LAB. METEOROLOGICAL STATISTICS .... FOURTH STAGE

(First Semester)

Department of Atmospheric Sciences

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Lecturers: **A.Prof . Zahraa Salah , L. Ruaa mazin ,**

L. Luma Mahdi , **L. Salwa salman**

Preparing by: L. Ruaa mazin , L. Luma mahdi

C- The standard deviation

The standard deviation of a set of N values $x_1, x_2, \ldots \ldots x_N$ is denoted (S)

1- Calculation the Standard deviation for unclassified data:

$$SD = \sqrt{\frac{\sum(x_i - \bar{x})^2}{N}}$$

For example\\ calculate the standard deviation of the following data?
(2,3.5,4,4.5,5)

x_i	$(x_i - \bar{x})$	$(x_i - \bar{x})^2$
3	3-4=-1	1
3.5	3.5-4= -0.5	0.25
4	(4-4) = 0	0
4.5	(4.5-4)= 0.5	0.25
5	(5-4)= 1	1
		$\sum (x_i - \bar{x})^2 = 2.5$

$$SD = \sqrt{\frac{\sum(x_i - \bar{x})^2}{N}} \implies \sqrt{\frac{2.5}{5}} = \sqrt{0.5}$$

H.W \\ find the standard deviation from the following data :

(2,8,3,7,6,4)

2-Calculation the standard deviation of the classified data:

The standard deviation some times called root mean square deviation (Rms) if $x_1, x_2, \ldots \ldots x_N$ is mid point of classes and $f_1, f_2, \ldots \ldots f_N$ is frequency the standard deviation can be by :

$$SD = \sqrt{\frac{\sum f_i(x-\bar{x})^2}{\sum f_i}}$$

For example\\ calculate The Standerd deviation of the following data?

Class	f_i	x_i	$f_i x_i$
15-19	3	17	51
20-24	5	22	110
25-29	7	27	189
30-34	15	32	480
35-39	10	37	370
40-44	6	42	252
45-49	4	47	188
	$\sum f_i$ =50		$\sum f_i x_i$=1640

$$SD = \sqrt{\frac{\sum f_i(x-\bar{x})^2}{\sum f_i}}$$

$$\bar{x} = 32.8$$

Class	f_i	x_i	$f_i x_i$	$(x_i - \bar{x})$	$(x_i - \bar{x})^2$	$f_i(x_i - \bar{x})^2$
15-19	3	17	51	-15.8	249.64	748. 92
20-24	5	22	110	-10.8	116.64	583.2
25-29	7	27	189	-5.8	33.64	235.48
30-34	15	32	480	-0.8	0.64	9.6
35-39	10	37	370	4.2	17.64	176.4
40-44	6	42	252	9.2	84.64	507.8
45-49	4	47	188	14.2	201.64	806.56
	$\sum f_i$=50		$\sum f_i x_i$=1640			$\sum f_i(x_i - x)^2$ =3068

$$SD = \sqrt{\frac{\sum f_i(x_i - \bar{x})^2}{\sum f_i}} \qquad \longrightarrow \sqrt{\frac{3068}{50}} = \sqrt{61.36} = 7.83$$