Interactive Supplementary Lesson Four for Grade 12 Students

General Instructions: Choose the correct answer for the following questions, which are designed for your interactive supplementary practice. The questions, correct answers, and distractive choices are linked. Attempt to answer them, and then check your response by clicking on the alternatives, which will lead you to feedback. You may attempt each question three times until you get it correct. Every time, you get it wrong, you should click on 'Try Again' to return to the same question.

1. Determine standard deviation (SD) of the given data set:
   (6, 7, 4, 11, 10, 11, 12, 13, 17.
   A. ≈ 13.88
   B. ≈ 3.72
   C. 9
   D. ≈ 10.11
2. In the first month of the summer program, a community center welcomed 1200 participants. These participants collectively planted 5400 trees. Calculate the coefficient of variation if the square of the sum of the trees planted is 29160.
   A. 20.25%
   B. 2.01%
   C. 4.5%
   D. 44.67%
3. Of the following is a drawback of using standard deviation (SD) in interpretation.
   A. Quantifies variability
   B. Statistical inference
   C. Sensitivity to outliers
   D. Comparison and benchmarking
4. There are 150 different types of frozen pizza available in the local grocery store. The researcher decides to use systematic sampling to select 30 pizzas for her study. Calculate the sampling interval and describe how the researcher would select her sample of pizzas.
   A. 5
   B. 30
   C. $\frac{1}{5}$
   D. 50
5. A researcher is studying the heights of 50 different types of plants in a greenhouse. The heights (in centimeters) are grouped into the intervals as presented in table, and calculate coefficient of variation of the heights.

Height (cm)	30-49	50-69	70-89	90-109	110-129	130-149
Frequency (f)	8	12	15	10	3	2

   A. 41%
   B. 39%
   C. 19.26%
   D. 66.5%

IncorrectAnsToQ1. Try Again.
IncorrectAnsToQ2. Try Again.
IncorrectAnsToQ3. Try Again.
IncorrectAnsToQ4. Try Again.
IncorrectAnsTpQ5. Try Again.

Feedback

Good job. Have a look at the explanation for #Q1 below if you like and then go to the next question.

Solution:

To determine standard deviation (SD) of the given data set: 6, 7, 4, 11, 10, 11, 12, 13, 17, follow these steps:

Step 1: Calculate the Mean

The mean (μ) is calculated using the formula: $\mu = \frac{\sum x}{N}$

Where (N) is the number of data points.

1. Sum of the data points: 6 + 7 + 4 + 11 + 10 + 11 + 12 + 13 + 17 = 91
2. Number of data points: N = 9
3. Mean: $\mu = \frac{90}{9} \approx 10.11$

Step 2: Calculate the Variance

Variance (σ^2) is calculated using the formula: $\sigma^2 = \frac{\sum(x-\mu)^2}{N}$

1. Calculate each squared deviation from the mean:
   - $(6 - 10.11)^2 \approx 16.49$
   - $(7 - 10.11)^2 \approx 9.81$
   - $(4 - 10.11)^2 \approx 37.23$
   - $(11 - 10.11)^2 \approx 0.79$
   - $(10 - 10.11)^2 \approx 0.01$
   - $(11 - 10.11)^2 \approx 0.79$
   - $(12 - 10.11)^2 \approx 3.57$
   - $(13 - 10.11)^2 \approx 8.41$
   - $(17 - 10.11)^2 \approx 47.79$
2. Sum of squared deviations:
   16.49 + 9.81 + 37.23 + 0.79 + 0.01 + 0.79 + 3.57 + 8.41 + 47.79 ≈ 124.89
3. Variance: $\sigma^2 = \frac{124.89}{9} \approx 13.88$

Step 3: Calculate the Standard Deviation (σ):

The standard deviation (σ) is the square root of the variance:

$$\sigma = \sqrt{\sigma^2} \approx \sqrt{13.88} \approx 3.72$$

∴

Variance: $\sigma^2 \approx 13.88$

Standard Deviation: $\sigma \approx 3.72$

Good job. Have a look at the explanation for #Q2 below if you like and then go to the next question.

Solution:

In the first month of the summer program, a community center welcomed 1200 participants. These participants collectively planted 5400 trees. Calculate and interpret the coefficient of variation if the square of the sum of the trees planted is 29160.

Step 1: Calculate the Mean: The mean number of trees planted per participant is calculated using the formula:

$$\text{Mean}(\mu) = \frac{\text{Total trees planted}}{\text{Number of participants}} = \frac{5400}{1200} = 4.5$$

Step 2: Calculate the Total of the Individual Squared Values: We are given that the square of the sum of the trees planted is 29160. To find the sum of the individual squared values (S), we can use the formula for the coefficient of variation.

Step 3: Calculate the Variance: To find the variance, we need to use the relationship between the sum of the squares of the individual values and the mean:

1. We know the following relationships: S^2 = Sum of the individual values^2 = 29160, and the total number of trees planted is 5400. Hence, the variance (σ^2) can be calculated as:

$$\sigma^2 = \frac{S_2 - n\mu^2}{n}$$

Where:- S_2 is the sum of the squares (given in this case), n is the number of participants, and σ is the mean.

Step 4: Calculate the Variance: Given: S_2 = 29160, n = 1200 and σ = 4.5

Now, we plug in the values:

$$\sigma^2 = \frac{29160 - 1200 \cdot (4.5)^2}{1200}$$

Calculate 1200 . $(4.5)^2$:

$(4.5)^2 = 20.25 \Rightarrow 1200 . 20.25 = 24300$

Now, substitute back into the variance equation:

$$\sigma^2 = \frac{29160 - 24300}{1200} = \frac{4860}{1200} = 4.05$$

Step 5: Calculate the Standard Deviation

Standard deviation (σ) is the square root of variance: $\sigma = \sqrt{4.05} \approx 2.01$

Step 6: Calculate the Coefficient of Variation

The coefficient of variation (CV) is calculated using the following formula:

$$\text{CV} = \frac{\sigma}{\mu} \times 100\%$$

Substituting the values:

$$\text{CV} = \frac{2.01}{4.5} \times 100\% \approx 44.67\%$$

Interpretation: The coefficient of variation of approximately 44.67% indicates a moderate level of relative variability in the number of trees planted per participant. This means that participants' performance in tree planting varies, on average, about 44.67% from the mean number of trees planted (4.5), showing some inconsistency in participation among different individuals in the program.

Good job. Have a look at the explanation for #Q3 below if you like and then go to the next question.

Solution:
Advantages and Disadvantages of Standard Deviation (SD) in Interpretation

Standard Deviation (SD) is a statistical measure that quantifies the amount of variation or dispersion of a set of values. It's widely used in various fields, including interpretation, to assess the reliability and consistency of data.

Advantages of SD in Interpretation:

Quantifies Variability: SD provides a numerical value that directly measures how much data points deviate from the mean. This allows for a precise comparison of variability between different datasets.

Statistical Inference: SD is crucial for many statistical tests and calculations, such as hypothesis testing and confidence interval estimation. It helps to determine the significance of findings and draw reliable conclusions.

Data Understanding: By understa00nding the SD, interpreters can better grasp the distribution of data and identify outliers or unusual patterns.

Comparison and Benchmarking: SD can be used to compare the variability of different groups or samples. This is valuable for assessing the performance of different systems, processes, or individuals.

Disadvantages of SD in Interpretation:

Sensitivity to Outliers: SD can be heavily influenced by outliers, which are extreme values that can distort the overall measure of variability. This may lead to misleading interpretations.

Lack of Meaningful Interpretation: While SD provides a numerical value, it may not always be intuitively understandable without additional context. It's important to consider the units of measurement and the nature of the data when interpreting SD.

Assumption of Normality: Many statistical methods based on SD assume that the data follows a normal distribution. If the data is not normally distributed, the results may be biased.

In conclusion, SD is a valuable tool for interpretation, providing a quantitative measure of variability. However, it's essential to be aware of its limitations and use it in conjunction with other statistical methods and domain knowledge to draw accurate and meaningful conclusions.

Good job. Have a look at the explanation for #Q4 below if you like and then go to the next question.

Solution:

A researcher wants to study the average number of calories in a serving of various types of frozen pizza. There are 150 different types of frozen pizza available in the local grocery store. The researcher decides to use systematic sampling to select 30 pizzas for her study.

To determine the sampling interval for selecting frozen pizza available in the local grocery store, follow these steps:

Step 1: Calculate the Sampling Interval

1. Identify the total number of pages (N): = 150
2. Identify the desired sample size (n): = 30
3. Calculate the sampling interval (k): = $\frac{N}{n}$

Substituting the values:

$$k = \frac{150}{30} = 5$$

Conclusion

The sampling interval is 5. This means that the researcher would select every 5^{th} pizza in the store.

Good job. Have a look at the explanation for #Q5 below if you like.

Solution

To calculate the coefficient of variation (CV) of the heights based on the given frequency distribution, we first need to find the mean and standard deviation of the heights.

Step 1: Calculate the Midpoints for Each Height Class

The midpoint (x) is calculated as follows: Midpoint = $\frac{\text{Lower limit} + \text{Upper limit}}{2}$

HEIGHT (CM)	FREQUENCY (F)	MIDPOINT (X)
40-49	5	44.5
50-59	10	54.5
60-69	15	64.5
70-79	12	74.5
80-89	6	84.5
90-99	2	94.5
TOTAL	50	

Step 2: Calculate $f.x$ *and* $f.x^2$

HEIGHT (CM)	FREQUENCY (F)	MIDPOINT (X)	$f.x$	$f.x^2$
40-49	5	44.5	222.5	9901.25
50-59	10	54.5	545	29702.5
60-69	15	64.5	967.5	62403.75
70-79	12	74.5	894	66603
80-89	6	84.5	507	42841.5
90-99	2	94.5	189	17860.5
TOTAL	**50**		**3325**	**229312.5**

Step 3: Sum Up

Now let's sum these values:

1. Sum of Frequencies (N) = 8 + 12 + 15 + 10 + 3 + 2 = 50
2. Sum of $f.x$:

$$\sum f.x = 222.5 + 545 + 967.5 + 894 + 507 + 189 = 3325$$

3. Sum of $f.x^2$:

$\sum f.x^2$ = 49506.25+297025+936056.25+799236+ 257049+35721=2374593.5

Step 4: Calculate Mean and Variance

Mean $(\mu) = \frac{\sum f.x}{N} = \frac{3325}{50} = 66.5$

Variance $(\sigma^2) = \frac{\sum(f \cdot x^2)}{N} - \mu^2 = \frac{229312.5}{50} - (66.5)^2 = 4586.25 - 4422.25 = 164$

Step 5: Calculate Coefficient of Variation (CV) = $\left(\frac{\sigma}{\mu}\right) \times 100\% = \left(\frac{12.81}{66.5}\right) \times 100\%$

CV = (0.192632)×100 ≈ 19.26%