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

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

1. H,H,T
2. H,T,H
3. T,H,H

Probability of H, H, T: (1/2) \* (1/2) \* (1/2) = 1/8

Probability of H, T, H: (1/2) \* (1/2) \* (1/2) = 1/8

Probability of T, H, H: (1/2) \* (1/2) \* (1/2) = 1/8

Now, add these probabilities together: Now, add these probabilities together:

(1/8) + (1/8) + (1/8) = 3/8

So, the probability of getting two heads and one tail when three coins are tossed is 3/8, or 37.5%.

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

1. Equal to 1
2. Less than or equal to 4
3. Sum is divisible by 2 and 3

**Ans:** Total Events

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

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

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

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

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

(6,1), (6,2), (6,3), (6,4), (6,5), (6,6)} = 36

1. Equal to 1: 0% Probability
2. Less than or equal to 4: 6/36 = 1/6
3. Sum is divisible by 2 and 3: 6/36 = 1/6

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?

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 | MEDIAN | MODE | Variance | Std. Dev | Range |
| Points | 3.59 | 3.70 | 3.92 | 0.29 | 0.53 | 2.17 |
| Score | 3.22 | 3.33 | 3.44 | 0.96 | 0.98 | 3.91 |
| Weigh | 17.85 | 17.71 | 17.02 | 3.19 | 1.79 | 8.40 |

No case has the variable Mean = Median = Mode

Thus as seen in the graph dataset “score” and “Weigh” has outliers

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. = Sum (X \* Probability of X)

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

= 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**

**Ans.**

|  |  |  |
| --- | --- | --- |
|  | **Skewness** | **Kurtosis** |
| **Speed** | -0.11751 | -0.50899 |
| **Distance** | 0.806895 | 0.405053 |
| **SP** | 1.61145 | 2.977329 |
| **Weight** | -0.61475 | 0.950291 |

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



Ans - Majority of the Chicks has weight in range 50 – 100, followed by 100 -150 and 150 – 200

The data is positively Skewed



Ans - There is lots of outliers is present and the data is positively skewed.

**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 –

n=2000

x̅=200

s=30

SE=

CI = SE \* tvalue

|  |  |  |  |
| --- | --- | --- | --- |
|  | **94%** | **98%** | **96%** |
| **Lower** | 201.04 | 201.38 | 201.17 |
| **Upper** | 198.96 | 198.62 | 198.83 |

**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.

Ans.

|  |  |
| --- | --- |
| Mean | 41 |
| Median | 40.50 |
| Variance | 25.53 |
| Std Deviation | 5.05 |

1. What can we say about the student marks?

Ans- Majority of the students scored between 35 – 45 Marks

Data has outlier

Performance: Below Average

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

Ans. Skewness is totally 0 and perfectly symmetric bell-shaped curve

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

Ans. Right-skewed

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

Ans. Left-skewed

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

Ans. Positive kurtosis means the curve is more peaked and it is Leptokurtic

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

Ans. Negative Kurtosis means the curve will be flatter and broader

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



What can we say about the distribution of the data?

Ans. It is not a Normal Distribution

What is nature of skewness of the data?

Ans. It is left skewed

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)

Ans. 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

prob\_MPG\_less\_than\_50 = np.round(stats.norm.cdf(50, loc = q20.MPG.mean(), scale = q20.MPG.std()),3)

print('P(MPG<50)=',(prob\_MPG\_less\_than\_50))

P(MPG<50)= 0.956

prob\_MPG\_greaterthan20\_and\_lessthan50= (prob\_MPG\_less\_than\_50) - (prob\_MPG\_greater\_than\_20)

print('P(20<MPG<50)=',(prob\_MPG\_greaterthan20\_and\_lessthan50))

P(20<MPG<50)= 0.013000000000000012

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 -

|  |  |
| --- | --- |
| **90%** | 1.6449 |
| **94%** | 1.8808 |
| **60%** | 0.84162 |

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

Ans -

|  |  |
| --- | --- |
| **95%** | 2.06 |
| **96%** | 2.17 |
| **99%** | 2.79 |

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

Ans - 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%