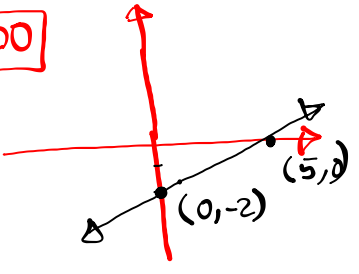
Math 110
Winter 2021
Lecture 3

Class QZ 1

① Simplify: $\frac{8 \cdot 150 - 30^2}{8 \cdot 7} = \frac{1200 - 900}{56} = \frac{300}{56} \approx 5.357$

② Find $8! - 5! = 40320 - 120 = 40200$

③ Draw $y = \frac{2}{5}x - 2$



Ch. 3 Basic Computations with data SGS-9

Consider the data set 2, 3, 5, 6, 6

1) $n = 5$ 2) Range $= 6 - 2 = 4$ 3) Midrange $= \frac{6+2}{2} = 4$

4) Mode $= 6$ 5) $\sum x = 2 + 3 + 5 + 6 + 6 = 22$

$\sum$: Summation

6) $\sum x^2 = 2^2 + 3^2 + 5^2 + 6^2 + 6^2 = 110$

7) $\bar{x}$ "x-bar" → Sample Mean (Average) $\bar{x} = \frac{\sum x}{n}$

$\bar{x} = \frac{22}{5} = \boxed{4.4}$

8) s^2 "Sample Variance" $s^2 = \frac{\sum (x-\bar{x})^2}{n-1}$ $s^2 = \frac{n\sum x^2 - (\sum x)^2}{n(n-1)}$

$s^2 = \frac{5 \cdot 110 - 22^2}{5(5-1)} = \frac{550 - 484}{5 \cdot 4} = \frac{66}{20} = \boxed{3.3}$

9) s "Sample Standard deviation" $s = \sqrt{s^2}$

$s = \sqrt{s^2} = \sqrt{3.3} \approx \boxed{1.817}$

Consider the Sample below

1, 3, 3, 3, 5, 5, 5, 10

1) $n = 8$ 2) Range $= 10 - 1 = 9$ 3) Midrange $= \frac{10+1}{2} = 5.5$

4) Mode $= 3$ & 5 5) $\sum x = 1 + 3 + 3 + 3 + 5 + 5 + 5 + 10 = \boxed{35}$

6) $\sum x^2 = 1^2 + 3^2 + 3^2 + 3^2 + 5^2 + 5^2 + 5^2 + 10^2 = \boxed{203}$

7) $\bar{x} = \frac{\sum x}{n} = \frac{35}{8} = \boxed{4.375}$ 8) $s^2 = \frac{n\sum x^2 - (\sum x)^2}{n(n-1)} = \frac{8 \cdot 203 - 35^2}{8(8-1)}$

$= \frac{1624 - 1225}{8 \cdot 7} = \frac{399}{56} = \boxed{7.125}$

9) $s = \sqrt{s^2} = \sqrt{7.125} = \boxed{2.669}$

To Estimate Sample Standard deviation

$s \approx \frac{\text{Range}}{4}$ $s \approx \frac{9}{4} = \boxed{2.25}$

"The range rule-of-thumb"

Z - Score for data element x

$$Z = \frac{x - \bar{x}}{S}$$, always round to 3-decimal places.

Suppose a data set has a mean of 84 and standard deviation of 6.

Find the Z-Score for data element 92

$$Z = \frac{x - \bar{x}}{S} = \frac{92 - 84}{6} = \frac{8}{6} = \frac{4}{3} = 1.333$$

Suppose a data set has a mean of 6250 with standard deviation of 400.

Find the data element which has Z-Score of 2.125

$$Z = \frac{x - \bar{x}}{S} \quad 2.125 = \frac{x - 6250}{400}$$

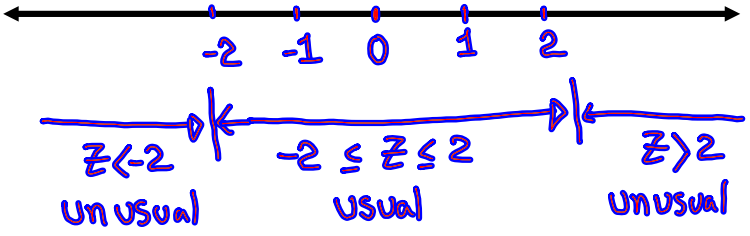
Cross-Multiply

$x - 6250 = 400(2.125)$

$x = 6250 + 400(2.125)$

$x = 7100$

Usual & Unusual data element



Exam 1: $\bar{x} = 84$ & $S = 5$

Alex got 93 $\Rightarrow Z = \frac{x - \bar{x}}{S} = \frac{93 - 84}{5} = \frac{9}{5} = 1.8$

Usual Score

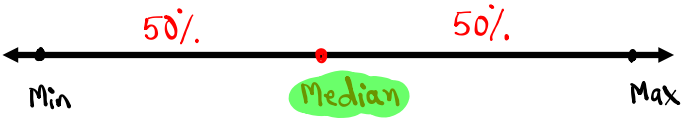
I got 72 on the same exam $\Rightarrow Z = \frac{x - \bar{x}}{S} = \frac{72 - 84}{5} = -2.4$

Unusual Score

$Z < -2$

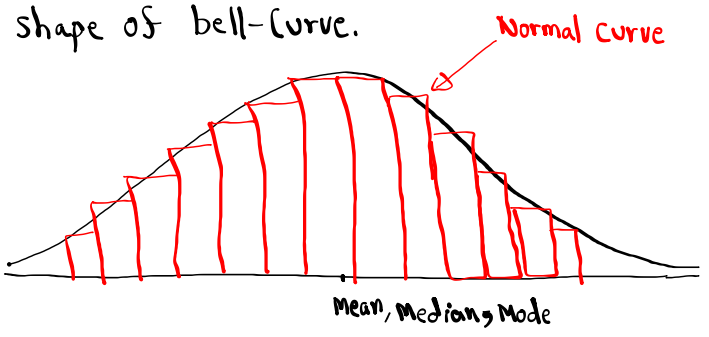
Consider a data set that is **Sorted**

the value in the middle is called **Median**.



whenever **Mean, Mode, and median are the Same,**

data distribution will be Symmetric, and takes the shape of bell-curve.



Empirical Rule

1) 68% Range $\Rightarrow \bar{x} \pm s$

2) 95% Range $\Rightarrow \bar{x} \pm 2s$ Usual Range

3) 99.7% Range $\Rightarrow \bar{x} \pm 3s$

Suppose results of exam 1 are Symmetric with $\bar{x} = 85$ & $s = 5$.

By empirical rule

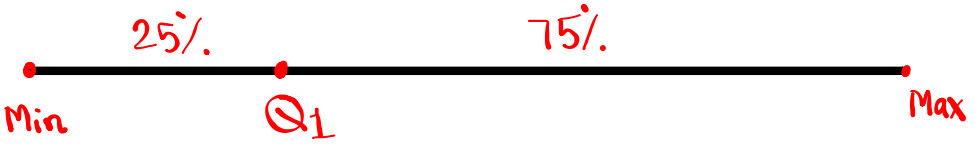
1) 68% Range $\Rightarrow \bar{x} \pm s = 85 \pm 5 \Rightarrow$ 80 to 90 (Sample Mean; Sample Standard dev.)

2) 95% Range $\Rightarrow \bar{x} \pm 2s = 85 \pm 2(5) \Rightarrow$ 75 to 95 (Usual Range)

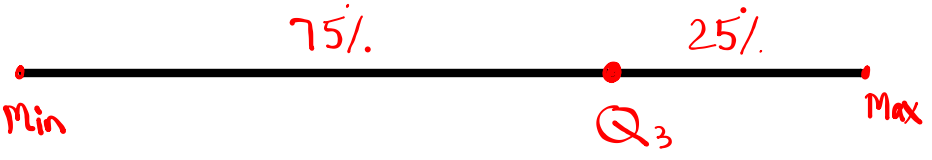
3) 99.7% Range $\Rightarrow \bar{x} \pm 3s = 85 \pm 3(5) \Rightarrow$ 70 to 100

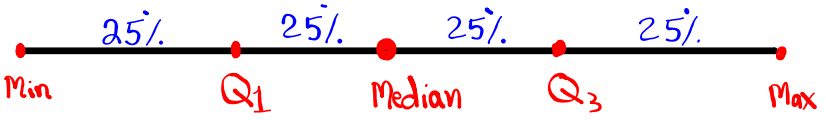
For a Sorted data

Q_1 ⇒ First Quartile ⇒ It separates the bottom 25% from the top 75%.



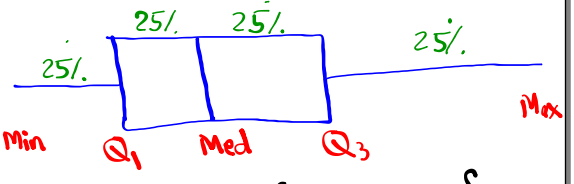
Q_3 ⇒ Third Quartile ⇒ It separates the bottom 75% from the top 25%.





Min, Q_1, Median, Q_3, and Max are called Five-Number Summary.

Draw Box Plot



Exam 1 results had a 5-Number Summary of 40, 70, 78, 85, and 100.

Draw its Box Plot

More on Box Plot

IQR = Inter-Quartile-Range $= Q_3 - Q_1$

Upper Fence $= Q_3 + 1.5(IQR)$

Lower Fence $= Q_1 - 1.5(IQR)$

Any value below the lower fence or above the upper fence is called an outlier.

Exam 1 had the following 5-Number Summary

40, 70, 78, 85, 100

$IQR = Q_3 - Q_1 = 85 - 70 = 15$

Upper Fence $= Q_3 + 1.5(IQR) = 85 + 1.5(15) = 107.5$

Lower Fence $= Q_1 - 1.5(IQR) = 70 - 1.5(15) = 47.5$

No value above 107.5 (Max = 100) No outlier.

Any value from 40 to 47.5 is an outlier.

TI instructions:

1) To clear the Screen: [Clear]

2) To quit: [2nd] [MODE]

3) To clear all lists: [2nd] [+] [4:] [Enter] (4: Clear All lists)

4) To Reset all lists: [STAT] Edit
[5: Setup Editor] [Enter]

5) To turn the Diagnostic key on.
[2nd] [0] ↓ ↓↓↓ ---- ↓ [Diagnostic On] [Enter] [Enter]

6) Clear the Screen: [Clear]

Store the following data in a list:

5 7 3 10 5 8 12 2

STAT Edit
1: Edit

L1
5 enter
7 "
3 "
⋮
2 "

Let's quit
2nd Mode

Clear the Screen
Clear

STAT → CALC
1: 1-Var Stats

2nd 1

with Menu
List: L1
Freq List: Clear
Calculate

No Menu
1-Var Stats L1
Enter

$\bar{x} = 6.5$
$\sum x = 52$
$\sum x^2 = 420$
$S_x = S = 3.423$
$n = 8$

Min = 2
$Q_1 = 4$
Med = 6
$Q_3 = 9$
Max = 12

I randomly selected 20 Students. Here are their ages:

25	32	24	35	18
20	30	43	40	45
50	21	19	36	30
18	24	27	33	36

Clear all lists
2nd + 4: Clear all Lists
Enter

Store this Sample in L1
STAT Edit
1: Edit

L1
25 enter
32 "
24 "
⋮
36 "

Let's Quit
2nd Mode

Clear the Screen
Clear

2nd 1 Enter
{25 32 24 → →

Let's Sort this data
STAT Edit
2: SortA

2nd 1 Enter

Let's view L1 again
2nd 1 Enter
{18 18 19 ... → →

Find $\bar{x}$ and S.

STAT → CALC

1: 1-Var Stats

With Menu	No Menu
List: L1	1-Var Stats
Freqlist: clear	L1 Enter
Calculate	

2nd 1

$\bar{x} = 30.3$

$S = 9.454$

$n = 20$

VARS

5: Statistics

3: S_x

x^2 Enter

$S^2 = 89.379$

MATH 1: ▶Frac Enter

$S^2 = \frac{8491}{95}$