|  |  |
| --- | --- |
| 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 | Nomonal |
| 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?

**Solution:**

When three coins are tossed together, the total number of outcomes=8

i.e.,

(HHH, HHT, HTH, THH, TTT, TTH, THT, HTT)

Total no. of possible outcomes = 8

Let E be the event of getting two heads and one tail.

E = ( HHT, HTH, THH)

i.e. n(E) = 3

Therefore,

P(E)=

=

The probability of getting two heads and one tail is .

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

**Solution:**

When two dice are rolled, the total number of outcomes = 36.

a): Let A be the event of getting the sum equal to 1

n(A) = 0

{i.e. not possible that sum always exceed to 1}

P(A) =

=

= 0

The probability of getting sum equal to 1 is 0.

b): Let B be event of getting the sum less than or equal to 4.

N(B) = 3

{ i.e.(1,3), (2,2), (3,1) }

P(B) =

= =

The probability of getting the sum less than or equal to 4 is .

c): Let C be the event of getting the sum is divisible by 2 and 3.

N(C) = 6

{ i.e. (1,5), (2,4), (3,3), (4,2), (5,1), (6,6) }

P(C) =

= = .

The probability of getting the sum is divisible by 2 and 3 is .

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?

**Solution:**

Total number of balls = (2 + 3 + 2) = 7

Let S be the sample space.

Then, n(S) = number of ways of drawing 2 balls out of 7

= 7C2 =  = 21

Let E be the event of drawing 2 balls, none of which is blue.

n(E) = number of ways of drawing 2 balls out of (2 + 3) balls.

= 5C2 =  = 10

P(E) = =

The probability that none of the balls drawn is blue.

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

**Solution:**

Expected number of candies for a randomly selected child

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

= 0.015 + 0.8 + 1.95 + 0.025 + 0.06 + 0.24

= 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**

Solution:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Points | Score | Weigh |
| Mazda RX4 | 3.9 | 2.62 | 16.46 |
| Mazda RX4 Wag | 3.9 | 2.875 | 17.02 |
| Datsun 710 | 3.85 | 2.32 | 18.61 |
| Hornet 4 Drive | 3.08 | 3.215 | 19.44 |
| Hornet Sportabout | 3.15 | 3.44 | 17.02 |
| Valiant | 2.76 | 3.46 | 20.22 |
| Duster 360 | 3.21 | 3.57 | 15.84 |
| Merc 240D | 3.69 | 3.19 | 20 |
| Merc 230 | 3.92 | 3.15 | 22.9 |
| Merc 280 | 3.92 | 3.44 | 18.3 |
| Merc 280C | 3.92 | 3.44 | 18.9 |
| Merc 450SE | 3.07 | 4.07 | 17.4 |
| Merc 450SL | 3.07 | 3.73 | 17.6 |
| Merc 450SLC | 3.07 | 3.78 | 18 |
| Cadillac Fleetwood | 2.93 | 5.25 | 17.98 |
| Lincoln Continental | 3 | 5.424 | 17.82 |
| Chrysler Imperial | 3.23 | 5.345 | 17.42 |
| Fiat 128 | 4.08 | 2.2 | 19.47 |
| Honda Civic | 4.93 | 1.615 | 18.52 |
| Toyota Corolla | 4.22 | 1.835 | 19.9 |
| Toyota Corona | 3.7 | 2.465 | 20.01 |
| Dodge Challenger | 2.76 | 3.52 | 16.87 |
| AMC Javelin | 3.15 | 3.435 | 17.3 |
| Camaro Z28 | 3.73 | 3.84 | 15.41 |
| Pontiac Firebird | 3.08 | 3.845 | 17.05 |
| Fiat X1-9 | 4.08 | 1.935 | 18.9 |
| Porsche 914-2 | 4.43 | 2.14 | 16.7 |
| Lotus Europa | 3.77 | 1.513 | 16.9 |
| Ford Pantera L | 4.22 | 3.17 | 14.5 |
| Ferrari Dino | 3.62 | 2.77 | 15.5 |
| Maserati Bora | 3.54 | 3.57 | 14.6 |
| Volvo 142E | 4.11 | 2.78 | 18.6 |

 Mean for Points = 3.59, Score = 3.21 and Weigh = 17.84 Median for Points = 3.69, Score = 3.32 and Weigh = 17.71 Mode for Points = 3.07, Score = 3.44 and Weigh = 17.02 Variance for Points = 0.28, Score = 0.95, Weigh = 3.19 Standard Deviation for Points = 0.53, Score = 0.97, Weigh = 1.78 Range [Min-Max] for Points [3.59 – 4.93], Score [3.21 – 5.42] and Weigh [17.84 – 22.9]

**Inferences:**





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?

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

one of the patients is chosen at random.

**To Find :** Expected Value

**Solution:**

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**

**Solution:**

Q.9 a): = pd.read\_csv("C:\Users\LENOVO\Downloads\cars.csv", index\_col = 'Index')

print('For Cars Speed', "Skewness value=", np.round(q9a.speed.skew(),2), 'and' , 'Kurtosis value=', np.round(q9a.dist.skew(),2))

For Cars Speed Skewness value= -0.12 and Kurtosis value= 0.81

print('Skewness value =', np.round(q9a.dist.skew(),2),'and', 'Kurtosis value =', np.round(q9a.dist.kurt(),2), 'for Cars Distance')

Skewness value = 0.81 and Kurtosis value = 0.41 for Cars Distance

**SP and Weight (WT)**

**Use Q9\_b.csv**

**Solution:**

Q.9 b): = pd.read\_csv("C:\Users\LENOVO\Downloads\cars.csv")

print('For SP Skewness =', np.round(SP.skew(),2), 'kurtosis =', np.round(WT.kurt(),2))

For SP Skewness = 1.61 kurtosis = 0.95

print('For WT Skewness =', np.round(SP.skew(),2), 'Kurtosis =', np.round(WT.kurt(),2))

For WT Skewness = 1.61 Kurtosis = 0.95

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



- Chick weight data is right skewed or positively skewed.

- More than 50% Chick Weight is between 50 to 150.

- Most of the chick weight is between 50 to 100.



- The data is right skewed.

- There are outliers at upper 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?

**Solution:**

The **information given** is:

Sample **mean**of https://tex.z-dn.net/?f=%5Coverline%7Bx%7D%20%3D%20200.

Sample **standard deviation** of https://tex.z-dn.net/?f=s%20%3D%2030.

Sample **size**of https://tex.z-dn.net/?f=n%20%3D%202000.

The **interval** is:

https://tex.z-dn.net/?f=%5Coverline%7Bx%7D%20%5Cpm%20t%5Cfrac%7Bs%7D%7B%5Csqrt%7Bn%7D%7D

* In which **t** is the critical value for the two-tailed confidence interval.

Considering a **94%** confidence level, using a calculator, with 200 - 1 = **199 df**, the critical value is **t = 1.8916**, hence:

https://tex.z-dn.net/?f=%5Coverline%7Bx%7D%20-%20t%5Cfrac%7Bs%7D%7B%5Csqrt%7Bn%7D%7D%20%3D%20200%20-%201.8916%5Cfrac%7B30%7D%7B%5Csqrt%7B2000%7D%7D%20%3D%20198.73

https://tex.z-dn.net/?f=%5Coverline%7Bx%7D%20%2B%20t%5Cfrac%7Bs%7D%7B%5Csqrt%7Bn%7D%7D%20%3D%20200%20%2B%201.8916%5Cfrac%7B30%7D%7B%5Csqrt%7B2000%7D%7D%20%3D%20201.27

The **94%** confidence interval is **(198.73, 201.27).**

Considering a **96%** confidence level, using a calculator, with 200 - 1 = **199 df**, the critical value is **t = 2.0673**, hence:

https://tex.z-dn.net/?f=%5Coverline%7Bx%7D%20-%20t%5Cfrac%7Bs%7D%7B%5Csqrt%7Bn%7D%7D%20%3D%20200%20-%202.0673%5Cfrac%7B30%7D%7B%5Csqrt%7B2000%7D%7D%20%3D%20198.61

https://tex.z-dn.net/?f=%5Coverline%7Bx%7D%20%2B%20t%5Cfrac%7Bs%7D%7B%5Csqrt%7Bn%7D%7D%20%3D%20200%20%2B%202.0673%5Cfrac%7B30%7D%7B%5Csqrt%7B2000%7D%7D%20%3D%20201.39

The **96%** confidence interval is **(198.61, 201.39).**

Considering a **98%** confidence level, using a calculator, with 200 - 1 = **199 df**, the critical value is **t = 2.3452**, hence:

https://tex.z-dn.net/?f=%5Coverline%7Bx%7D%20-%20t%5Cfrac%7Bs%7D%7B%5Csqrt%7Bn%7D%7D%20%3D%20200%20-%202.3452%5Cfrac%7B30%7D%7B%5Csqrt%7B2000%7D%7D%20%3D%20198.43

https://tex.z-dn.net/?f=%5Coverline%7Bx%7D%20%2B%20t%5Cfrac%7Bs%7D%7B%5Csqrt%7Bn%7D%7D%20%3D%20200%20%2B%202.3452%5Cfrac%7B30%7D%7B%5Csqrt%7B2000%7D%7D%20%3D%20201.57

The **98%** confidence interval is **(198.43, 201.57).**

**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.

**Solution:**

Mean = 41

Median = 40.5

Variance = 25.52

Standard Deviation = 5.05

1. What can we say about the student marks?

**Solution:**

We don’t have outliers and the data is slightly skewed towards right because mean is greater than median.

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

**Solution:**

The Distribution is symmetric.

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

**Solution:**

Right skewed

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

**Solution:**

Left Skewed

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

**Solution:**

The data is normally distributed and kurtosis value is zero.

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

**Solution:**

The distribution of the data has lighter tails and a flatter peaks

than the distribution.

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



What can we say about the distribution of the data?

**Solution**:

The above boxplot is not normally distributed the median is towards the

Higher value.

What is nature of skewness of the data?

**Solution:**

Left skewed, median is greater than mean.

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

**Solution:**

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.

**Solution:**

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)

Solution:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| HP | MPG | VOL | SP | WT |
| 49 | 53.70068 | 89 | 104.1854 | 28.76206 |
| 55 | 50.0134 | 92 | 105.4613 | 30.46683 |
| 55 | 50.0134 | 92 | 105.4613 | 30.1936 |
| 70 | 45.69632 | 92 | 113.4613 | 30.63211 |
| 53 | 50.50423 | 92 | 104.4613 | 29.88915 |
| 70 | 45.69632 | 89 | 113.1854 | 29.59177 |
| 55 | 50.0134 | 92 | 105.4613 | 30.30848 |
| 62 | 46.71655 | 50 | 102.5985 | 15.84776 |
| 62 | 46.71655 | 50 | 102.5985 | 16.35948 |
| 80 | 42.29908 | 94 | 115.6452 | 30.92015 |
| 73 | 44.65283 | 89 | 111.1854 | 29.36334 |
| 92 | 39.35409 | 50 | 117.5985 | 15.75353 |
| 92 | 39.35409 | 99 | 122.1051 | 32.81359 |
| 73 | 44.65283 | 89 | 111.1854 | 29.37844 |
| 66 | 45.73489 | 89 | 108.1854 | 29.34728 |
| 73 | 44.65283 | 89 | 111.1854 | 29.60453 |
| 78 | 42.78991 | 91 | 114.3693 | 29.53578 |
| 92 | 39.35409 | 50 | 117.5985 | 16.19412 |
| 78 | 42.78991 | 91 | 114.3693 | 29.92939 |
| 90 | 38.90183 | 103 | 118.4729 | 33.51697 |
| 92 | 38.411 | 99 | 119.1051 | 32.32465 |
| 74 | 42.82848 | 107 | 110.8408 | 34.90821 |
| 95 | 38.31061 | 101 | 120.289 | 32.67583 |
| 81 | 40.47472 | 96 | 113.8291 | 31.83712 |
| 95 | 38.31061 | 89 | 119.1854 | 28.78173 |
| 92 | 38.411 | 50 | 114.5985 | 16.04317 |
| 92 | 38.411 | 117 | 120.7605 | 38.06282 |
| 92 | 38.411 | 99 | 119.1051 | 32.83507 |
| 52 | 43.46943 | 104 | 99.56491 | 34.48321 |
| 103 | 35.40419 | 107 | 121.8408 | 35.54936 |
| 84 | 39.43124 | 114 | 113.4846 | 37.04235 |
| 84 | 39.43124 | 101 | 112.289 | 33.23436 |
| 102 | 36.28546 | 97 | 119.9211 | 31.38004 |
| 102 | 36.28546 | 113 | 121.3926 | 37.57329 |
| 81 | 39.53163 | 101 | 111.289 | 32.70164 |
| 90 | 37.95874 | 98 | 115.0131 | 31.91122 |
| 90 | 37.95874 | 88 | 114.0934 | 28.754 |
| 102 | 34.07067 | 86 | 116.9094 | 27.87992 |
| 102 | 34.07067 | 86 | 116.9094 | 28.6305 |
| 130 | 31.01413 | 92 | 128.4613 | 30.11543 |
| 95 | 35.15273 | 113 | 116.3926 | 37.39252 |
| 95 | 35.15273 | 106 | 115.7488 | 35.02718 |
| 102 | 34.07067 | 92 | 117.4613 | 30.52743 |
| 95 | 35.15273 | 88 | 114.0934 | 28.34398 |
| 93 | 35.64356 | 102 | 114.381 | 33.07863 |
| 100 | 34.5615 | 99 | 117.1051 | 32.62192 |
| 100 | 34.5615 | 111 | 118.2087 | 36.49862 |
| 98 | 35.05233 | 103 | 116.4729 | 33.91006 |
| 130 | 31.01413 | 86 | 127.9094 | 28.0706 |
| 115 | 29.62994 | 101 | 118.289 | 33.45847 |
| 115 | 29.62994 | 101 | 118.289 | 33.21395 |
| 115 | 29.62994 | 101 | 118.289 | 33.43671 |
| 115 | 29.62994 | 124 | 120.4043 | 40.39816 |
| 180 | 24.48737 | 113 | 143.3926 | 37.62069 |
| 160 | 26.85228 | 113 | 135.3926 | 37.25439 |
| 130 | 27.85625 | 124 | 126.4043 | 40.58907 |
| 96 | 31.11358 | 92 | 110.4613 | 30.14754 |
| 115 | 29.62994 | 101 | 118.289 | 32.73452 |
| 100 | 30.13192 | 94 | 112.6452 | 30.61528 |
| 100 | 28.86023 | 115 | 115.5766 | 37.66287 |
| 145 | 27.35427 | 111 | 130.2087 | 36.88815 |
| 120 | 24.60913 | 116 | 117.6685 | 37.86041 |
| 140 | 23.51592 | 131 | 126.0481 | 43.39099 |
| 140 | 23.51592 | 123 | 125.3123 | 40.72283 |
| 150 | 23.60516 | 121 | 128.1284 | 40.15948 |
| 165 | 40.05 | 50 | 126.5985 | 15.71286 |
| 165 | 23.10317 | 114 | 132.4846 | 37.97996 |
| 165 | 23.10317 | 127 | 133.6802 | 41.57397 |
| 165 | 23.10317 | 123 | 133.3123 | 40.47204 |
| 245 | 21.27371 | 112 | 158.3007 | 37.14173 |
| 280 | 19.67851 | 50 | 164.5985 | 15.82306 |
| 162 | 23.20357 | 135 | 133.416 | 44.01314 |
| 162 | 23.20357 | 132 | 133.1401 | 43.35312 |
| 140 | 19.08634 | 160 | 124.7152 | 52.99775 |
| 140 | 19.08634 | 129 | 121.8642 | 42.6187 |
| 175 | 18.76284 | 129 | 132.8642 | 42.77822 |
| 322 | 36.9 | 50 | 169.5985 | 16.13295 |
| 238 | 19.19789 | 115 | 150.5766 | 37.92311 |
| 263 | 34 | 50 | 151.5985 | 15.76963 |
| 295 | 19.83373 | 119 | 167.9445 | 39.4231 |
| 236 | 12.10126 | 107 | 139.8408 | 34.94861 |

Prob\_MPG\_greater\_than\_38 = np.round(1 - stats.norm.cdf(38, loc=MPG.mean(), scale= 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 = MPG.mean(), scale = 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 = MPG.mean(), scale = 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 = MPG.mean(), scale = 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

Solution:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| HP | MPG | VOL | SP | WT |
| 49 | 53.70068 | 89 | 104.1854 | 28.76206 |
| 55 | 50.0134 | 92 | 105.4613 | 30.46683 |
| 55 | 50.0134 | 92 | 105.4613 | 30.1936 |
| 70 | 45.69632 | 92 | 113.4613 | 30.63211 |
| 53 | 50.50423 | 92 | 104.4613 | 29.88915 |
| 70 | 45.69632 | 89 | 113.1854 | 29.59177 |
| 55 | 50.0134 | 92 | 105.4613 | 30.30848 |
| 62 | 46.71655 | 50 | 102.5985 | 15.84776 |
| 62 | 46.71655 | 50 | 102.5985 | 16.35948 |
| 80 | 42.29908 | 94 | 115.6452 | 30.92015 |
| 73 | 44.65283 | 89 | 111.1854 | 29.36334 |
| 92 | 39.35409 | 50 | 117.5985 | 15.75353 |
| 92 | 39.35409 | 99 | 122.1051 | 32.81359 |
| 73 | 44.65283 | 89 | 111.1854 | 29.37844 |
| 66 | 45.73489 | 89 | 108.1854 | 29.34728 |
| 73 | 44.65283 | 89 | 111.1854 | 29.60453 |
| 78 | 42.78991 | 91 | 114.3693 | 29.53578 |
| 92 | 39.35409 | 50 | 117.5985 | 16.19412 |
| 78 | 42.78991 | 91 | 114.3693 | 29.92939 |
| 90 | 38.90183 | 103 | 118.4729 | 33.51697 |
| 92 | 38.411 | 99 | 119.1051 | 32.32465 |
| 74 | 42.82848 | 107 | 110.8408 | 34.90821 |
| 95 | 38.31061 | 101 | 120.289 | 32.67583 |
| 81 | 40.47472 | 96 | 113.8291 | 31.83712 |
| 95 | 38.31061 | 89 | 119.1854 | 28.78173 |
| 92 | 38.411 | 50 | 114.5985 | 16.04317 |
| 92 | 38.411 | 117 | 120.7605 | 38.06282 |
| 92 | 38.411 | 99 | 119.1051 | 32.83507 |
| 52 | 43.46943 | 104 | 99.56491 | 34.48321 |
| 103 | 35.40419 | 107 | 121.8408 | 35.54936 |
| 84 | 39.43124 | 114 | 113.4846 | 37.04235 |
| 84 | 39.43124 | 101 | 112.289 | 33.23436 |
| 102 | 36.28546 | 97 | 119.9211 | 31.38004 |
| 102 | 36.28546 | 113 | 121.3926 | 37.57329 |
| 81 | 39.53163 | 101 | 111.289 | 32.70164 |
| 90 | 37.95874 | 98 | 115.0131 | 31.91122 |
| 90 | 37.95874 | 88 | 114.0934 | 28.754 |
| 102 | 34.07067 | 86 | 116.9094 | 27.87992 |
| 102 | 34.07067 | 86 | 116.9094 | 28.6305 |
| 130 | 31.01413 | 92 | 128.4613 | 30.11543 |
| 95 | 35.15273 | 113 | 116.3926 | 37.39252 |
| 95 | 35.15273 | 106 | 115.7488 | 35.02718 |
| 102 | 34.07067 | 92 | 117.4613 | 30.52743 |
| 95 | 35.15273 | 88 | 114.0934 | 28.34398 |
| 93 | 35.64356 | 102 | 114.381 | 33.07863 |
| 100 | 34.5615 | 99 | 117.1051 | 32.62192 |
| 100 | 34.5615 | 111 | 118.2087 | 36.49862 |
| 98 | 35.05233 | 103 | 116.4729 | 33.91006 |
| 130 | 31.01413 | 86 | 127.9094 | 28.0706 |
| 115 | 29.62994 | 101 | 118.289 | 33.45847 |
| 115 | 29.62994 | 101 | 118.289 | 33.21395 |
| 115 | 29.62994 | 101 | 118.289 | 33.43671 |
| 115 | 29.62994 | 124 | 120.4043 | 40.39816 |
| 180 | 24.48737 | 113 | 143.3926 | 37.62069 |
| 160 | 26.85228 | 113 | 135.3926 | 37.25439 |
| 130 | 27.85625 | 124 | 126.4043 | 40.58907 |
| 96 | 31.11358 | 92 | 110.4613 | 30.14754 |
| 115 | 29.62994 | 101 | 118.289 | 32.73452 |
| 100 | 30.13192 | 94 | 112.6452 | 30.61528 |
| 100 | 28.86023 | 115 | 115.5766 | 37.66287 |
| 145 | 27.35427 | 111 | 130.2087 | 36.88815 |
| 120 | 24.60913 | 116 | 117.6685 | 37.86041 |
| 140 | 23.51592 | 131 | 126.0481 | 43.39099 |
| 140 | 23.51592 | 123 | 125.3123 | 40.72283 |
| 150 | 23.60516 | 121 | 128.1284 | 40.15948 |
| 165 | 40.05 | 50 | 126.5985 | 15.71286 |
| 165 | 23.10317 | 114 | 132.4846 | 37.97996 |
| 165 | 23.10317 | 127 | 133.6802 | 41.57397 |
| 165 | 23.10317 | 123 | 133.3123 | 40.47204 |
| 245 | 21.27371 | 112 | 158.3007 | 37.14173 |
| 280 | 19.67851 | 50 | 164.5985 | 15.82306 |
| 162 | 23.20357 | 135 | 133.416 | 44.01314 |
| 162 | 23.20357 | 132 | 133.1401 | 43.35312 |
| 140 | 19.08634 | 160 | 124.7152 | 52.99775 |
| 140 | 19.08634 | 129 | 121.8642 | 42.6187 |
| 175 | 18.76284 | 129 | 132.8642 | 42.77822 |
| 322 | 36.9 | 50 | 169.5985 | 16.13295 |
| 238 | 19.19789 | 115 | 150.5766 | 37.92311 |
| 263 | 34 | 50 | 151.5985 | 15.76963 |
| 295 | 19.83373 | 119 | 167.9445 | 39.4231 |
| 236 | 12.10126 | 107 | 139.8408 | 34.94861 |

 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

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

**Solution:**

|  |  |
| --- | --- |
| Waist | AT |
| 74.75 | 25.72 |
| 72.6 | 25.89 |
| 81.8 | 42.6 |
| 83.95 | 42.8 |
| 74.65 | 29.84 |
| 71.85 | 21.68 |
| 80.9 | 29.08 |
| 83.4 | 32.98 |
| 63.5 | 11.44 |
| 73.2 | 32.22 |
| 71.9 | 28.32 |
| 75 | 43.86 |
| 73.1 | 38.21 |
| 79 | 42.48 |
| 77 | 30.96 |
| 68.85 | 55.78 |
| 75.95 | 43.78 |
| 74.15 | 33.41 |
| 73.8 | 43.35 |
| 75.9 | 29.31 |
| 76.85 | 36.6 |
| 80.9 | 40.25 |
| 79.9 | 35.43 |
| 89.2 | 60.09 |
| 82 | 45.84 |
| 92 | 70.4 |
| 86.6 | 83.45 |
| 80.5 | 84.3 |
| 86 | 78.89 |
| 82.5 | 64.75 |
| 83.5 | 72.56 |
| 88.1 | 89.31 |
| 90.8 | 78.94 |
| 89.4 | 83.55 |
| 102 | 127 |
| 94.5 | 121 |
| 91 | 107 |
| 103 | 129 |
| 80 | 74.02 |
| 79 | 55.48 |
| 83.5 | 73.13 |
| 76 | 50.5 |
| 80.5 | 50.88 |
| 86.5 | 140 |
| 83 | 96.54 |
| 107.1 | 118 |
| 94.3 | 107 |
| 94.5 | 123 |
| 79.7 | 65.92 |
| 79.3 | 81.29 |
| 89.8 | 111 |
| 83.8 | 90.73 |
| 85.2 | 133 |
| 75.5 | 41.9 |
| 78.4 | 41.71 |
| 78.6 | 58.16 |
| 87.8 | 88.85 |
| 86.3 | 155 |
| 85.5 | 70.77 |
| 83.7 | 75.08 |
| 77.6 | 57.05 |
| 84.9 | 99.73 |
| 79.8 | 27.96 |
| 108.3 | 123 |
| 119.6 | 90.41 |
| 119.9 | 106 |
| 96.5 | 144 |
| 105.5 | 121 |
| 105 | 97.13 |
| 107 | 166 |
| 107 | 87.99 |
| 101 | 154 |
| 97 | 100 |
| 100 | 123 |
| 108 | 217 |
| 100 | 140 |
| 103 | 109 |
| 104 | 127 |
| 106 | 112 |
| 109 | 192 |
| 103.5 | 132 |
| 110 | 126 |
| 110 | 153 |
| 112 | 158 |
| 108.5 | 183 |
| 104 | 184 |
| 111 | 121 |
| 108.5 | 159 |
| 121 | 245 |
| 109 | 137 |
| 97.5 | 165 |
| 105.5 | 152 |
| 98 | 181 |
| 94.5 | 80.95 |
| 97 | 137 |
| 105 | 125 |
| 106 | 241 |
| 99 | 134 |
| 91 | 150 |
| 102.5 | 198 |
| 106 | 151 |
| 109.1 | 229 |
| 115 | 253 |
| 101 | 188 |
| 100.1 | 124 |
| 93.3 | 62.2 |
| 101.8 | 133 |
| 107.9 | 208 |
| 108.5 | 208 |





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

Solution:

# z value for 90% confidence interval

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

Z score for 60% Conifidence Intervla = -1.6449

# z value for 94% confidence interval

print('Z score for 60% Conifidence Intervla =',np.round(stats.norm.ppf(.03),4))

Z score for 60% Conifidence Intervla = -1.8808

# z value for 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

Ans:

# 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 94% 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

**Solution:**

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%