|  |  |
| --- | --- |
| 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 |

Q1) Identify the Data type for the Following:

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

Nominal, Ordinal, Interval, Ratio.

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

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

Ans: 3/8 or 0.375.

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

1. Equal to 1 : Zero
2. Less than or equal to 4 : 1/12
3. Sum is divisible by 2 and 3 : 36

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?

Ans: 10/21 .

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

Ans : 3.09 .

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**

**Ans :**

mean() :

Points 3.596563

Score 3.217250

Weigh 17.848750

dtype: float64

median() :

Points 3.695

Score 3.325

Weigh 17.710

dtype: float64

Points**.**mode() :

0 3.07

1 3.92

dtype: float64

Score**.**mode() :

0 3.44

dtype: float64

Weigh**.**mode() :

0 17.02

1 18.90

dtype: float64

var() :

Points 0.285881

Score 0.957379

Weigh 3.193166

dtype: float64

std() :

Points 0.534679

Score 0.978457

Weigh 1.786943

dtype: float64

Points\_Range**=**cars**.**Points**.**max()**-**cars**.**Points**.**min()

Points\_Range

2.17

Score\_Range**=**cars**.**Score**.**max()**-**cars**.**Score**.**min()

Score\_Range

3.9109999999999996

Weigh\_Range**=**cars**.**Weigh**.**max()**-**cars**.**Weigh**.**min()

Weigh\_Range

8.399999999999999

Q8) Calculate Expected Value for the problem below

1. 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?

Ans : Expected Value  =  ∑ ( probability  \* Value )

 ∑ P(x).E(x)

there are 9 patients

Probability of selecting each patient = 1/9

Ex  108, 110, 123, 134, 135, 145, 167, 187, 199

P(x)  1/9  1/9   1/9  1/9   1/9   1/9   1/9   1/9  1/9

Expected Value  =  (1/9)(108) + (1/9)110  + (1/9)123 + (1/9)134 + (1/9)135 + (1/9)145 + (1/9(167) + (1/9)187 + (1/9)199

= (1/9) ( 108 + 110 + 123 + 134 + 135 + 145 + 167 + 187 + 199)

= (1/9)  (  1308)

= 145.33

Expected Value of the Weight of that patient = **145.33**

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

**Cars speed and distance**

**Use Q9\_a.csv**

**SP and Weight(WT)**

**Use Q9\_b.csv**

**Answer:**

1) Skew

library(psych)

skew(cars$speed)

[1] -0.1105533

2) Kurtosis

kurtosi(cars$speed)

[1] -0.6730924

**Q10) Draw inferences about the following boxplot & histogram**



: The histograms peak has right skew and tail is on right. Mean > Median. We have outliers on the higher side.



: The boxplot has outliers on the maximum side

**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?

Ans:-

conf\_94 =stats.t.interval(alpha = 0.94, df=1999, loc=200, scale=30/np.sqrt(2000))

print(np.round(conf\_94,0)) print(conf\_94)

For 94% confidence interval Range is [ 198.73 – 201.26]

For 98% confidence interval range is [198.43 – 201.56]

For 96% confidence interval range is [198.62 – 201.37]

**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?

**import** numpy **as** np

**import** pandas **as** pd

**from** matplotlib **import** pyplot **as** plt

**import** statistics

marks**=**[34,36,36,38,38,39,39,40,40,41,41,41,41,42,42,45,49,56]

statistics**.**mean(marks)

41

statistics**.**median(marks)

40.5

statistics**.**mode(marks)

41

statistics**.**stdev(marks)

5.05266382858645

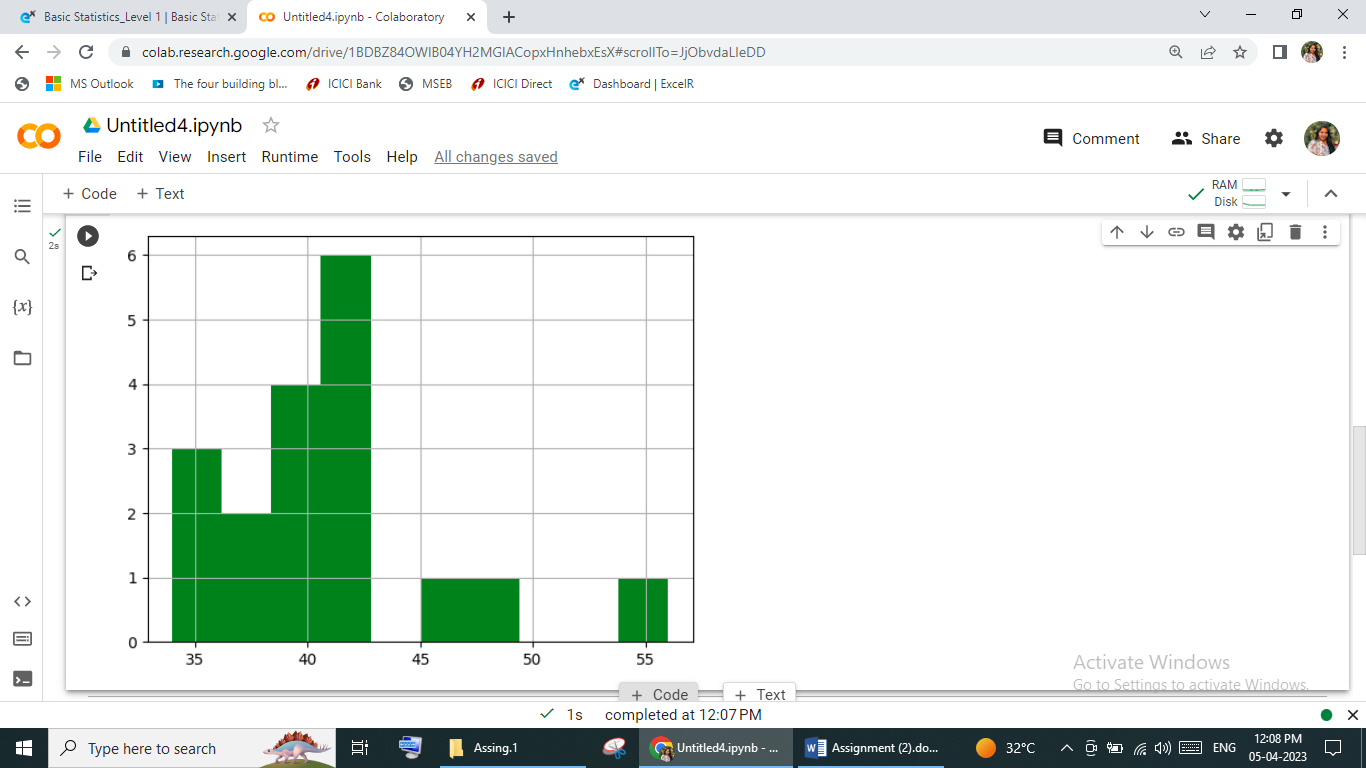
statistics**.**variance(marks)

25.529411764705884

plt**.**hist(marks, color**=**'g')

plt**.**grid()

plt**.**show()



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

Ans:- If the distribution is symmetric, then the mean is equal to the median, and the distribution has zero skewness.

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

Ans:- Skewness and tail is towards Right

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

Ans:- Skewness and tail is towards left

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

Ans:- Positive values of kurtosis indicate that distribution is peaked and possesses thick tails.

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

Ans:- A distribution with a negative kurtosis value indicates that the distribution has lighter tails than the normal distribution.

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



What can we say about the distribution of the data?

Ans:-The above Boxplot is not normally distributed the median is towards the higher value

What is nature of skewness of the data?

Ans: The data is a skewed towards left. The whisker range of minimum value is greater than maximum

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

Ans: The Inter Quantile Range = Q3 Upper quartile – Q1 Lower Quartile = 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.

Ans:- First there are no outliers. Second both the box plot shares the same median that is approximately in a range between 275 to 250 and they are normally distributed with zero to no skewness neither at the minimum or maximum whisker range.

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

* 1. P(MPG>38)

Ans:-

Prob\_MPG\_greater\_than\_38 = np.round

(1 - stats.norm.cdf

(38, loc= q20.MPG.mean(), scale= q20.MPG.std()),

3) print('P(MPG>38)=',Prob\_MPG\_greater\_than\_38)

P(MPG>38)= 0.348

* 1. P(MPG<40)

:- prob\_MPG\_less\_than\_40 = np.round(stats.norm.cdf

(40, loc =q20.MPG.mean(), scale = q20.MPG.std()),

3) print('P(MPG<40)=',prob\_MPG\_less\_than\_40)

P(MPG<40)= 0.729

* 1. P (20<MPG<50)

Ans:-

prob\_MPG\_greater\_than\_20 = np.round

(1-stats.norm.cdf(20, loc = q20.MPG.mean(), scale = q20.MPG.std()),

3) print('p(MPG>20)=',(prob\_MPG\_greater\_than\_20)) p(MPG>20)= 0.943

P(MPG<40)= 0.729

Q 21) Check whether the data follows normal distribution

1. Check whether the MPG of Cars follows Normal Distribution

Dataset: Cars.csv

ANs:- MPG of cars follows normal distribution

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

Dataset: wc-at.csv

Ans:- Adipose Tissue (AT) and Waist does not follow Normal Distribution

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

Ans: Z scores of 90% confidence interval:

print('Z score for 60% Conifidence Interval = np.round(stats.norm.ppf(.05),4))

Z score for 90% Conifidence Intervla = -1.6449

Z scores of 94% confidence interval:

print('Z score for 94% Conifidence Intervla =',np.round(stats.norm.ppf(.03),4))

Z score for 94% Conifidence Intervla = -1.8808

Z scores of 60% confidence interval:

print('Z score for 60% Conifidence Intervla =',np.round(stats.norm.ppf(.2),4))

Z score for 60% Conifidence Intervla = -0.8416

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

**t score for 95% confidence interval**

print('T score for 95% Confidence Interval =',np.round(stats.t.ppf(0.025,df=24),4))

T score for 95% Confidence Interval = -2.0639

**t value for 96% confidence interval**

print('T score for 94% Confidence Inteval =',np.round(stats.t.ppf(0.03,df=24),4))

T score for 94% Confidence Inteval = -1.974

**t value for 99% Confidence Interval**

print('T score for 95% Confidence Interval =',np.round(stats.t.ppf(0.005,df=24),4))

T score for 95% Confidence Interval = -2.7969

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

import numpy as np

Import scipy as stats

t\_score = (x - pop mean) / (sample standard daviation / square root of sample size)

(260-270)/90/np.sqrt(18)) t\_score = -0.471

stats.t.cdf(t\_score, df = 17) 0.32 = 32%