# LAB. METEOROLOGICAL STATISTICS ..... FOURTH STAGE

(First Semester)

Department of Atmospheric Sciences

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## ***Measures of Dispersion and Variability***

measure of variability is a summary statistic that represents the amount of dispersion in a dataset. How spread out are the values? A low dispersion indicates that the data points tend to be clustered tightly around the center. High dispersion signifies that they tend to fall further away.

### *A- Range:*

Let's start with the range because it is the most straightforward measure of variability to calculate and the simplest to understand. The range of a dataset is the difference between the largest and smallest values in that dataset.

***For example,*** \\ calculate the range of the dataset: -

60,65.55,50,45

Range = 65 – 45=20

We write the data, arrange them in ascending order, choose the highest and lowest values, and subtract them.

***For example***\\ calculate the range from the dataset:-

100,65,55,50,45

Range = max – min = 100-45 = 55

***For example*** // The numbers are 7,4,9,7,3,12 find the range?

We find the highest and lowest value, then find the range, we arrange the data in ascending order

**Soluce**\\

Range =12-3=9

***H.W\\ Calculate the Rang in the two datasets below?***

| datasets1 | datasets2 |
|---|---|
| 20 | 11 |
| 21 | 16 |
| 22 | 19 |
| 25 | 23 |
| 26 | 25 |
| 29 | 32 |
| 33 | 39 |
| 34 | 46 |
| 38 | 52 |

## *B-Mean deviation(MD)*:

The mean deviation is defined as a statistical measure that is used to calculate the average deviation from the mean value of the given data set. The mean deviation of the data values can be easily calculated using the below procedure:

Step 1: Find the mean value for the given data values

Step 2: Now, subtract the mean value from each of the data values given (Note: Ignore the minus symbol)

Step 3: Now, find the mean of those values obtained in step 2.

### *1- The mean deviation of the ungrouped data*

The mean deviation or average deviation of a sat N numbers
$X_1, X_2, X_3, \ldots, X_N$

Is MD and defined by :

$$\textbf{\textit{Mean deviation (MD)}} = \frac{\sum|x-\bar{x}|}{N}$$

Σ represents the addition of values

X represents each value in the data set

$\bar{x}$ represents the mean of the data set (arithmetic mean)

N represents the number of data values

| | represents the absolute value, which ignores the "-" symbol

$$\bar{x} = \frac{\sum x_i}{N}$$ **Arithmetic mean**

***For example*** // find the mean of the set : 2,3,6,8,11

$$\bar{x} = \frac{\sum x_i}{N} = \frac{2+3+6+8+11}{5} = \frac{30}{5} = 6$$

$$MD = \frac{|2-6|+|3-6|+|6-6|+|8-6|+|11-6|}{5}$$

$$MD = \frac{|-4|+|-3|+|0|+|2|+|5|}{5} = \frac{4+3+0+2+5}{5} = \frac{14}{5} = 2.8$$

***H.W\\ Calculate the mean deviation from the following data:***

6,7,10,12,13,4,8,12

## *2- The mean deviation of the unclassified data*

The mean deviation can be give by :-

$$MD = \frac{\sum f\,|x-\bar{x}|}{\sum f}$$

Where (f) is frequency.

(x) is midpoint of classes .

***For example*** // find the mean deviation of the following data :

| Class | (fi) | (xi) | fixi |
|---|---|---|---|
| 10-20 | 2 | 10+20/2=15 | 2*15=30 |
| 20-30 | 3 | 25 | 75 |
| 30-40 | 8 | 35 | 280 |
| 40-50 | 14 | 45 | 630 |
| 50-60 | 8 | 55 | 440 |
| 60-70 | 3 | 65 | 194 |
| 70-80 | 2 | 75 | 150 |
| | ∑fi=40 | | ∑fixi=1800 |

We find the arithmetic mean

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{1800}{40} = 45$$

| $\lvert x_i - \bar{x} \rvert$ | Abs | f | f*$\lvert x_i - \bar{x} \rvert$ |
|---|---|---|---|
| $\lvert 15 - 45 \rvert$ | $\lvert -30 \rvert$ | 2 | 60 |
| $\lvert 25 - 45 \rvert$ | $\lvert -20 \rvert$ | 3 | 60 |
| $\lvert 35 - 45 \rvert$ | $\lvert -10 \rvert$ | 8 | 80 |
| $\lvert 45 - 45 \rvert$ | $\lvert 0 \rvert$ | 14 | 0 |
| $\lvert 55 - 45 \rvert$ | $\lvert 10 \rvert$ | 8 | 80 |
| $\lvert 65 - 45 \rvert$ | $\lvert 20 \rvert$ | 3 | 60 |
| $\lvert 75 - 45 \rvert$ | $\lvert 30 \rvert$ | 2 | 60 |

$$\sum f * \lvert x_i - \bar{x} \rvert = 400$$

$$MD = \frac{\sum f \lvert x - \bar{x} \rvert}{\sum f} = \frac{400}{40} = 10$$

***H.W\\ Calculate the mean deviation from the following data:***

| classes | f |
|---|---|
| 2-4 | 2 |
| 4-6 | 3 |
| 6-8 | 6 |
| 8-10 | 2 |
| 10-12 | 1 |