Statistics

Lecture 5

Feb 19-8:47 AM

$\bar{x} \to$ x-bar , Sample Mean

$s^2 \to$ Sample Variance

$s \to$ Sample Standard deviation

$\bar{x} = \dfrac{\sum x}{n}$ $s^2 = \dfrac{\sum (x-\bar{x})^2}{n-1}$ $s^2 = \dfrac{n\sum x^2 - (\sum x)^2}{n(n-1)}$

$s = \sqrt{s^2}$

Consider the Sample below:

3 5 5 5 7

$n = 5$, $\sum x = 25$, $\sum x^2 = 133$

$\bar{x} = \dfrac{\sum x}{n} = \dfrac{25}{5} = \boxed{5}$

$s^2 = \dfrac{n\sum x^2 - (\sum x)^2}{n(n-1)} = \dfrac{5 \cdot 133 - 25^2}{5(5-1)} = \dfrac{40}{20} = \boxed{2}$

$s = \sqrt{s^2} = \sqrt{2} \approx \boxed{1.414}$

Mar 9-9:57 AM

What is Sample standard deviation?

1) It is non-negative. $S \geq 0$

2) When S is small, data elements are close to $\bar{x}$.

When S is Large, data elements are more spread out from $\bar{x}$.

$\boxed{\text{When } S = 0, \text{ All data elements are equal to } \bar{x}.}$

Mar 9-10:06 AM

Sample

1 3 3 3 5

$\sum x = 15$ $\sum x^2 = 53$

$\bar{x} = \frac{\sum x}{n} = \frac{15}{5} = 3$

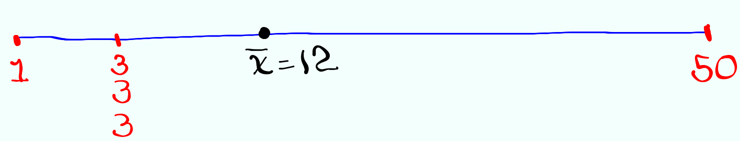
$S^2 = \frac{n\sum x^2 - (\sum x)^2}{n(n-1)} = \frac{5 \cdot 53 - 15^2}{5(5-1)} = \frac{40}{20} = 2$

$S = \sqrt{S^2} = \sqrt{2} = 1.414$

Now Sample below

1 3 3 3 50

$\bar{x} = 12$, $S = 21.260$



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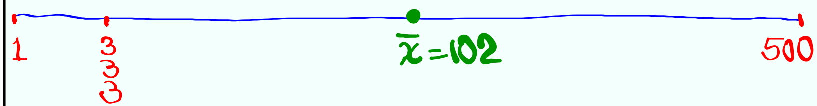
what about

1 3 3 3 500

$\bar{x} = 102$, $S = 222.490$



what about

2 3 3 3 4

$\bar{x} = 3$ $S = .707$

How to estimate S:

$$\boxed{S \approx \frac{\text{Range}}{4}}$$

The range rule-of-thumb.

Mar 9-10:18 AM

I randomly selected 25 exams. Min. Score was 45, Max was 95.

1) Range = Max − Min = 95 − 45 = $\boxed{50}$

2) Midrange = $\dfrac{\text{Max} + \text{Min}}{2} = \dfrac{95 + 45}{2} = \boxed{70}$

3) Estimate $S \approx \dfrac{\text{Range}}{4} = \dfrac{50}{4} = \boxed{12.5}$

4) Estimate $S^2 \approx (12.5)^2 \approx \boxed{156.25}$

Mar 9-10:25 AM

Empirical Rule:

It is best when $\underbrace{\text{mean} = \text{Mode} = \text{Median}}$.

Data dist. will be symmetric.

About 68% of data fall within

$\bar{x} \pm S$

About 95% of data fall within

$\bar{x} \pm 2S$

Usual Range

About 99.7% of data fall within

$\bar{x} \pm 3S$

Mar 9-10:31 AM

I randomly selected 40 exams.

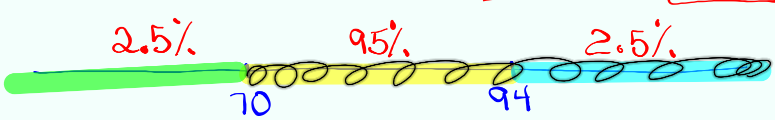
$\bar{x} = 82$ & $S = 6$.

68% Range $= \bar{x} \pm S = 82 \pm 6 \rightarrow \boxed{76 \text{ to } 88}$

Usual Range $\rightarrow$ 95% Range

$\bar{x} \pm 2S = 82 \pm 2(6)$

$= 82 \pm 12 \rightarrow \boxed{70 \text{ to } 94}$



what% of Scores were at least 70?

95% + 2.5% = 97.5%

How many of Scores were at least 70?

$97.5\% \, (40) = \boxed{39}$

Mar 9-10:36 AM

Z - Score

Always round to 3-dec. Places

$$Z = \frac{x - \bar{x}}{s}$$

It allows us to standardize data elements

we can compare data elements from different samples.

$-2 \le Z \le 2 \rightarrow$ data element is usual

$Z < -2$ or $Z > 2 \rightarrow$ data element is unusual.

Z-Score measures how many standard deviations is data element away from $\bar{x}$.

$Z > 0 \rightarrow x > \bar{x}$

$Z < 0 \rightarrow x < \bar{x}$

$Z = 0 \rightarrow x = \bar{x}$

Mar 9-10:46 AM

Diego got 90 on exam 1 & 78 on exam 2.

Exam 1

$\bar{x} = 82$

$s = 10$

$$\rightarrow Z = \frac{x - \bar{x}}{s} = \frac{90 - 82}{10} = \frac{8}{10} = \boxed{.8}$$

usual Score

Exam 2

$\bar{x} = 70$

$s = 4$

$$\rightarrow Z = \frac{x - \bar{x}}{s} = \frac{78 - 70}{4} = \frac{8}{4} = \boxed{2}$$

unusual

Mar 9-10:53 AM

Salaries of nurses in LA county:

$\bar{x} = 6400$ $\quad S = 500$

Maria makes \$7500, find her Z-score.

$$Z = \frac{x - \bar{x}}{S} = \frac{7500 - 6400}{500} = \boxed{2.2}$$

unusual high Salary

John has a Z-Score of -1.8.

find his Salary.

Cross-Multiply

$$Z = \frac{x - \bar{x}}{S}$$

$$-1.8 = \frac{x - 6400}{500}$$

$$x - 6400 = -1.8(500)$$

$$x = 6400 - 1.8(500)$$

$$\boxed{x = 5500}$$

\$5500

Mar 9-10:58 AM

Some TI instructions:

1) To clear the Screen $\boxed{\text{Clear}}$

2) To quit $\boxed{\text{2nd}}$ $\boxed{\text{MODE}}$

3) To clear all lists.

$\boxed{\text{2nd}}$ $\boxed{+}$ $\boxed{\text{4:Clear all lists}}$ $\boxed{\text{Enter}}$

4) To reset all lists:

$\boxed{\text{STAT}}$ Edit $\boxed{\text{5:Set up Editor}}$ $\boxed{\text{Enter}}$

Mar 9-11:06 AM