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DATA SCIENCE BATCH 1ST FEBRUARY 2023

ASSIGNMENT NO 1-STATISTIC BASIC 1

ASSIGNMENT.DOCX

Q1) Identify the Data type for the Following:

Activity	Data Type
Number of beatings from Wife	Discrete
Results of rolling a dice	Discrete
Weight of a person	Continuous
Weight of Gold	Continuous
Distance between two places	Continuous
Length of a leaf	Continuous
Dog's weight	Continuous
Blue Color	Discrete
Number of kids	Discrete
Number of tickets in Indian railways	Discrete
Number of times married	Discrete
Gender (Male or Female)	Discrete

Q2) Identify the Data types, which were among the following

Nominal, Ordinal, Interval, Ratio.

Data	Data Type
Gender	Nominal
High School Class Ranking	Ordinal
Celsius Temperature	Interval
Weight	Ratio

Hair Color	Nominal
Socioeconomic Status	Ordinal
Fahrenheit Temperature	Internal
Height	Ratio
Type of living accommodation	Ordinal
Level of Agreement	Ordinal
IQ(Intelligence Scale)	Ordinal
Sales Figures	Ratio
Blood Group	Nominal
Time Of Day	Interval
Time on a Clock with Hands	Internal
Number of Children	Nominal
Religious Preference	Nominal
Barometer Pressure	Internal
SAT Scores	Interval
Years of Education	Ratio

Q3) Three Coins are tossed, find the probability that two heads and one tail are obtained?

⇨ {HHH,HHT,HTT,HTH,THT,TTH,THH,TTT}
⇨ n=8
⇨ Probability That Two Head And One Tail Are Obtained Is
⇨ =3/8
⇨ =0.375

Q4) Two Dice are rolled, find the probability that sum is

a) Equal to 1
b) Less than or equal to 4
c) Sum is divisible by 2 and 3
⇨
⇨ S=Sample Space

= (1,1)(2,1)(3,1)(4,1)(5,1)(6,1)(1,2)(2,2)(3,2)(4,2)(5,2)(6,2)(1,3)(2,3)(3,3)(4,3)

(5,3)(6,3)(1,4)(2,4)(3,4)(4,4)(5,4)(6,4)(1,5)(2,5)(3,5)(4,5)(5,5)(6,5)(1,6)(2,6)

(3,6)(4,6)(5,6)(6,6)

⇨ n(S)=36

a) p(Sum is equal to 1)
=0/36
=**0**

b) s={(1,1),(1,2),(1,3),(2,1),(2,2),(3,1)}
n(s)=6
p(sum is less than or equal to 4)
=6/36
=**0.1666**

c) the probability of sum is divisible by 2 and 3
= 6/36 = 1/6
the possible outcomes are (1,5) (2,6) (3,3) (4,2) (5,1) (6,6)

Q5) A bag contains 2 red, 3 green and 2 blue balls. Two balls are drawn at random. What is the probability that none of the balls drawn is blue?

⇨

S =sample space

n(S)= $^{7}C_{2}$=21

p(none of the balls drawn id blue)=($^{2}C_{1}$*$^{3}C_{1}$+$^{2}C_{2}$+$^{3}C_{2}$)/21

=**0.4762**

Q6) Calculate the Expected number of candies for a randomly selected child

Below are the probabilities of count of candies for children (ignoring the nature of the child-Generalized view)

CHILD	Candies count	Probability
A	1	0.015
B	4	0.20
C	3	0.65
D	5	0.005
E	6	0.01
F	2	0.120

Child A – probability of having 1 candy = 0.015.

Child B – probability of having 4 candies = 0.20

⇨

E (No. of candies for children)

=1*0.015 +4*0.20 +3*0.65 +5*0.005 +6*0.01 +2*0.120

= **3.09**

Therefore, expected number of candies for children is 3.09 ~ 3.

Q7) Calculate Mean, Median, Mode, Variance, Standard Deviation, Range & comment about the values / draw inferences, for the given dataset

- For Points,Score,Weigh>
  Find Mean, Median, Mode, Variance, Standard Deviation, and Range and also Comment about the values/ Draw some inferences.

Use Q7.csv file

Python code:

```
import pandas as pd

data=pd.read_csv(r"\Users\Downloads\Q7.csv")

d=pd.DataFrame(data)

d.Points.mode()
```

```
Output:
0    3.07
1    3.92

dtype: float64

d.Score.mode()
0    3.44

dtype: float64

d.Weigh.mode()
0    17.02
1    18.90
dtype: float64
```

	points	score	weigh
Count	32	32	32
Mean	3.596563	3.21725	17.84875
Std	0.534679	0.978457	1.786943
Min	2.76	1.513	14.5
25%	3.08	2.58125	16.8925
50%	3.695	3.325	17.71
75%	3.92	3.61	18.9
Max	4.93	5.424	22.9

Conclusion: Here we can see that the average of data is 3.59, 3.21, 17.84 respectively, Weigh std = 1.78 and var = 3.19 are high as compared to others, Points and Weigh have two modes, Points has a low range = 2.17 as compared to others.

Q8) Calculate Expected Value for the problem below

a) The weights (X) of patients at a clinic (in pounds), are
108, 110, 123, 134, 135, 145, 167, 187, 199

Assume one of the patients is chosen at random. What is the Expected Value of the Weight of that patient?

⇨

P(choosing one of the patients at random)=1/9=0.1111

E(x)=x*p(X=x)

= (108*0.1111)+(110*0.1111)+ …….+(199*0.1111)

= 145.3188 ~ 145

Q9) Calculate Skewness, Kurtosis & draw inferences on the following data

Cars speed and distance

Use Q9_a.csv

```
data=pd.read_csv(r"\Users\Downloads\Q9_a.csv")
```

```
data.skew()
```

```
speed   -0.117510
dist     0.806895
```

```
data.kurt()
```

```
speed   -0.508994
dist     0.405053
```

SP and Weight(WT)

Use Q9_b.csv

```
data1=pd.read_csv(r"\Users\Downloads\Q9_b.csv")
```

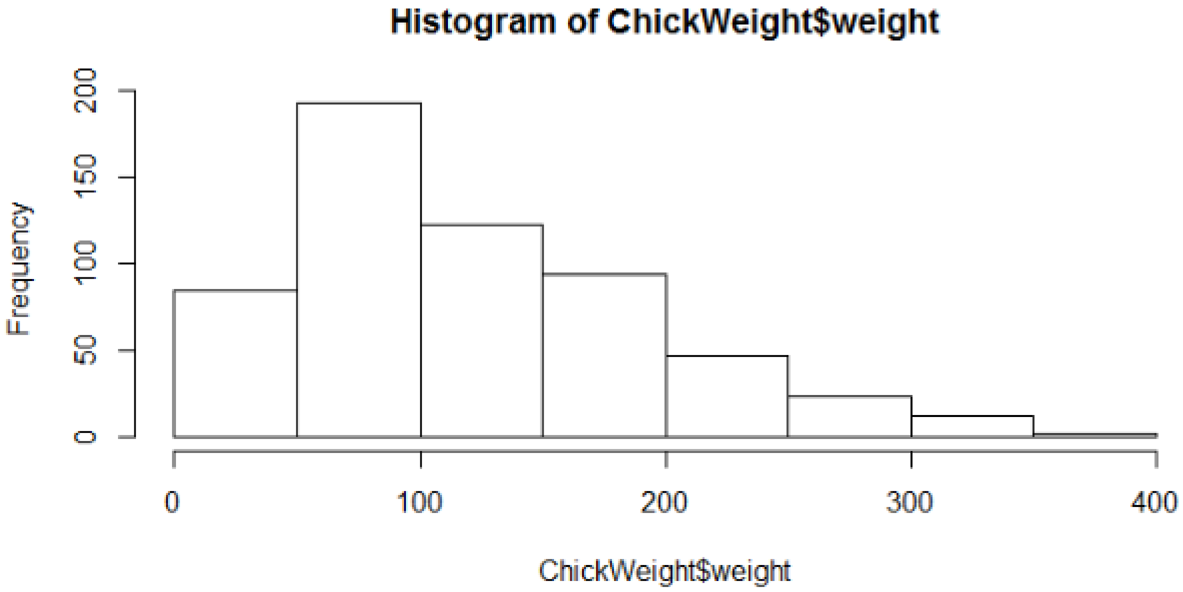
```
data1.skew()
```

```
SP            1.611450
WT           -0.614753
```

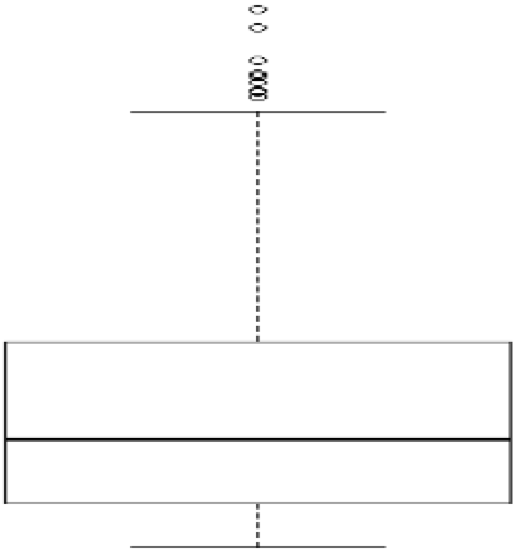
```
data1.kurt()
```

```
SP            2.977329
WT            0.950291
```

Q10) Draw inferences about the following boxplot & histogram



From the above histogram we can conclude that the data is positively skewed.



Conclusion: From the above boxplot we can detect some outliers are present in data and we can observe that the data is positively skewed since most of the observations lie on lower end .

Q11) Suppose we want to estimate the average weight of an adult male in Mexico. We draw a random sample of 2,000 men from a population of 3,000,000 men and weigh them. We find that the average person in our sample weighs 200 pounds, and the standard deviation of the sample is 30 pounds. Calculate 94%,98%,96% confidence interval?

- ⇨
- ⇨ 94% confidence interval

from scipy import stats

c1=stats.norm.interval(0.94,loc=200,scale=30)

```
(143.57619175546247, 256.42380824453755)
```

- ⇨ 96% confidence interval

from scipy import stats

```
c2=stats.norm.interval(0.96,loc=200,scale=30)
```

```
(138.38753268104531, 261.61246731895466)
```

⇨ 98% confidence interval

```
from scipy import stats
c3=stats.norm.interval(0.98,loc=200,scale=30)
```

```
(130.2095637787748, 269.7904362212252)
```

Q12) Below are the scores obtained by a student in tests

34,36,36,38,38,39,39,40,40,41,41,41,41,42,42,45,49,56

1) Find mean, median, variance, standard deviation.
2) What can we say about the student marks?

⇨

```
a=pd.Series([34,36,36,38,38,39,39,40,40,41,41,41,41,42,42,45,49,56])
a.describe()
```

```
count
18.000000
mean
41.000000
std      5.052664
min
34.000000
25%
38.250000
50%
40.500000
75%
41.750000
max
56.000000
```

Q13) What is the nature of skewness when mean, median of data are equal?

- ⇨ : Symmetric

Q14) What is the nature of skewness when mean > median ?

- ⇨ : Positively Skewed

Q15) What is the nature of skewness when median > mean?

- ⇨ : Negatively Skewed

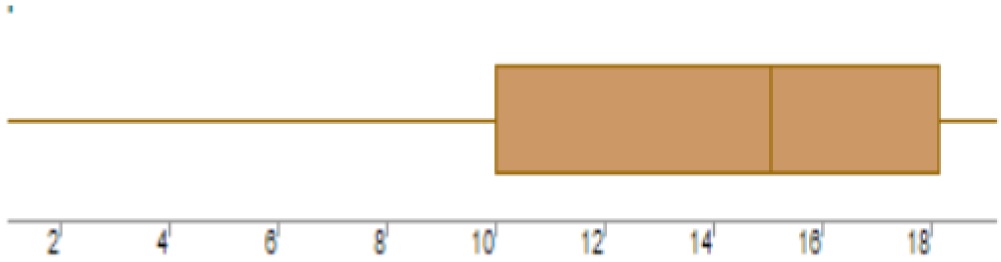
Q16) What does positive kurtosis value indicates for a data ?

- ⇨ : Positive value for kurtosis indicates that the distribution is leptokurtic i.e. the distribution is having more peak than the normal distribution.

Q17) What does negative kurtosis value indicates for a data?

- ⇨ : Negative value for kurtosis indicates that the distribution is platykurtic i.e. the distribution is having less peak than the normal distribution.

Q18) Answer the below questions using the below boxplot visualization.



What can we say about the distribution of the data?

- ⇨ : Density of the data is more on the right side.

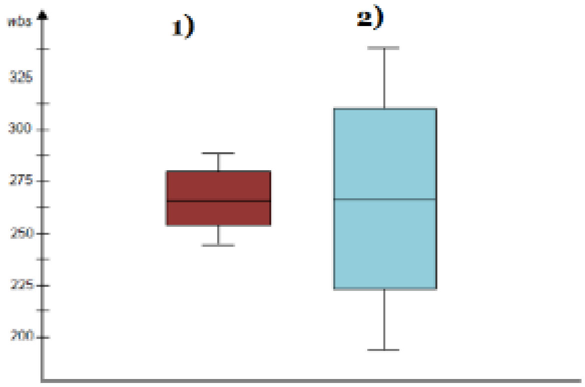
What is nature of skewness of the data?

- ⇨ : The data is negatively skewed.

What will be the IQR of the data (approximately)?

- ⇨ : here , Q1=10, Q3=18
  IQR =Q3-Q1=18-10=8

Q19) Comment on the below Boxplot visualizations?



Draw an Inference from the distribution of data for Boxplot 1 with respect Boxplot 2.

⇨

- From both box plot we can observe that there is no outliers in the data.
- Median of both the data is same.

- Compare to the first box plot, second box plot has more variation in the data.
- IQR of second box plot is higher than first box plot.

Q 20) Calculate probability from the given dataset for the below cases

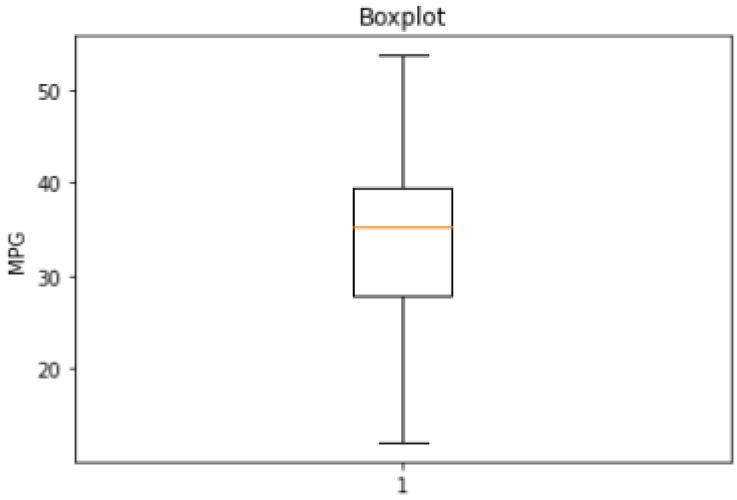
Data _set: Cars.csv

Calculate the probability of MPG of Cars for the below cases.

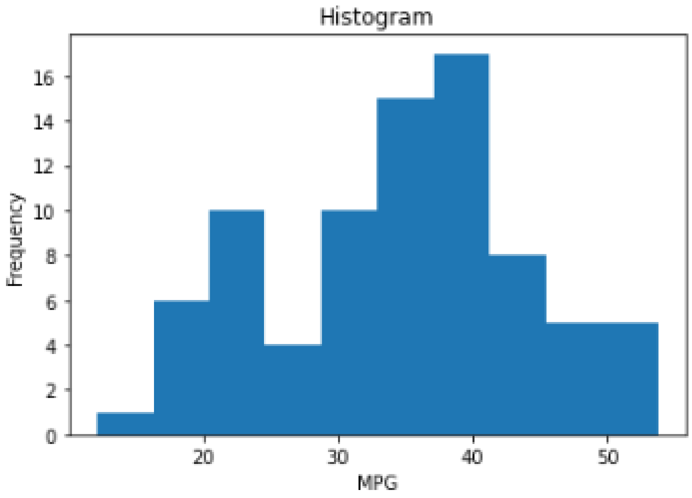
MPG <- Cars$MPG

a. P(MPG>38)
b. P(MPG<40)
c. P (20<MPG<50)

```
import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

import seaborn as sns

from scipy import stats

cars=pd.read_csv(r"C:\Users\rajes\Downloads\Cars.csv")

plt.boxplot(cars['MPG'])

plt.ylabel("MPG")

plt.title("Boxplot")

plt.show()
```



```
plt.hist(cars['MPG'])
plt.xlabel("MPG")
plt.ylabel("Frequency")
plt.title("Histogram")
plt.show()
```



a)

```
#P(MPG>38)
1-stats.norm.cdf(38,cars.MPG.mean(),cars.MPG.std())
```

```
0.3475939251582705
```

b)

```
#P(MPG<40)
stats.norm.cdf(40,cars.MPG.mean(),cars.MPG.std())
```

```
0.7293498762151616
```

c)

```
#P(20<MPG<50)

stats.norm.cdf(50,cars.MPG.mean(),cars.MPG.std())-
stats.norm.cdf(20,cars.MPG.mean(),cars.MPG.std())
```

```
0.8988689169682046
```

Q 21) Check whether the data follows normal distribution

a) Check whether the MPG of Cars follows Normal Distribution
   Dataset: Cars.csv

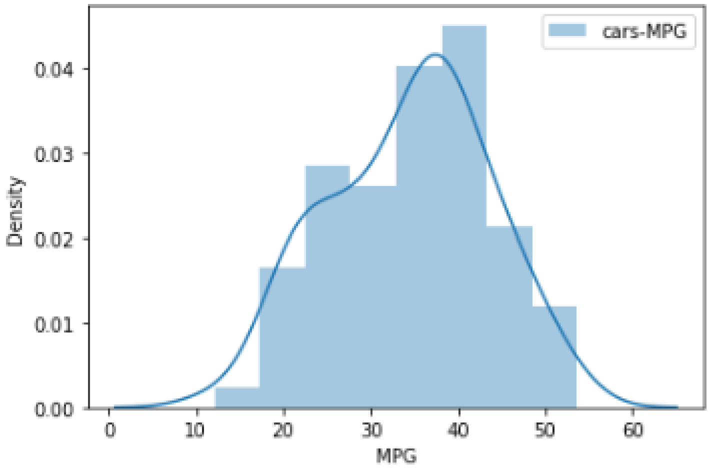
⇨

:- (Kolmogorov test for normality (N < 5000**)**

H0 : The data is normal. v/s

H1 : The data is not normal

```
 import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

Import seaborn as sns

from scipy import stats

          sns.distplot(cars.MPG,label='cars-MPG')

         plt.xlabel('MPG')

         plt.ylabel('Density')

         plt.legend();

         plt.show()
```



Conclusion: here the p-value is less than 0.05, so we reject the null Hypothesis and conclude that the data is not normal.

b) Check Whether the Adipose Tissue (AT) and Waist Circumference(Waist) from wc-at data set follows Normal Distribution
Dataset: wc-at.csv

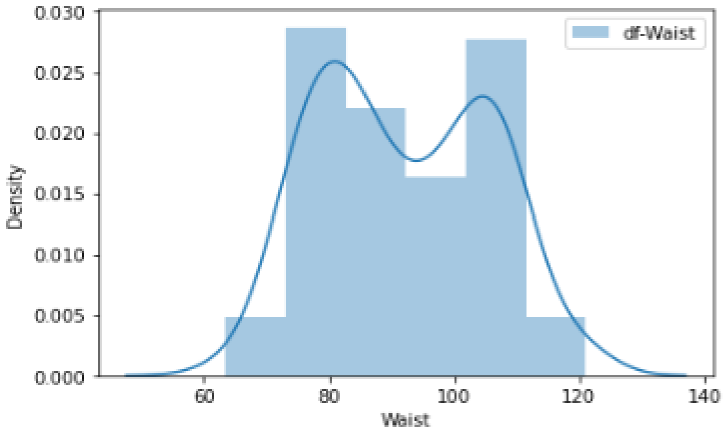
⇨

(Kolmogorov test for normality (N < 5000**)**

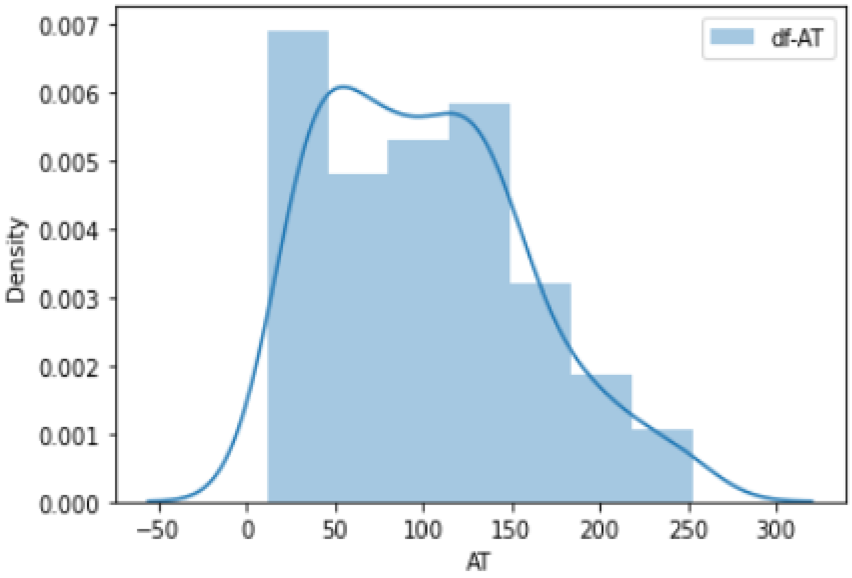
H0: The data is normal.
H1: The data is not normal.

```
import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

import seaborn as sns

from scipy import stats
```

```
df=pd.read_csv(r"C:\Users\Downloads\wc-at.csv")
sns.distplot(df.Waist,label='df-Waist')
plt.xlabel('Waist')
plt.ylabel('Density')
plt.legend();
plt.show()
```



```
sns.distplot(df.AT,label='df-AT')
plt.xlabel('AT')
plt.ylabel('Density')
plt.legend();
plt.show()
```



Conclusion: Here the p-value is less than 0.05, so we reject the null Hypothesis and conclude that the data is not normal.

Q 22) Calculate the Z scores of 90% confidence interval,94% confidence interval, 60% confidence interval

⇨

```
import pandas as pd
import numpy as np
from scipy import stats
# z-score of 90% C.I
stats.norm.ppf(0.95)
1.6448536269514722
# z-score of 94% C.I
stats.norm.ppf(0.97)
1.8807936081512509
# z-score of 80% C.I
stats.norm.ppf(0.8)
0.8416212335729143
```

Q 23) Calculate the t scores of 95% confidence interval, 96% confidence interval, 99% confidence interval for sample size of 25

⇨

```
import pandas as pd

import numpy as np

from scipy import stats

# z-score of 90% C.I

stats.norm.ppf(0.95)
```

```
1.6448536269514722
```

```
# z-score of 94% C.I

stats.norm.ppf(0.97)
```

```
1.8807936081512509
```

```
# z-score of 80% C.I

stats.norm.ppf(0.8)
```

```
0.8416212335729143
2.1665866344527562
```

```
# z-score of 99% C.I

stats.t.ppf(0.995,25)
```

```
2.787435813675851
```

Q 24**)** A Government company claims that an average light bulb lasts 270 days. A researcher randomly selects 18 bulbs for testing. The sampled bulbs last an average of 260 days, with a standard deviation of 90 days. If the CEO's claim were true, what is the probability that 18 randomly selected bulbs would have an average life of no more than 260 days

Hint:

rcode → pt(tscore,df)

df → degrees of freedom

⇨

Solution:

p(x<260)=?

n=18

```
> xbar=260

> s=90

> mu=270

> tscore=(xbar-mu)/(s/sqrt(n));tscore

 -0.4714045

> pt(tscore,17)

0.3216725
```