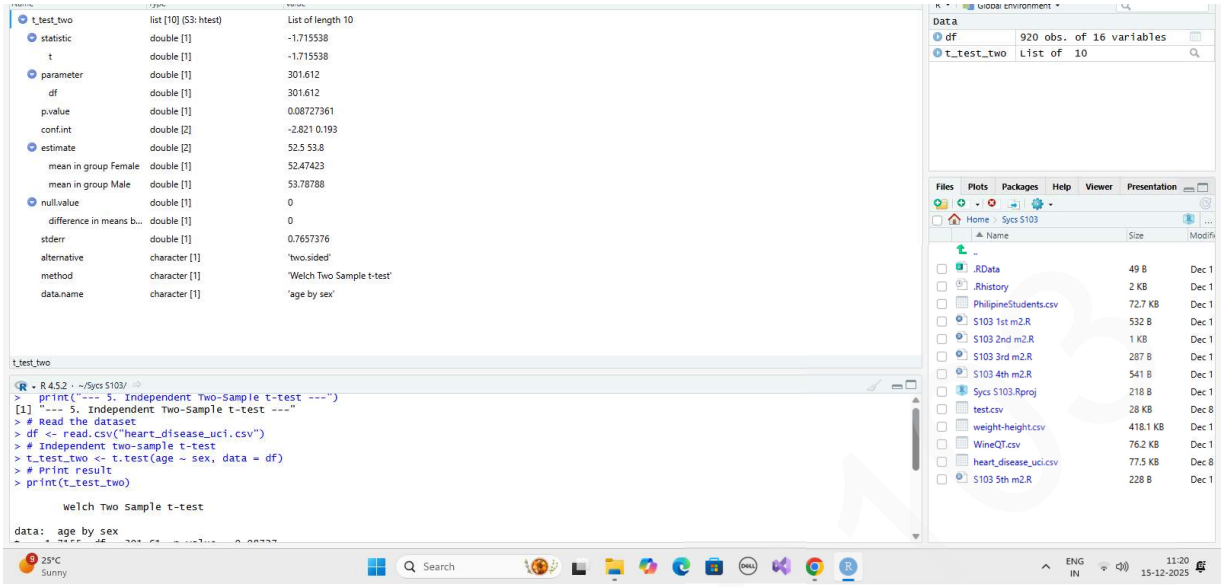
id	age	sex	dataset	cp	trestbps	chol	fbs	restecg	thalch	exang	oldpeak	slope	ca	thal	num
1	63	Male	Cleveland	typical angina	145	233	TRUE	lv hypertrophy	150	FALSE	2.3	downsloping	0	fixed defect	0
2	67	Male	Cleveland	asymptomatic	160	286	FALSE	lv hypertrophy	108	TRUE	1.5	flat	3	normal	2
3	67	Male	Cleveland	asymptomatic	120	229	FALSE	lv hypertrophy	129	TRUE	2.6	flat	2	reversable defect	1
4	37	Male	Cleveland	non-anginal	130	250	FALSE	normal	187	FALSE	3.5	downsloping	0	normal	0
5	41	Female	Cleveland	atypical angina	130	204	FALSE	lv hypertrophy	172	FALSE	1.4	upsloping	0	normal	0
6	56	Male	Cleveland	atypical angina	120	236	FALSE	normal	178	FALSE	0.8	upsloping	0	normal	0
7	62	Female	Cleveland	asymptomatic	140	268	FALSE	lv hypertrophy	160	FALSE	3.6	downsloping	2	normal	3
8	57	Female	Cleveland	asymptomatic	120	354	FALSE	normal	163	TRUE	0.6	upsloping	0	normal	0
9	63	Male	Cleveland	asymptomatic	130	254	FALSE	lv hypertrophy	147	FALSE	1.4	flat	1	reversable defect	2
10	53	Male	Cleveland	asymptomatic	140	203	TRUE	lv hypertrophy	155	TRUE	3.1	downsloping	0	reversable defect	1
11	57	Male	Cleveland	asymptomatic	140	192	FALSE	normal	148	FALSE	0.4	flat	0	fixed defect	0
12	56	Female	Cleveland	atypical angina	140	294	FALSE	lv hypertrophy	153	FALSE	1.3	flat	0	normal	0
13	56	Male	Cleveland	non-anginal	130	256	TRUE	lv hypertrophy	142	TRUE	0.6	flat	1	fixed defect	2
14	44	Male	Cleveland	atypical angina	120	263	FALSE	normal	173	FALSE	0.0	upsloping	0	reversable defect	0
15	52	Male	Cleveland	non-anginal	172	199	TRUE	normal	162	FALSE	0.5	upsloping	0	reversable defect	0
16	57	Male	Cleveland	non-anginal	150	168	FALSE	normal	174	FALSE	1.6	upsloping	0	normal	0
17	48	Male	Cleveland	atypical angina	110	229	FALSE	normal	168	FALSE	1.0	downsloping	0	reversable defect	1
18	54	Male	Cleveland	asymptomatic	140	239	FALSE	normal	160	FALSE	1.2	upsloping	0	normal	0

Showing 1 to 19 of 920 entries, 16 total columns

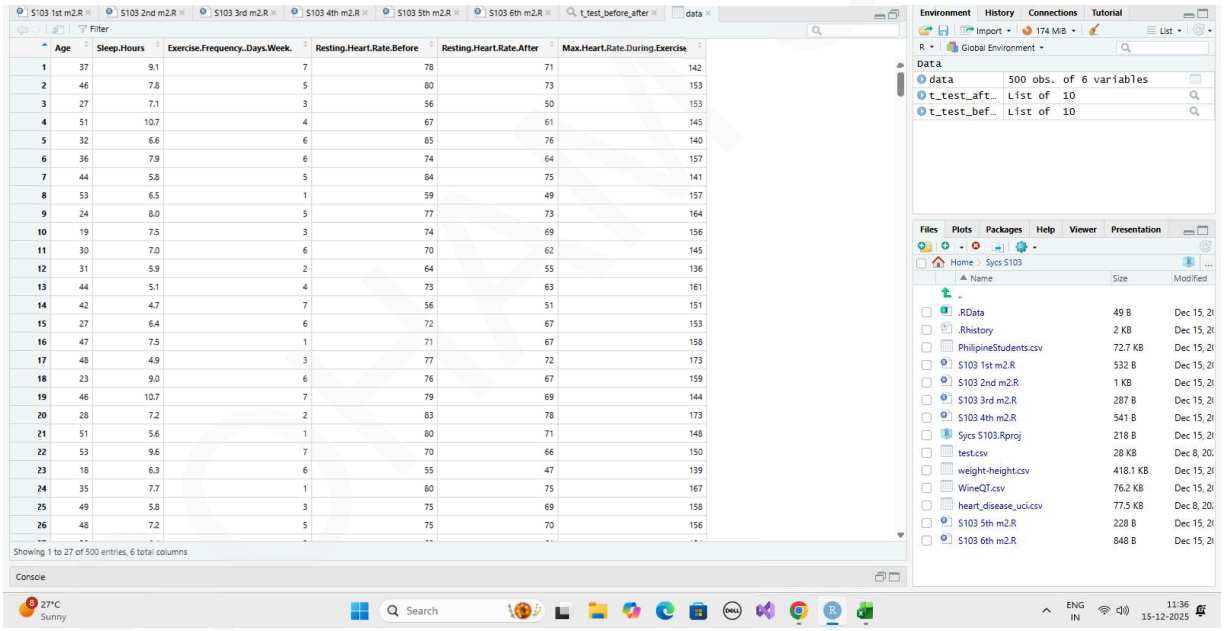


Soham Sycs S103

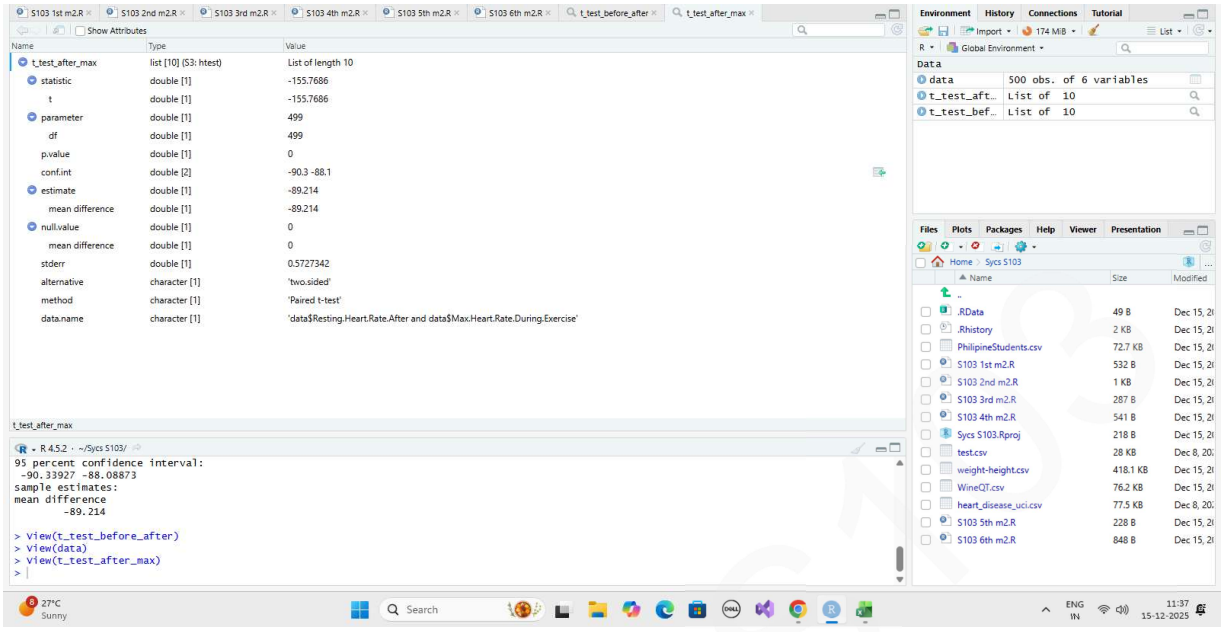
SHETH L.U.J. AND SIR M.V. COLLEGE
SUBJECT:Data Analysis with R

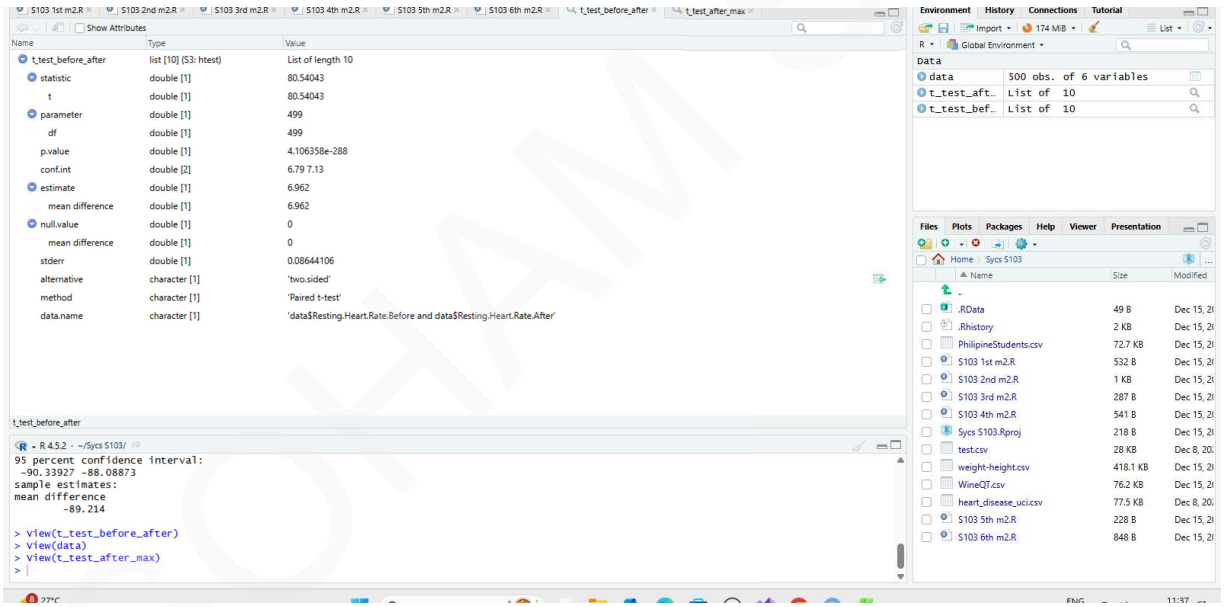


6th:



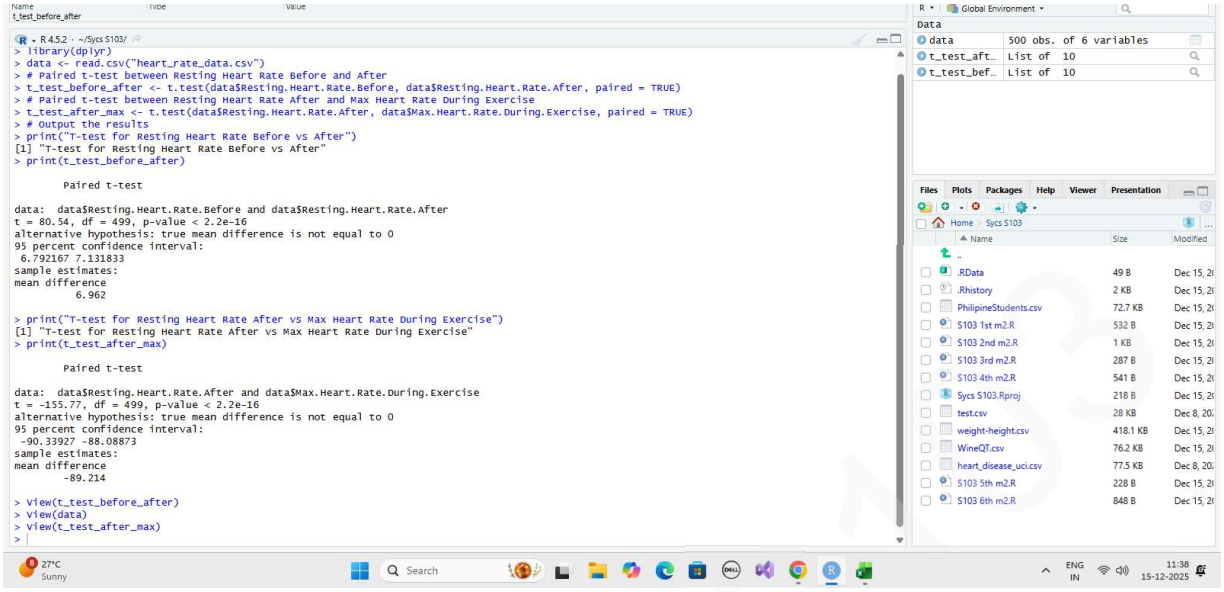
SHETH L.U.J. AND SIR M.V. COLLEGE
SUBJECT:Data Analysis with R





Soham Sycs S103

SHETH L.U.J. AND SIR M.V. COLLEGE
SUBJECT:Data Analysis with R



```
> library(dplyr)
> data <- read.csv("heart_rate_data.csv")
> # Paired t-test between Resting Heart Rate Before and After
> t_test_before_after <- t.test(data$Resting.Heart.Rate.Before, data$Resting.Heart.Rate.After, paired = TRUE)
> # Paired t-test between Resting Heart Rate After and Max Heart Rate During Exercise
> t_test_after_max <- t.test(data$Resting.Heart.Rate.After, data$Max.Heart.Rate.During.Exercise, paired = TRUE)
> # Output the results
> print("T-test for Resting Heart Rate Before vs After")
[1] "T-test for Resting Heart Rate Before vs After"
> print(t_test_before_after)

        Paired t-test

data:  data$Resting.Heart.Rate.Before and data$Resting.Heart.Rate.After
t = 80.54, df = 499, p-value < 2.2e-16
alternative hypothesis: true mean difference is not equal to 0
95 percent confidence interval:
 6.792167 7.131833
sample estimates:
mean difference
          6.962

> print("T-test for Resting Heart Rate After vs Max Heart Rate During Exercise")
[1] "T-test for Resting Heart Rate After vs Max Heart Rate During Exercise"
> print(t_test_after_max)

        Paired t-test

data:  data$Resting.Heart.Rate.After and data$Max.Heart.Rate.During.Exercise
t = -155.77, df = 499, p-value < 2.2e-16
alternative hypothesis: true mean difference is not equal to 0
95 percent confidence interval:
 -90.33927 -88.08873
sample estimates:
mean difference
         -89.214

> View(t_test_before_after)
> View(data)
> View(t_test_after_max)
>
```