VI. Measure of Center

It is the characteristic of the center of the data set.

Notation:

x is usually "hidden", it is each data in the data set.
also, it has its order: $x_1, x_2, \ldots x_n$ for n^{th} data

n is the number of datas in a sample.

N is . . . a population.

s is the standard deviation for a sample set of datas.

σ . . . a population . . . .

v is the variance for a sample set of datas.

V is . . . a population . . .
(Var)

$\sum$ is the sum of all the data set. ✓

$v = (\text{std. dev})^2$

Std. dev.
— ← ground

variance
| ← height

i. Mean

It is the average of the data set.

$\bar{x}$ is the sample mean.

$\bar{x}$ is called x bar

$\bar{x}$ is the sample mean.

μ is the population mean.

$\bar{x}$ is called x bar

μ pronounce "mute" without t sound

eg Find the mean for the sample datas:

22 22 26 23

s:

$$\bar{x} = \frac{22 + 22 + 26 + 23}{4}$$

$$= \frac{93}{4}$$

$$= \boxed{23.25}$$

ii. Median (Q2)

It is the middle value. Notation: $\tilde{x}$

$\tilde{x}$ is x tilde

rule: sort the data first

odd number — $\tilde{x}$ is the middle value

even number — $\tilde{x}$ is $\frac{\text{middle 1} + \text{middle 2}}{2}$

eg Given the datas: 5, 1, 4, 7, 10. Find the median.

s: 1, 4, 5, 7, 10

$$\tilde{x} = \boxed{5}$$

eg. Find the median for the following:

a. 3 5 3 3 6

b. 4 8 2 10 15 20

s: a. 3 3 3 5 6

$\tilde{x} = \boxed{3}$

b. 2 4 8 10 15 20

$\tilde{x} = \frac{8+10}{2} = \boxed{9}$

iii. Mode ← no symbol ← can tie

It is most repeated value.

eg 5.4, 1.1, 0.4, 0.7, 1.1, 0.6, 1.8

mode = $\boxed{1.1}$

eg 27 27 26 25 27 25 26

mode = $\boxed{27}$

eg 4, 8, 8, 4, 5, 2, 4, 8, 9, 5, 2, 5

eg 4, 8, 8, 4, 5, 2, 4, 8, 9, 5, 2, 5

mode = $\boxed{4, 8, 5}$

eg 1, 6, 8, 2, 3, 10

$\boxed{\text{no mode}}$

iv. Range "new car: 20k - 100k" range = 80k

It is the difference between the smallest to biggest.

That is,

$$\boxed{\text{range} = \text{max} - \text{min}}$$

eg 4, 5, 3, 2, 10

range = 10 − 2

= $\boxed{8}$

eg NCAA Coach Salary: 47k, 70k, 100k, 65k, 2 million.

range = 2 million − 47k

= $\boxed{1,953,000}$ dollars

eg Handbags price : $50, $100, $2000, $2500, $15,000, $1000

range = $15,000 − $50

= $14,950

V. Midrange ← "midlife : 43 year old" ← "me: born 0, die 86"

It is the half way of the range.

That is,

$$\text{midrange} = \frac{\text{min} + \text{max}}{2}$$

eg Midrange of my life is 43, because $\frac{0 + 86}{2} = 43$.

eg SAT's midrange :

$\frac{200 + 800}{2}$ ← 200 is the lowest, 800 is the highest.

= 500

eg The speed for the traffic at 4:30 AM on Freeway-99, the slowest is 60 mph, and fastest is 90 mph.

Then,

$$\text{midrange} = \frac{60 + 90}{2}$$

then,

$$\text{midrange} = \frac{60 + 90}{2}$$

$$= \boxed{75} \text{ mph}$$

vi. Standard deviation

The standard deviation is the measure of datas' spread from the mean.

Notation: s for the sample datas

σ for the population datas

Formula:

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}, \qquad \sigma = \sqrt{\frac{\sum (x - \mu)^2}{N}}$$

Note: If the problem does not specify the datas are in population, we automatically assum they are samples.

eg Find the standard deviation: $\overset{x_1}{22}, \overset{x_2}{22}, \overset{x_3}{26}, \overset{x_4}{24}$.

s:

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$ ← use s because it doesn't say it is in population

$$\bar{x} = \frac{22 + 22 + 26 + 24}{4} = \frac{94}{4} = 23.5$$

then,

$$s = \sqrt{\frac{(22 - 23.5)^2 + (22 - 23.5)^2 + (26 - 23.5)^2 + (24 - 23.5)^2}{4 - 1}}$$

$$= \sqrt{\frac{(-1.5)^2 + (-1.5)^2 + (2.5)^2 + (0.5)^2}{3}}$$

$$= \sqrt{\frac{2.25 + 2.25 + 6.25 + 0.25}{3}}$$

$$= \sqrt{\frac{11}{3}}$$

$$\approx \boxed{1.915}$$

vii. Variance

Variance is s^2 or σ^2.

Notation: v for sample datas.

V for population datas.

(Var)

eg Find the variance: 22, 22, 26, 24. ← same datas from above

s: $v = s^2 = (1.195)^2 \approx \boxed{3.667}$

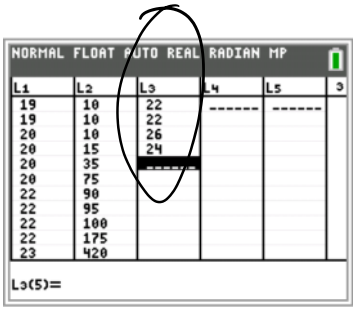
Outlier(s): The outliers of a data set is the value that is extreme and it affects the other data values.

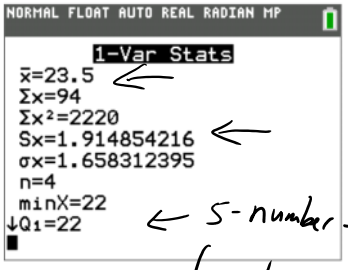
eg The score of 0 of an exam in a class.

eg Elon Musk's fortune in Fremont. ← make Fremont very rich

TI-84: put on a list: Stat → EDIT → 1:EDIT...

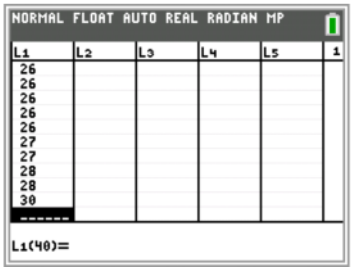
Then, Stat → (Tab) CALC → 1:1-Var Stats

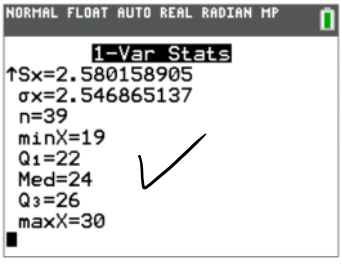




← 5-number summary for boxplot as well

From previous lesson's example:





HW Problem:

65 of them:

4 4 4 4 4 4 44 3 3 3 3 33 5 5 5 5

← 65 of them

S: Sort ✓

$L_{25} = 0.25 \cdot 65 = 16.25$

$Q_1 = \frac{4+4}{2} = \boxed{4}$