Here's a detailed explanation of how the **mean**, **variance**, and **standard deviation** were calculated step by step:

---

1. Mean ((\bar{X}))

The formula for the mean of grouped data is:

[\bar{X} = \frac{\sum(f \cdot X)}{\sum f}]

Where:

- (f) = frequency
- (X) = midpoint of the class interval

Steps:

1. Compute the midpoint ((X)) of each class interval:
    - (X = \frac{\text{Lower Bound} + \text{Upper Bound}}{2})

   Example for the first interval (10–15): [X = \frac{10 + 15}{2} = 12.5]
2. Multiply each midpoint ((X)) by its frequency ((f)):
    - (f \cdot X)
3. Sum up all the (f \cdot X) values: [\sum(f \cdot X) = 37.5 + 18.5 + 98.0 + 152.5 + 73.0 + 212.5 = 592.0]
4. Sum up all the frequencies ((f)): [\sum f = 3 + 1 + 4 + 5 + 2 + 5 = 20]
5. Divide (\sum(f \cdot X)) by (\sum f): [\bar{X} = \frac{592.0}{20} = 29.6]

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2. Variance ((\sigma^2))

The formula for variance is:

[\sigma^2 = \frac{\sum(f \cdot (X - \bar{X})^2)}{\sum f}]

Where:

- (X) = midpoint
- (\bar{X}) = mean
- (f) = frequency

Steps:

1. Calculate ((X - \bar{X})^2) for each class:
    - Example for the first class (10–15, midpoint = 12.5): [(12.5 - 29.6)^2 = (-17.1)^2 = 292.41]
2. Multiply ((X - \bar{X})^2) by the frequency ((f)):

- $(f \cdot (X - \bar{X})^2)$

Example for the first class: $[3 \cdot 292.41 = 877.23]$

3. Sum up all $(f \cdot (X - \bar{X})^2)$ values: $[\sum(f \cdot (X - \bar{X})^2) = 877.23 + 123.21 + 104.04 + 4.05 + 95.22 + 832.05 = 2035.8]$
4. Divide the result by $(\sum f)$: $[\sigma^2 = \frac{2035.8}{20} = 101.79]$

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3. Standard Deviation ((σ))

The formula for standard deviation is:

$[\sigma = \sqrt{\sigma^2}]$

Steps:

1. Take the square root of the variance: $[\sigma = \sqrt{101.79} = 10.09]$

Let me know if you need further clarification!

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Let me know if you need further clarification!k

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Results:

Frequency Table with Calculations:

Class Interval	Frequency (f)	Midpoint (X)	f * X	$(X - \bar{X})^2$	$f * (X - \bar{X})^2$
10-15	3	12.5	37.5	292.41	877.23
16-21	1	18.5	18.5	123.21	123.21
22-27	4	24.5	98.0	26.01	104.04
28-33	5	30.5	152.5	0.81	4.05
34-39	2	36.5	73.0	47.61	95.22
40-45	5	42.5	212.5	166.41	832.05

Summary Statistics:

- **Mean ((\bar{X}))**: (29.6)

- **Variance ((\sigma^2))**: (101.79)
- **Standard Deviation ((\sigma))**: (10.09)

Let me know if you need further clarification or additional calculations!

Sure! Let's solve the questions one by one.

Q.no1 (a): Difference between Descriptive Statistics and Inferential Statistics

- **Descriptive Statistics**:
  - **Definition**: Deals with methods of organizing, summarizing, and presenting data in an informative way.
  - **Examples**: Calculating the mean, median, mode, and creating graphs like histograms.
- **Inferential Statistics**:
  - **Definition**: Deals with methods for making predictions or inferences about a population based on sample data.
  - **Examples**: Hypothesis testing, confidence intervals, and regression analysis.

Q.no1 (b): Construction of Tally Column, Midpoint (X), Cumulative Frequency, and Class Boundaries

Data:

Marks: (30-39, 40-49, 50-59, 60-69, 70-79, 80-89, 90-99)
Frequency: (4, 7, 13, 15, 6, 3, 2)

1. **Class Boundaries**:
   - (29.5-39.5, 39.5-49.5, 49.5-59.5, 59.5-69.5, 69.5-79.5, 79.5-89.5, 89.5-99.5)
2. **Midpoints (X)**:
   Formula: (\text{Midpoint} = \frac{\text{Lower limit} + \text{Upper limit}}{2})
   (X = 34.5, 44.5, 54.5, 64.5, 74.5, 84.5, 94.5)
3. **Cumulative Frequency**: Add frequencies cumulatively:
   (4, 11, 24, 39, 45, 48, 50)

Q.no2 (a): Difference between Standard Deviation and Variance

- **Standard Deviation**:
  - Measures the spread of data points from the mean.
  - Formula: (\sigma = \sqrt{\frac{\sum (X - \bar{X})^2}{N}})
- **Variance**:

- Measures the average squared deviation from the mean.
- Formula: $\sigma^2 = \frac{\sum (X - \bar{X})^2}{N}$

Q.no2 (b): Calculate Variance and Standard Deviation

Data:

Scores: (10-15, 16-21, 22-27, 28-33, 34-39, 40-45)
Frequency ((f)): (3, 1, 4, 5, 2, 5)

Steps:

1. Find the midpoints ((X)).
2. Calculate $f \cdot X$, $(X - \bar{X})^2$, and $f \cdot (X - \bar{X})^2$.
3. Compute variance (σ^2) and standard deviation (σ).

Q.no3 (a): Define Population, Sample, Parameter, and Statistic

- **Population**: The entire group of individuals or items being studied.
  Example: All students in a school.
- **Sample**: A subset of the population used for analysis.
  Example: A group of 50 students from the school.
- **Parameter**: A numerical value summarizing a characteristic of a population.
  Example: Average height of all students in the school.
- **Statistic**: A numerical value summarizing a characteristic of a sample.
  Example: Average height of the sampled 50 students.

Q.no3 (b): Calculate Median

Data:

Marks: (30-39, 40-49, 50-59, 60-69, 70-79, 80-89, 90-99)
Frequency ((f)): (11, 15, 17, 20, 18, 12, 7)

1. Find the cumulative frequency.
2. Determine the median class using $(N/2)$, where $N = \sum f = 100$.
3. Use the formula:
   $$\text{Median} = L + \left(\frac{\frac{N}{2} - CF}{f_m}\right) \cdot h$$
   Where:
   - $L = \text{Lower boundary of median class}$
   - $CF = \text{Cumulative frequency before the median class}$
   - $f_m = \text{Frequency of the median class}$
   - $h = \text{Class width}$

Would you like me to solve any part in detail?
