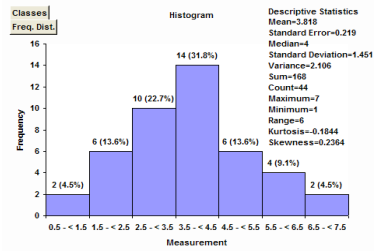


14.3 Measures of Dispersion



1

A measure of dispersion gives the spread of the data: clumped together or spread out.

The **range** is the difference between the largest and smallest value.

Ex 3 5 3 4 1 3 2 5 4

$$\text{Range} = 5 - 1 = 4$$

2

Better idea: how much does the data deviate from the mean?

Recall $\bar{x}$ = mean

$x - \bar{x}$ = deviation from mean

3

Example:

Sample Data = 2, 4, 7, 5, 4, 8

Mean $\bar{x}$ =

Data x	$x - \bar{x}$
2	
4	
7	
5	
4	
8	

4

Example:

Sample Data = 2, 4, 7, 5, 4, 8

Mean $\bar{x} = 30 / 6 = 5$

Data x	$x - \bar{x}$
2	-3
4	-1
7	2
5	0
4	-1
8	3

5

Notice: the sum of the deviations is 0

Idea: sum, then average, the squares!

Data x	$x - \bar{x}$	$(x - \bar{x})^2$
2	-3	
4	-1	
7	2	
5	0	
4	-1	
8	3	

6

Definition:

$$\text{Variance} = \frac{\sum (x - \bar{x})^2}{n-1}$$

Data x	$x - \bar{x}$	$(x - \bar{x})^2$
2	-3	9
4	-1	1
7	2	4
5	0	0
4	-1	1
8	3	9
Sum (Σ)	0	24

7

Definition:

$$\text{Variance} = \frac{\sum (x - \bar{x})^2}{n-1}$$

Data x	$x - \bar{x}$	$(x - \bar{x})^2$
2	-3	9
4	-1	1
7	2	4
5	0	0
4	-1	1
8	3	9
Sum (Σ)	0	24

$$\begin{aligned} \text{variance} &= 24/(6-1) \\ &= 1.2 \end{aligned}$$

8

Definition:

$$\text{Std. Deviation} = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

Data x	$x - \bar{x}$	$(x - \bar{x})^2$
2	-3	9
4	-1	1
7	2	4
5	0	0
4	-1	1
8	3	9
Sum (Σ)	0	24

$$\begin{aligned} \text{variance} &= 24/5 \\ &= 1.2 \\ \text{std. dev.} &= (1.2)^{1/2} \\ &= 1.09544 \end{aligned}$$

9

Example:

Data: 8 6 7 5 4

N = mean $\bar{x}$ =

Data x	$x - \bar{x}$	$(x - \bar{x})^2$
8		
6		
7		
5		
4		
Sum (Σ)		

10

Example:

Data: 8 6 7 5 4

N = 5 mean $\bar{x}$ = 30/5 = 6

Data x	$x - \bar{x}$	$(x - \bar{x})^2$
8	2	4
6	0	0
7	1	1
5	-1	1
4	-2	4
Sum (Σ)	0	10

$$\begin{aligned} \text{variance} &= 10/(5-1) \\ &= 2.5 \\ \text{std. dev.} &= (2.5)^{1/2} \\ &= 1.5811 \end{aligned}$$

11

Given a frequency table:

- N is the sum of the frequencies
- Find $(x - \bar{x})^2$ and multiply it by the frequencies
- If you wish, as a check, multiply $(x - \bar{x})$ by the frequencies. The sum should be 0.

12

If there is no single middle number,
average the two middle numbers.

Sum (Σ)
$$\begin{aligned}\text{Var} &= 39.00 / (20-1) = 2.0526 \\ \text{Std. Dev} &= (2.0526)^{1/2} = 1.4327\end{aligned}$$