# LAB. METEOROLOGICAL STATISTICS &METEOROLOGICAL DATA ANALYSIS FOURTH STAGE

**(First Semester)**

**Department of Atmospheric Sciences**

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***b- Median***: It is known in mathematics or statistics, and it is one of the measures of central tendency, which is the middle numerical value. It separates the higher value from the sample or the population from the lower half so that the number of values on its side is equal after being arranged in ascending or descending order.

The methods of calculating the median differ according to the different values whose median is to be known. The odd numerical values differ from the even ones. To know the method of calculating it, we must

**1-Calculation of the median for Unclassified data odd numbers**

***For example***\\ calculate the median of the following data?

[ 5,6,9,2,1 ]

***Solue***\\

- Arrange in ascending or descending order [1,2,5,6,9 ]

- Because the values are individual, we choose the median value, which represents the **median =5**

**2-Calculation of the median for Unclassified even numbers**

***For example***\\ calculate the median of the following data?

| | | | | | |
|---|---|---|---|---|---|
| 53 | 47 | 49 | 53 | 52 | 50 |

***Solue***\\

- Arrange in ascending or descending order

| | | | | | |
|---|---|---|---|---|---|
| 53 | 53 | 52 | 50 | 49 | 47 |

-To find the median of the even values, by finding the average of the two average values, i.e.

(50+52)\2= 51 ⟶ **Median=51**

**3-Calculating the median for the classified data:** to find the median for the classified values, we apply the following equation:

$$\textbf{Median} = L1 + \left(\frac{\frac{N}{2} - F}{f\ median}\right) * c$$

***Whereas*: L1**= Minimum middle class**,** **N**= Total repetitions, **C**= Category length

$\frac{\mathbf{N}}{\mathbf{2}}$ = The value that falls within or below it and rounds up the result

**F** = Cumulative pre-intermediate class frequency

**F**= Cumulative mean class frequency

***For example*** \\ Calculate the median for the following data:

***Solue***\\

| Class | frequency | cumulative f |
|---|---|---|
| 20-29 | 6 | 6 |
| 30 – 39 | 8 | 14 |
| 40 – 49 | 12 | 26 |
| 50 – 59 | 10 | 36 |
| 60- 69 | 14 | 50 |

$\sum f=n=50 \longrightarrow \frac{N}{2}=\frac{50}{2}=25$

C =Category length ⟶ C= 10; mediator class=(40-49) ⟶ L1=40; F=14;

f (median)=12

**Median = L1 +** $\left(\frac{\frac{N}{2} - F}{f\ median}\right)$***c** ⟶ $= 40+ \left(\frac{25-14}{12}\right)*10$ ⟶ $=40+9.17$ ⟶

med=49.17

***For example*** \\ Calculate the median for the following data:

***Solue***\\

.

| Class | frequency | cumulative f |
|---|---|---|
| 50-59 | 3 | 3 |
| 60-69 | 7 | 10 |
| 70-79 | 18 | 28 |
| 80-89 | 12 | 40 |
| 90-99 | 8 | 48 |
| 100-109 | 2 | 50 |

∑f=n=50 N/2=50/2=25

L1=70; F= 10; f=18; C=10

**Median = L1 + ( $\frac{\frac{N}{2}-F}{f\ median}$)*c** ⟹ = 70+ ( $\frac{25-10}{18}$)*10 ⟹ =70+8.33 ⟹ med=78.17

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H.W\\

**1- If you know that the city of Baghdad recorded the highest monthly average temperatures during the past year (33,20,54,56,50,48,58,28,50,31,24,19). Calculate the median value of the temperature data.**

**2-Calculate the median for the data listed in the table below:**

| Class | frequency |
|---|---|
| 120 - 129 | 5 |
| 130 - 139 | 7 |
| 140 - 149 | 10 |
| 150 - 159 | 8 |
| 160 - 169 | 6 |
| 170 -179 | 4 |

***c- Mode :*** Mode is one of the measures of central tendency of data analysis in statistics, which are values by which the central value of a set of data can be described The central value of a set of data, where the mode is expressed by the number of repeats in the data set, and it depends mainly on the frequency in the sample.

1- **Calculation of the Mode for unclassified data:**
It is the value that described as the greatest frequency.

**For example\\ calculate The mode of the following data?**

(5,2,5,10,2,2) Mode = 2

2- **Calculation of the mode of the classified data**:

$$\textbf{Mode} = L_1 + \left(\frac{d_1}{d_1+d_2}\right) * c$$

Whereas:
L1= Minimum modal class ,C= Category length

$d_1 =$ It is the result of subtracting the frequency of the modal class from the frequency of the class before it

$d_2 =$ It is the result of subtracting the frequency of the modal class from the frequency of the class after it

| Class | f |
|---|---|
| 150 – 159 | 8 |
| 160 – 169 | 12 |
| 170 – 179 | 15 |
| 180 – 189 | 9 |
| 190 – 199 | 6 |

← The modal class has the highest frequency

**L = 170 ,d1= 15-12 ,d2= 15 – 9 , C = 10**
**Mode = 173.33**

**H.W**

**1- Calculate the mode for the weights of the following a group of rice sacks:**

| the weight (kg) | number of bags |
|---|---|
| 45 | 8 |
| 50 | 11 |
| 55 | 7 |
| 60 | 10 |
| 65 | 12 |
| 70 | 9 |
| 75 | 8 |

**2- Calculate the measures of central tendency (mean, median, mode) for the following data?**

| Class | f |
|---|---|
| 60-62 | 5 |
| 63-65 | 15 |
| 66-68 | 45 |
| 69-71 | 27 |
| 72-74 | 8 |

***D- The harmonic mean***: It is a measure of central tendency, and it is the reciprocal of the arithmetic mean of the reciprocal of these values. It is preferred to use it to find the rate of velocity and rates of change and it cannot be used in the case if one of these values is equal to zero symbolizes it( HM).

$$HM=\frac{n}{\sum\frac{1}{x_1}+\frac{1}{x_2}+\cdots+\frac{1}{x_n}}$$

**1-Calculation of the harmonic mean for Unclassified data:**

***For example***\\ calculate the harmonic mean of the following data?

**[ 18,37,25,46,57,77,20]**

**First** You write the data in Excel, then we choose the harmonic mean function = Harmean (beginning of the cell: end of the cell)

**HM=31.13151**

2- **Calculation of the harmonic mean of the classified data**:

$$HM = \frac{\sum fi}{\sum fi / xi}$$

***For example***\\ calculate the harmonic mean of the following data?

| fi | xi | Fi\xi |
|---|---|---|
| 8 | 55 | |
| 10 | 65 | |
| 16 | 75 | |
| 14 | 85 | |
| 10 | 95 | |

**SOLUE**

**HM= 58 \ 0.782603** ➡ **HM=**74.11164

***E-The geometric mean*** is defined as the geometric mean of a set of data as the nth root of the product of these values and is symbolized by the symbol (**GM**). It is used when calculating the average values of a number of percentages, and it is distinguished from the arithmetic mean by being less affected than the arithmetic mean by outliers or anomalous values, and also it cannot be calculated if the values contain zeros or negative values.

**** Calculation of the geometric mean for data:**

$$G = \sqrt[n]{x_1 x_2 x_3 \dots \dots x_n}$$

***For example*\\ calculate the geometric mean of the following data?**

**[ 62, 80, 75, 30]**

**First** \\You write the data in Excel, then we choose the geometric mean function

= Geomean (beginning of the cell: end of the cell)

**GM= 57.79843**

## H.W\\ Calculate the geometric mean and the harmonic mean of the following data?

| X |
|---|
| 2 |
| 5 |
| 3 |
| 4 |
| 7 |
| 8 |
| 8 |

F- ***the weighted mean*** **:** It is the most accurate measure of results and investments that are related to each other, and this is usually the case with investment portfolios, study results and other statistics, and is symbolized by the symbol ($\overline{x}$W)

**** Calculation of the weighted mean for data:**

$$\overline{x}=\frac{\sum w_x}{\sum w}=\frac{x_1w_1+x_2w_2+x_3w_3\ldots.}{w_1+w_2+w_3\ldots\ldots}$$

***For example***\\ calculate the weighted mean of the following data?

| mark | weights |
|---|---|
| 90 | 1 |
| 85 | 3 |
| 70 | 1 |

**Solue**

$$\overline{x}=\frac{(90*1)+(85*3)+(70*1)}{1+3+1}=83$$

## H.W \\ calculate the weighted mean of the following data?

| Grade | weight |
|---|---|
| 75 | 0.25 |
| 55 | 0.50 |
| 97 | 0.25 |
| 61 | 0.25 |

## H.W\\ calculate the harmonic mean of the following data?

| Class | fi |
|---|---|
| 50- | 8 |
| 60- | 10 |
| 70- | 16 |
| 80- | 14 |
| 90- | 10 |
| 100- | 5 |
| 110-120 | 2 |