RANGE AND MEAN DEVIATION

Measures of Dispersion (or Scatter)

The mode, the median, and the mean give us some information about the performance of a group of individuals, but this information is not comprehensive. For instance, if two classes of students have averages 68.6 each, we might conclude that the performance of students in both classes are similar (or equivalent), but this may not be true. As such, measuring the spread of each individual's score about the mean is essential to help us understand the degree of similarities of the two sets or classes of data.

The measures of dispersion consist of the following: range, mean deviation, variance and standard deviation.

Range

Range is the difference between the highest and the lowest scores in any given set of data. For example: the range of the following values, 80, 75, 75, 75, 70, 70, 70, 70, 65, 65, 65, 60, 60, 55, 55, is 80 – 55 = 25.

Mean Deviation

This is the average sum of the deviations from the arithmetic mean (i.e. the sum of the differences between the scores and the mean) divided by the total frequency (or number).

$$Mean\ deviation = \frac{\Sigma f(x - \bar{x})}{\Sigma f}$$

Example: Find the mean deviation in the following test scores:

Score (x)	Frequency
95	1
85	1
80	1
75	4
70	1
65	3
55	1
40	3

Solving

$$\bar{x} = \frac{\Sigma fx}{\Sigma f}$$

x	f	fx
95	1	95
85	1	85
80	1	80
75	4	300
70	1	70
65	3	195
55	1	55
40	3	120
	$\Sigma f = 15$	$\Sigma fx = 1000$

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{1000}{15} = \mathbf{66.7}$$

$$Mean\ deviation = \frac{\Sigma f(x - \bar{x})}{\Sigma f}$$

x	f	$\bar{x}$	$(x - \bar{x})$	$f(x - \bar{x})$
95	1	66.7	28.3	28.3
85	1	66.7	18.3	18.3
80	1	66.7	13.3	13.3
75	4	66.7	8.3	33.2
70	1	66.7	3.3	3.3
65	3	66.7	-1.7	-5.1
55	1	66.7	-11.7	-11.7
40	3	66.7	-26.7	-80.1
	$\Sigma f = 15$			$\Sigma f(x - \bar{x}) = -0.5$

$$Mean\ deviation = \frac{\Sigma f(x - \bar{x})}{\Sigma f} = -\frac{0.05}{15} = -0.003$$

The value of mean deviation calculated as above is so small that it is ignored usually in computing

measures of dispersion which is not the true situation. So we talk about the mean absolute deviation to give the true picture.

Mean Absolute Deviation

Mean absolute deviation is defined as the arithmetic mean of the absolute (modulus) value of the difference of each score from the mean (that is adding the values of the deviations from the mean as if they were all positive) and dividing by their total frequency. That is the sum of the modulus of the deviations from the arithmetic mean divided by the total frequency. Hence, the mean absolute deviation is given by the formula:

$$mean\ deviation = \frac{\Sigma f|x - \bar{x}|}{\Sigma f}$$

Example: Find the mean deviation of the following set of scores:

Scores	Frequency (f)
40	3
55	1
65	3
70	1
75	4
80	1
85	1
95	1

Solving

x	f	fx	$\bar{x}$	$\lvert x-\bar{x}\rvert$	$f\lvert x-\bar{x}\rvert$
40	3	120	66.7	28.3	28.3
55	1	55	66.7	18.3	18.3
65	3	195	66.7	13.3	13.3
70	1	70	66.7	8.3	33.2
75	4	300	66.7	3.3	3.3

80	1	80	66.7	1.7	5.1
85	1	85	66.7	11.7	11.7
95	1	95	66.7	26.7	80.1
	$\Sigma f = 15$	$\Sigma fx = 1000$			$\Sigma f\lvert x - \bar{x}\rvert = 193.3$

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{1000}{15} = \mathbf{66.7}$$

$$mean\ deviation = \frac{\Sigma f|x - \bar{x}|}{\Sigma f} = \frac{193.3}{15} = \mathbf{12.89}$$

Interpreting the results: From the first value of -0.003, we find that the average deviation of each individual value from the mean is approximately zero. From the second value of 12.89, we find that the sum total of deviations from the mean are 12.89.