Math 110
Winter 2021
Lecture 3

Class QZ 1

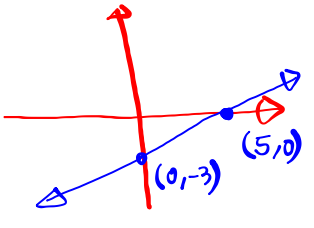
1) Simplify $\dfrac{10 \cdot 150 - 30^2}{10 \cdot 11}$ 3-decimals

$= \dfrac{1500-900}{110} = \dfrac{600}{110} = \dfrac{60}{11} = \boxed{5.455}$

2) Simplify $\dfrac{8!}{5!}$

$= \dfrac{8 \cdot 7 \cdot 6 \cdot 5!}{5!} = \boxed{336}$

3) Draw $y = \frac{3}{5}x - 3$



Ch. 3 Basic Computations with data elements

SG 5-9

Consider the data Set below

2, 3, 5, 5, 10

1) Sample Size $n = 5$

2) Range $= 10 - 2 = 8$

3) Midrange $= \frac{10+2}{2} = 6$

4) Mode $= 5$

5) $\sum x = 2+3+5+5+10 = \boxed{25}$

$\sum$ Summation

6) $\sum x^2 = 2^2+3^2+5^2+5^2+10^2 = \boxed{163}$

7) $\bar{x}$ "x-bar" $\Rightarrow$ Sample Mean (Average)

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

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

$s^2 = \frac{5 \cdot 163 - 25^2}{5(5-1)} = \frac{815-625}{5 \cdot 4} = \frac{190}{20} = \frac{19}{2} = \boxed{9.5}$

9) s "Sample Standard deviation" $s = \sqrt{s^2} \quad s = \sqrt{9.5} \approx \boxed{3.082}$

Consider the data Set below

2, 3, 3, 3, 5, 5, 5, 10

1) $n = 8$ 2) Range $= 10-2 = 8$ 3) Midrange $= \frac{10+2}{2} = 6$

4) Mode $= 3$ & 5 5) $\sum x = 2+3+3+3+5+5+5+10 = \boxed{36}$

6) $\sum x^2 = 2^2+3^2+3^2+3^2+5^2+5^2+5^2+10^2 = \boxed{206}$

7) $\bar{x} = \frac{\sum x}{n} = \frac{36}{8} = \boxed{4.5}$

8) $s^2 = \frac{n\sum x^2 - (\sum x)^2}{n(n-1)} = \frac{8 \cdot 206 - 36^2}{8(8-1)} = \frac{1648-1296}{8 \cdot 7} = \frac{352}{56}$

$= \boxed{6.286}$

9) $s = \sqrt{s^2} \quad s = \sqrt{6.286} \approx \boxed{2.507}$

To estimate the Sample Standard Deviation

$s \approx \frac{\text{Range}}{4}$ $\qquad s \approx \frac{\text{Range}}{4} = \frac{8}{4} = \boxed{2}$

"Range Rule-of-Thumb"

Z-Score

$$Z = \frac{x - \bar{x}}{s}$$ Always round to 3-decimals.

Ex: A data set has a mean of 85 and standard deviation of 8. Find the Z-score for data element 96.

$$Z = \frac{x - \bar{x}}{s} = \frac{96 - 85}{8} = \frac{11}{8} = 1.375$$

A data set has a mean of 6250 with standard deviation of 400. Find a data element that has Z-score of −2.5.

$$Z = \frac{x - \bar{x}}{s} \qquad -2.5 = \frac{x - 6250}{400}$$ Solve for x.

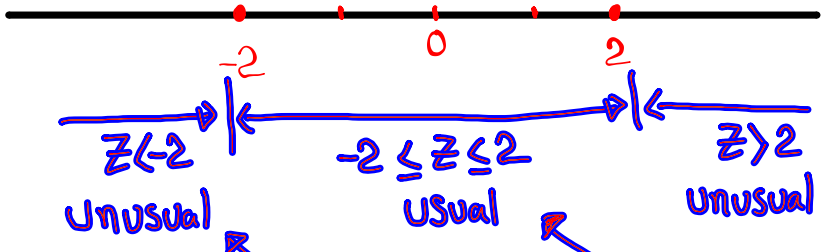
Cross-multiply

$x - 6250 = 400(-2.5)$

$x = 6250 - 2.5(400)$

$x = 5250$

Usual & Unusual data elements

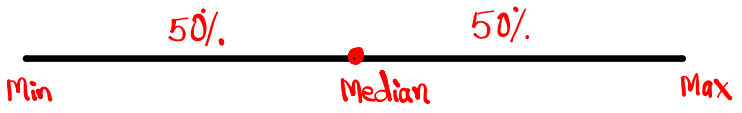


Exam 1: $\bar{x} = 88$, $s = 5$

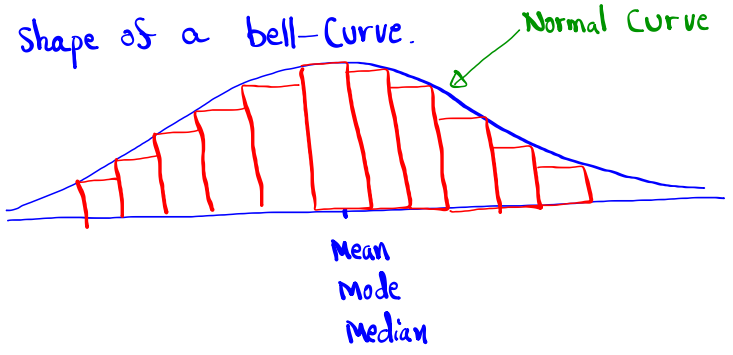
Darla got 95. $Z = \frac{x - \bar{x}}{s} = \frac{95 - 88}{5} = \frac{7}{5} = 1.4$

I got 75 $Z = \frac{x - \bar{x}}{s} = \frac{75 - 88}{5} = \frac{-13}{5} = -2.6$

When the data is sorted,
the value in the middle is called the median.



Whenever mean, mode, and median are the same, data distribution will be symmetric and takes a shape of a 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 $\Rightarrow \bar{x} \pm 3s$

Exam 1 results are symmetric with mean of 84 and standard deviation of 5.

68% Range $\Rightarrow \bar{x} \pm s = 84 \pm 5 \Rightarrow$ 79 to 89

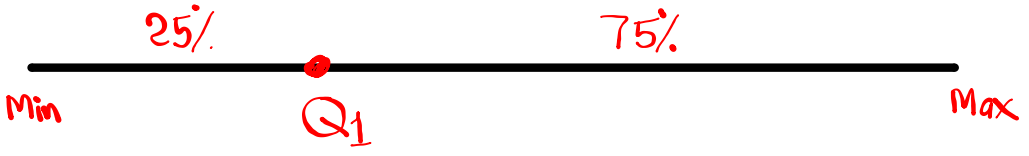
95% Range $\Rightarrow \bar{x} \pm 2s = 84 \pm 2(5) \Rightarrow$ 74 to 94

Usual Range

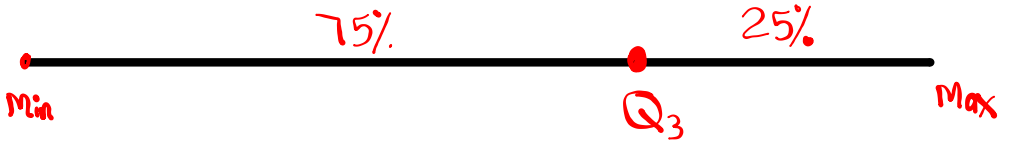
99.7% Range $\Rightarrow \bar{x} \pm 3s = 84 \pm 3(5) \Rightarrow$ 69 to 99

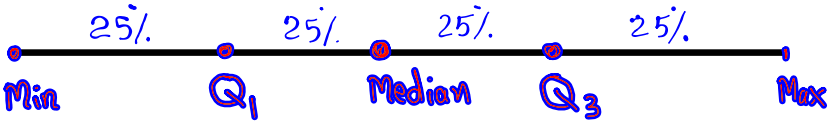
Whenever data elements are Sorted

Q_1 First Quartile, it separates the bottom 25% from the top 75%.



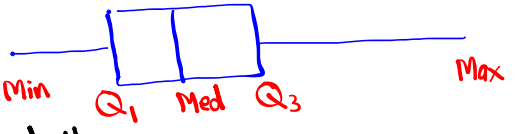
Q_3 Third Quartile, It Separates the bottom 75% from the top 25%.





Min, Q_1, Median, Q_3, and Max are Called 5-Number Summary.

We use them to draw Box Plot.



Results of exam 1 had the Following 5-Number Summary.

40, 70, 78, 82, and 100.

Min Q_1 Med Q_3 Max

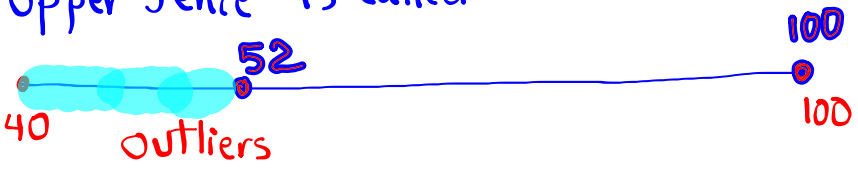
IQR Inter-Quartile-Range

$IQR = Q_3 - Q_1$ $\quad IQR = 82 - 70 = 12$

$\text{Upper Fence} = Q_3 + 1.5(IQR) = 82 + 1.5(12) = 100$

$\text{Lower Fence} = Q_1 - 1.5(IQR) = 70 - 1.5(12) = 52$

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



TI instructions:

1) To clear the Screen : Clear

2) To quit : 2nd Mode

3) To clear all lists: 2nd + 4:clearall lists Enter

4) To reset all lists: STAT Edit 5:SetupEditor Enter

5) To turn the Diagnostic key on

2nd 0 ↓↓↓ ---- ↓ DiagnosticOn Enter Enter

Let's quit 2nd Mode

Clear the Screen Clear

Store the following data in a list:

8 2 10 12 18
5 10 9 15 6

STAT Edit
1:Edit

L1
8 enter
2 "
10 "
⋮
6 "

Let's quit 2nd Mode

STAT → CALC
1:1-Var Stats

2nd 1

With Menu
List: L1
FreqList: Clear
Calculate

No Menu
1-Var Stats
L1
Enter

$\bar{x} = 9.5$
$\sum x = 95$
$\sum x^2 = 1103$
$S_x = S = 4.720$
$n = 10$

Min = 2
Q1 = 6
Med = 9.5
Q3 = 12
Max = 18
5-Number Summary

I randomly selected 20 students. Here are their ages

23	32	45	18	19
20	30	40	35	25
18	27	32	36	43
21	34	50	42	38

Store data in L1

STAT Edit
1:

L1
23 enter
32 "
⋮
38 "

Clear all lists

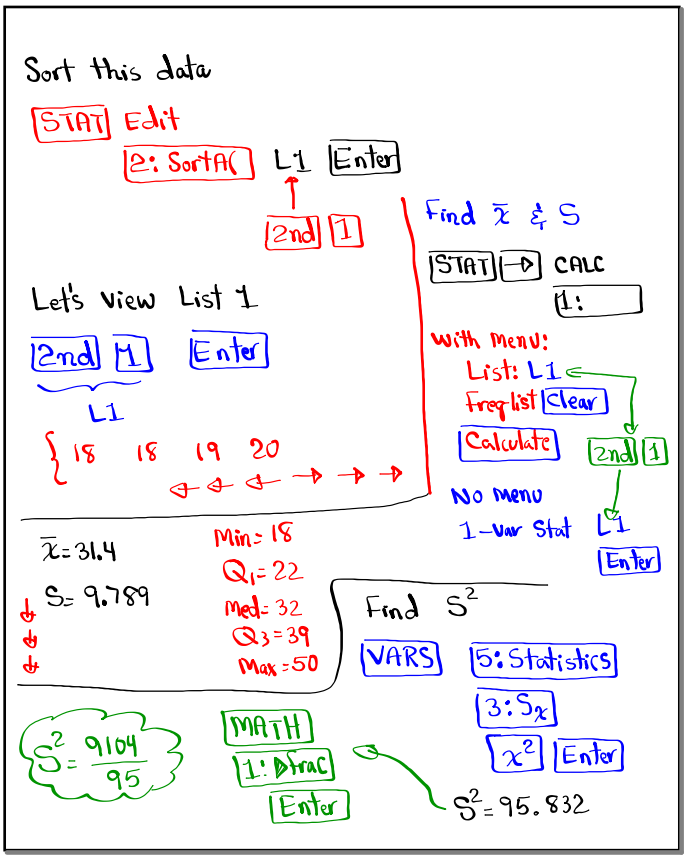
2nd + 4: Clear all lists
Enter

Reset all lists

STAT Edit
5: Set up editor
Enter

Let's quit 2nd Mode

Clear Screen Clear


Sort this data
STAT Edit
2: SortA(L1 Enter
2nd 1
Let's view List 1
2nd 1 Enter
L1
18 18 19 20
Find $\bar{x}$ & S
STAT → CALC
1:
With menu:
List: L1
Freq list Clear
Calculate
2nd 1
No menu
1-Var Stat L1
Enter
$\bar{x}$ = 31.4
S = 9.789
Min = 18
Q_1 = 22
Med = 32
Q_3 = 39
Max = 50
Find S^2
VARS 5: Statistics
3: S_x
x^2 Enter
$S^2 = \frac{9104}{95}$
MATH
1: ▶Frac
Enter
S^2 = 95.832