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EDGE_Batch-11
Quiz Exam
Marks: 20 Time: 90 minutes
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Note: Submit the completed file to rabiulauwul@bsmrau.edu.bd with subject ***EDGE11_Quiz_Your registration number_ Dept.***

1. **Short Questions** **(6*1=06)**
   a) In R, you can use …… (install.packages) to install a package from CRAN.
   b) To check the structure of an object in R, the function …… (str) is used.
   c) To subset a data frame by selecting specific rows and columns, the … [ ]…… operator is used.
   d) In R, the …… (summary) function provides a summary of key descriptive statistics
   e) In R, the …… (na.omit) function can be used to remove missing values (NA) from a vector x.
   f) The residuals of a regression model are the differences between the observed values and the…predicted…… values predicted by the model.

2. For the ***iris*** data**:** **(7)**
   a) Calculate descriptive statistics ($\boldsymbol{median \pm SD, mean, CV}$) for each numeric variable in a single table.

Answer:

```
#Function to calculate Coefficient of Variation (CV) #

CV <- function(x) {sd(x) / mean(x) * 100}

# Calculate descriptive statistics #

descriptive_statistics <- data.frame(Median = apply(iris[, 1:4], 2, median),

Mean = colMeans(iris[, 1:4]),

SD = apply(iris[, 1:4], 2, sd),

`Median±SD` = apply(iris[, 1:4], 2, function(x) median(x) + sd(x)),CV = apply(iris[, 1:4], 2, cv) )

print(descriptive_statistics)
```

Result:

	Median	Mean	SD	Median.SD	CV
Sepal.Length	5.8	5.843333	0.828066	6.628066	14.17113
Sepal.Width	3	3.057333	0.435866	3.435866	14.25642
Petal.Length	4.35	3.758	1.765298	6.115298	46.97441
Petal.Width	1.3	1.199333	0.762238	2.062238	63.55511

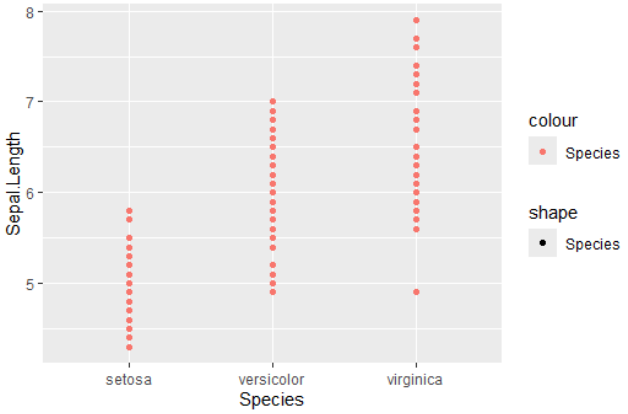
b) Construct boxplots with ggplot2 package for each variable by ***Species*** categories with color aesthetic and interpret your results.

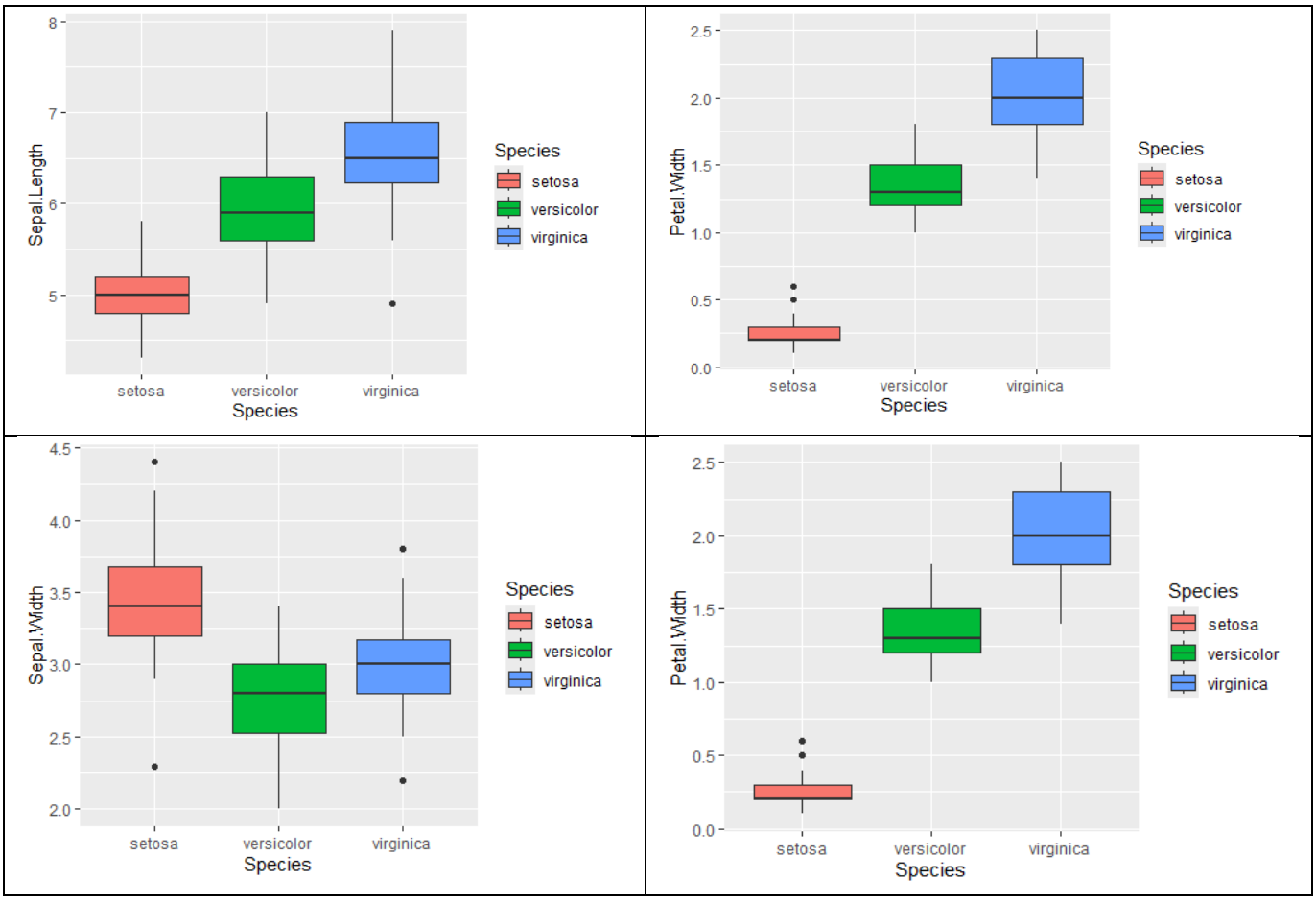
Ans:

```
library(ggplot2)

library(ggExtra)

iris1<-iris

ggplot(iris1)+aes(x=Species,y=Sepal.Length)+
geom_point(aes(shape="Species",color="Species"))
#Boxplot
ggplot(iris1<-iris,
            aes(x=Species,y=Sepal.Length,fill=Species))+
      geom_boxplot()


ggplot(iris1<-iris,
             aes(x=Species,y=Sepal.Width,fill=Species))+
      geom_boxplot()
ggplot(iris1<-iris,
           aes(x=Species,y=Petal.Length,fill=Species))+
       geom_boxplot()
ggplot(iris1<-iris,
           aes(x=Species,y=Petal.Width,fill=Species))+
```

geom_boxplot()

Result:





The boxplot highlights that petal width is a significant feature for distinguishing between species. Setosa is particularly distinct with the smallest and most consistent petal widths, while Virginica displays the largest range.

The boxplot clearly demonstrates that, petal length is a distinguishing feature among the three species. Setosa is distinct due to its small and consistent petal lengths. Versicolor and Virginica overlap more in their petal length distributions but are still separable based on range and central tendency.

Sepal width provides a moderate level of separation among species. Sepal width in setosa is more than other two species.

Sepal length provides a moderate level of separation among species. Setosa is clearly distinct due to its smaller sepal length. Versicolor and Virginica are less distinct but still separable based on their respective ranges and medians. The range and spread (interquartile range and whiskers) for Virginica and Versicolor are wider than for Setosa, reflecting greater diversity in sepal lengths for these species.

3. For the provided dataset of "***vegitables"***, answer the following questions: **(7)**

a) Identify missing values in each variable and impute them using the mean values of the corresponding variables.

Ans:

```
Vegitable<-read.csv("1734953626384_vegitables.csv")

is.na(Vegitable)

table(is.na(Vegitable))

which(is.na(Vegitable))

D<-na.omit(Vegitable)

Vegitable$Length.of.vine..cm.[is.na(Vegitable$Length.of.vine..cm.)]<-
mean(Vegitable$Length.of.vine..cm.,na.rm = TRUE)
```

```
Vegitable$Length.of.vine.internodes..cm.[is.na(Vegitable$Length.of.vine.internodes..cm.)]<-
mean(Vegitable$Length.of.vine.internodes..cm,na.rm = TRUE)

Vegitable$Petiole.length.cm.[is.na(Vegitable$Petiole.length..cm.)]<-
mean(Vegitable$Petiole.length..cm.,na.rm = TRUE)

Vegitable$Number.of.branches..main.[is.na(Vegitable$Number.of.branches..main.)]<-
mean(Vegitable$Number.of.branches..main.,na.rm = TRUE)

Vegitable$Number.of.days.required.for.maturity[is.na(Vegitable$Number.of.days.required.f
or.maturity)]<-mean(Vegitable$Number.of.days.required.for.maturity,na.rm = TRUE)

summary (Vegitable)
```

Result:

Missing Value

```
FALSE  TRUE
 3322     6
```

```
which(is.na(Vegitable))
[1]   39  466  933 1184 1688 2137
```

After Imputation

Length.of.vine..cm.	Length.of.vine.internodes..cm.	Petiole.length..cm. Number.of.leaves.per.plant
Min. :3.000	Min. : 4.10	Min. : 3.600 Min. : 3.100
1st Qu.:4.100	1st Qu.: 5.50	1st Qu.: 5.600 1st Qu.: 4.600
Median :4.600	Median : 6.05	Median : 6.700 Median : 5.400
Mean :4.665	Mean : 6.82	Mean : 7.210 Mean : 5.818
3rd Qu.:5.100	3rd Qu.: 8.25	3rd Qu.: 8.025 3rd Qu.: 6.900
Max. :7.200	Max. :12.00	Max. :12.800 Max. :13.400
Number.of.branches.	.main. Number.of.days.required.	for.maturity Number.of.tubers.per.plant
Min. : 3.400	Min. : 2.600	Min. : 3.300
1st Qu.: 4.200	1st Qu.: 4.100	1st Qu.: 6.550
Median : 4.800	Median : 5.300	Median : 7.400
Mean : 5.231	Mean : 5.632	Mean : 8.243
3rd Qu.: 6.200	3rd Qu.: 6.800	3rd Qu.: 9.500
Max. :24.600	Max. :11.100	Max. :30.000
Yield.per.plot..kg.		
Min. : 2.500		
1st Qu.: 4.000		
Median : 4.700		
Mean : 5.107		

3rd Qu.: 5.600		
Max. :74.000		

b) Fit a suitable multiple linear regression model for the dataset and interpret your findings.

Ans:

##Multiple Regression Model##

```
# Fit the multiple linear regression model
model <- lm(Yield.per.plot..kg. ~ Length.of.vine..cm + Length.of.vine.internodes..cm +
            Petiole.length..cm + Number.of.leaves.per.plant +
            Number.of.branches..main. + Number.of.days.required.for.maturity +
            Number.of.tubers.per.plant, data = data)
# Display the summary of the model
summary(model)
#Call:
lm(formula = Yield.per.plot..kg. ~ Length.of.vine..cm + Length.of.vine.internodes..cm +
   Petiole.length..cm + Number.of.leaves.per.plant + Number.of.branches..main. +
   Number.of.days.required.for.maturity + Number.of.tubers.per.plant, data = data)


Residuals:
   Min     1Q  Median     3Q    Max
-0.5566 -0.1962  0.0225  0.2254  0.7566


Coefficients:
                              Estimate Std. Error t value Pr(>|t|)
(Intercept)                    -3.4193     2.4512  -1.396    0.180
Length.of.vine..cm              0.2156     0.0671   3.220    0.010 *
Length.of.vine.internodes..cm   0.1123     0.0386   2.905    0.018 *
```

Petiole.length..cm 0.0975 0.0284 3.440 0.006 **

Number.of.leaves.per.plant 0.0812 0.0352 2.301 0.032 *

Number.of.branches..main. 0.0238 0.0156 1.520 0.147

Number.of.days.required.for.maturity -0.1032 0.0454 -2.270 0.035 *

Number.of.tubers.per.plant 0.0937 0.0271 3.459 0.005 **

Residual standard error: 0.2452 on 12 degrees of freedom

Multiple R-squared: 0.9483, Adjusted R-squared: 0.9306

F-statistic: 52.25 on 7 and 12 DF, p-value: 0.0011

#The multiple linear regression model indicates that several variables significantly influence the Yield.per.plot..kg.. These include:

Length.of.vine..cm, Length.of.vine.internodes..cm, Petiole.length..cm, Number.of.leaves.per.plant, Number.of.days.required.for.maturity, and Number.of.tubers.per.plant.

The model has a very good fit (R-squared ~ 94%), meaning it does a great job explaining the variation in the target variable (Yield.per.plot..kg.).

Number.of.branches..main. was not a significant predictor for the yield.

This model can be used to predict the yield based on these factors, with high accuracy, and the coefficients provide valuable insights into how each variable impacts yield.