Statistics
Summer 2023
Lecture 4

Feb 19-8:47 AM

I surveyed 280 students and I discovered 15% had A, 25% had B, 40% had C, and the rest got D on a given exam.

Exam grade	F	% F
A	42	15%
B	70	25%
C	112	40%
D	56	20%

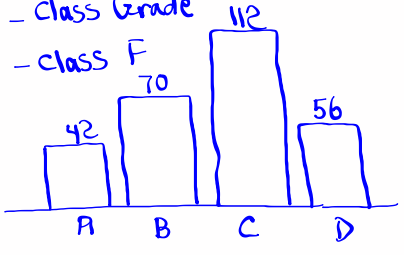
15% of 280 =
.15 (280) = 42

25% of 280 =
.25 (280) = 70

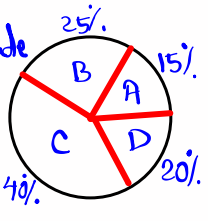
40% of 280 =
.4 (280) = 112

% of D grade
100% - (15% + 25% + 40%)
100% - 80% = 20%

Bar chart
- Class Grade
- Class F



Pie chart
- Circle
- Class Grade
- % F



Jun 15-7:31 AM

I randomly selected 8 QZ, and here are the Scores

2 5 5 6
8 8 9 10

1) $n = 8$

2) Min. = 2 , Max. = 10

3) Range = Max − Min = 8

4) Midrange = $\frac{\text{Max}+\text{Min}}{2} = 6$

5) Mode = 5 & 8

6) $\Sigma x = 2+5+5+6+8+8+9+10 = 53$

7) $\Sigma x^2 = 2^2+5^2+5^2+6^2+8^2+8^2+9^2+10^2 = 399$

8) $\bar{x} = \frac{\Sigma x}{n} = \frac{53}{8} = \boxed{6.625}$

9) $s^2 = \frac{n\Sigma x^2 - (\Sigma x)^2}{n(n-1)} = \frac{8\cdot 399 - 53^2}{8(8-1)} = \frac{383}{56} \approx \boxed{6.839}$

10) $s = \sqrt{s^2} = \sqrt{6.839} \approx \boxed{2.615}$

Jun 15-7:41 AM

A data set has a bell-shape dist with $\bar{x} = 175$ and $s = 25$.

Use Empirical rule to find

1) 68% Range

$\bar{x} \pm s$

$= 175 \pm 25$

$\Rightarrow$ 150 To 200

2) Usual Range

95% Range

$\bar{x} \pm 2s$

$= 175 \pm 2(25)$

$= 175 \pm 50$

$\Rightarrow$ 125 To 225

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

Find z Score when $x = 210$.

$z = \frac{x-\bar{x}}{s} = \frac{210-175}{25} = 1.4$ usual data element

Find x when $z = -2.8$

$-2.8 = \frac{x-175}{25}$

$x - 175 = 25(-2.8)$

$x = 175 + 25(-2.8)$

$x = 105$ Unusual Data element

Usual

$z < -2$ | $-2 \le z \le 2$ | $z > 2$

-2 2

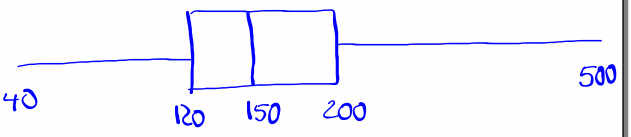
Unusual Unusual

Jun 15-7:50 AM

A data set has the following 5-Number Summary

40 (Min) 120 (Q_1) 150 (Median) 200 (Q_3) 500 (Max)

Box Plot

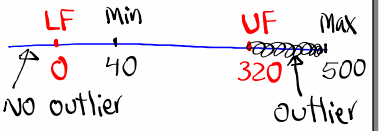


$IQR = Q_3 - Q_1 = 200 - 120 = 80$

Upper Fence $= Q_3 + 1.5(IQR) = 200 + 1.5(80) = \boxed{320}$

Lower Fence $= Q_1 - 1.5(IQR) = 120 - 1.5(80) = \boxed{0}$

Discuss possible outliers



Jun 15-7:59 AM

I randomly selected 20 students, and here are their ages:

18	19	19	20	24
25	25	25	27	32
32	32	35	37	39
39	40	45	48	50

1) $n = 20$

2) Min $= 18$ Max $= 50$

3) Range $= 50 - 18 = 32$

4) Midrange $= \frac{50+18}{2} = 34$

5) Mode 25 & 32
Bimodal

Find class width if we wish to have a frequency table with

6) 3 classes

$CW = \frac{\text{Range}}{3} = \frac{32}{3} = 10.\overline{6}$

$\boxed{CW = 11}$

7) 4 classes

$CW = \frac{\text{Range}}{4} = \frac{32}{4} = 8$

$\boxed{CW = 9}$

Jun 15-8:10 AM

18 19 19 20 24
25 25 25 27 32
32 32 35 37 39
39 40 45 48 50

8) STEM Plot

1	8 9 9
2	0 4 5 5 5 7
3	2 2 2 5 7 9 9
4	0 5 8
5	0

9) How many data elements are below 40? 16

10) What % of data elements are below 40?

$$\frac{16}{20} \cdot 100 \Rightarrow \boxed{80\%}$$

Jun 15-8:17 AM

I randomly selected 20 students, and here are their ages:

18 19 19 20 24
25 25 25 27 32
32 32 35 37 39
39 40 45 48 50

1) Clear all lists
2nd + 4:ClrAll Lists Enter

2) Reset all lists
STAT Edit 5: SetUpEditor Enter

3) Store this data set in L1.
STAT Edit 1: Edit

L1
18 Enter
19
⋮
50 Enter

4) Use TI to find $\bar{x}$, S, and n.
STAT → CALC 1: 1-Var Stats

No Menu
L1 Enter

with Menu
List: L1 (2nd 1)
Freq List: Clear
Calculate

$\bar{x} = 31.55$
$S = S_x = 9.881$
$n = 20$
Min = 18
$Q_1 = 24.5$
Med. = 32
$Q_3 = 39$
Max = 50
5-Number Summary

Find S^2 in reduced fraction
VARS 5: Statistics 3: S_x χ^2 Enter
MATH 1: ▶Frac Enter

37099/380
97.629...

Jun 15-8:10 AM

What is Standard deviation?

It is a non-negative numerical value that indicates how data elements spread from the mean.

If Standard deviation is Small, data elements are close to the mean.

If standard deviation is big, data elements are more spread out from the mean.

If Standard deviation is Zero, then there is no spread, there is no deviation from the mean, all data elements are equal to the mean.

Sample Standard deviation $\Rightarrow$ S (S_x in the calc.)

Jun 15-9:05 AM

Store the following in L1.

5 5 5 5

5 5 5 5

Use L1 with 1-Var stats to find

$\bar{x} = 5$ $S = 0$ $n = 8$

Go back to L1, change first 5 to 6, then find

$\bar{x} = 5.125$ $S = .354$ $n = 8$

Go back to L1, change 6 to 50, find

$\bar{x} = 10.625$ $S = 15.910$ $n = 8$

Go back to L1, change 50 to 100, find

$\bar{x} = 16.875$ $S = 33.588$ $n = 8$

Go back to L1, change 100 to 4.95, find

$\bar{x} = 4.994$ $S = .018$ $n = 8$

Small S $\rightarrow$ Data elements are close to $\bar{x}$

Big S $\rightarrow$ Data elements are more spread out from $\bar{x}$.

Zero S $\rightarrow$ All data elements are the same and equal to $\bar{x}$.

Jun 15-9:10 AM

Clear all lists. [2nd] [+] [4:clear all lists] [Enter]

Reset all lists. [STAT] Edit [5:SetUpEditor] [Enter]

Store the following in L1.

75	83	65	50	100
70	90	95	90	55
85	88	68	72	94

[STAT] Edit [1:Edit]

L1
75
83
65
⋮
94

Let's view L1

[2nd] [1] [Enter] {75 83 65 50 ... 94}

now Sort L1, then view it.

[STAT] Edit [2nd] [1] [Enter]

[2:SortA(]

[2nd] [1] [Enter] {50 55 65 68 70 ... 100}

Jun 15-9:24 AM

Make STEM Plot

5	0 5
6	5 8
7	0 2 5
8	3 5 8
9	0 0 4 5
10	0

Use 1-Var Stats with L1 to find

$\bar{x} = 78.6$ $S = 15.060$ $n = 15$

5-Number Summary

Min = 50 $Q_3 = 90$

$Q_1 = 68$ Max = 100

Med = 83

Find S^2 in reduced fraction

[VARS] [5: Statistics] [3: S_x] [x^2] [MATH] [1: ▶Frac] [Enter]

$\frac{4763}{21}$

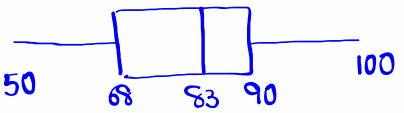
Jun 15-9:34 AM

5-Number Summary

Min = 50 Q_3 = 90

Q_1 = 68 Max = 100

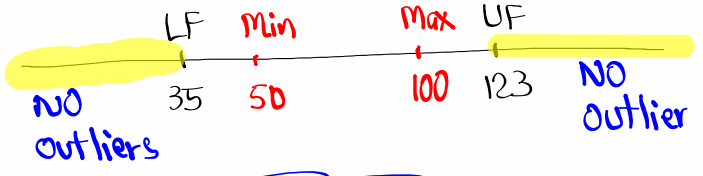
Med = 83



$IQR = Q_3 - Q_1 = 90 - 68 = 22$

Upper fence $= Q_3 + 1.5(IQR) = 90 + 1.5(22) =$ **123**

Lower fence $= Q_1 - 1.5(IQR) = 68 - 1.5(22) =$ **35**



No outliers

Jun 15-9:42 AM

Consider the chart below

class MP	class F
18	5
30	10
42	15
54	7
66	3

1) How many classes?

5 Rows → 5 classes

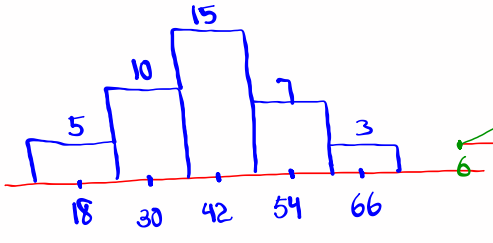
2) class width?

CW = 12

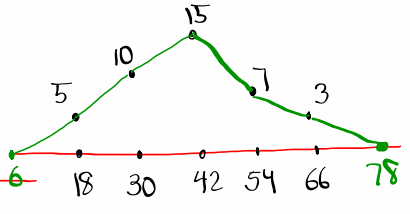
3) Sample Size?

$n = \Sigma f =$ 40

4) Draw histogram



5) Draw Freq. Polygon



Jun 15-9:48 AM

Use class mp & class F to find

$\bar{x} = 39.9$ $S = S_x = 13.282$ $n = 40$

No Menu

Clear all lists.

Class mp → L1

Class F → L2

1-Var Stats L1, L2

With menu: 2nd [1] enter

List: L1 (2nd [1])

FreqList: L2 (2nd [2] [7])

Calculate

Find S^2 in reduced fraction $S^2 = \frac{882}{5}$

VARS | 5: Statistics | 3: S_x | χ^2 | MATH | 1: ▶Frac | Enter

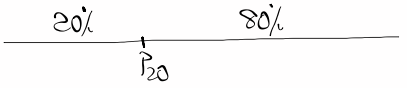
Jun 15-9:54 AM

Percentile & Percentile Ranking (SG 5-9)

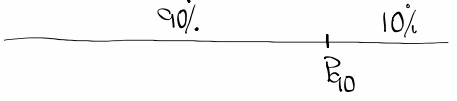
Notation P_K

"Data must be Sorted"

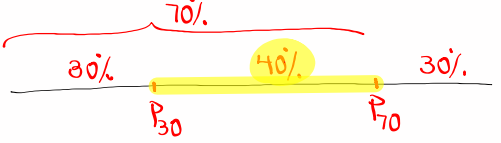
ex: P_{20}



ex: P_{90}

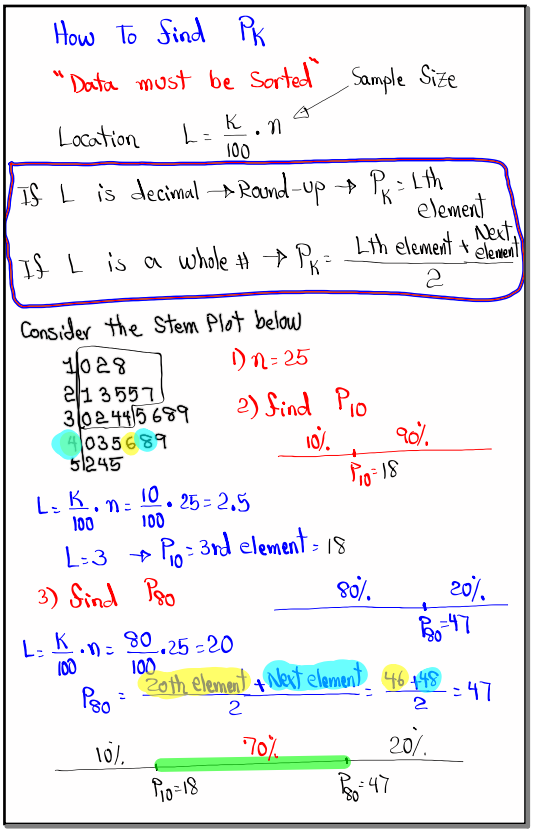


What % of data falls within P_{30} & P_{70}?

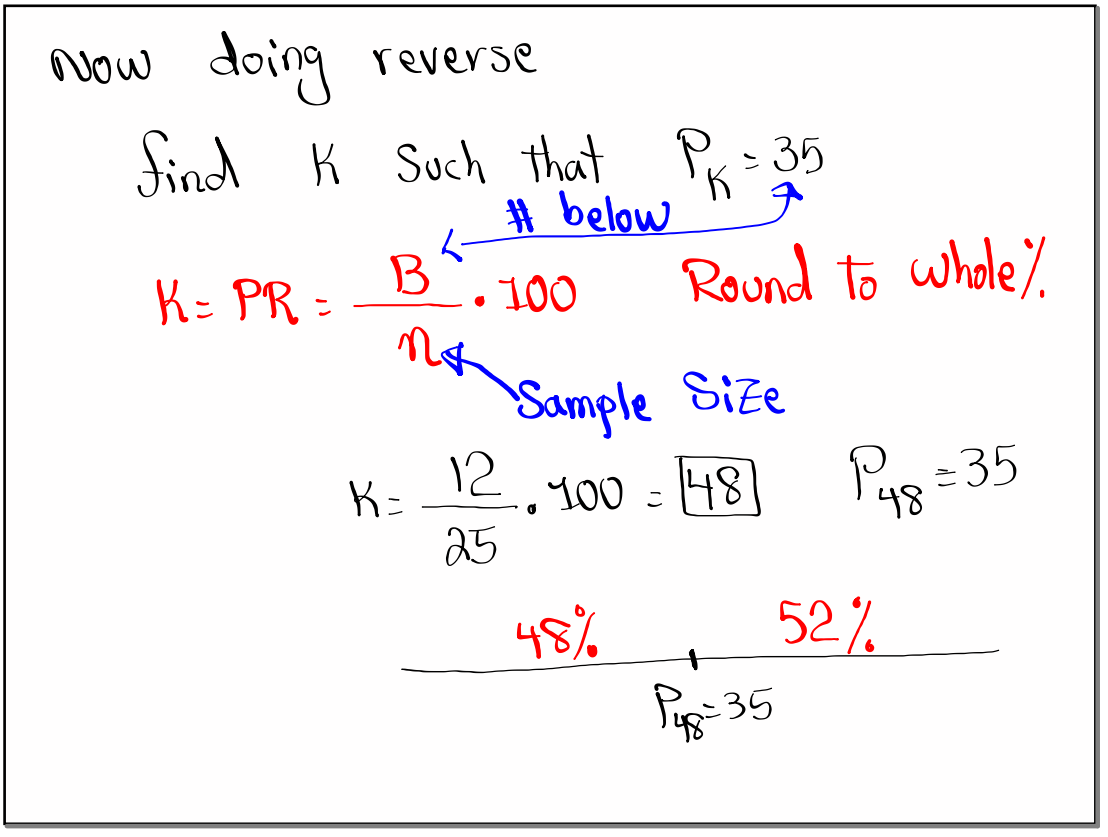


40%

Jun 15-10:30 AM



Jun 15-10:35 AM



Jun 15-10:45 AM

I randomly selected 32 exams, and here are the scores:

48	53	55	60
62	65	68	70
70	72	75	75
75	78	80	84
84	84	86	88
89	90	92	95
95	95	96	97
98	99	100	100

STEM Plot

4 | 8
5 | 3 5
6 | 0 2 5 8
7 | 0 0 2 5 5 5 8
8 | 0 4 4 4 6 8 9
9 | 0 2 5 5 5 6 7 8 9
10 | 0 0

$n = 32$ Range $= 100 - 48 = 52$

Midrange $= \frac{100 + 48}{2} = 74$ Mode: 75, 84, 95 Trimodal

class width for

4 classes: $CW = \frac{\text{Range}}{4} = \frac{52}{4} = 13 \rightarrow \boxed{CW = 14}$

5 classes: $CW = \frac{\text{Range}}{5} = \frac{52}{5} = 10.4$ $\boxed{CW = 11}$

Estimate S

$S \approx \frac{\text{Range}}{4} = \frac{52}{4} = \boxed{13}$ Range rule-of-thumb

Jun 15-10:50 AM

4 | 8
5 | 3 5
6 | 0 2 5 8
7 | 0 0 2 5 5 5 8
8 | 0 4 4 4 6 8 9
9 | 0 2 5 5 5 6 7 8 9
10 | 0 0

Find P_{20}

P_{20} = 7th element = 68

$L = \frac{20}{100} \cdot 32 = 6.4 \rightarrow L = 7$

20% | 80%

$P_{20} = 68$

Find P_{50}

$L = \frac{50}{100} \cdot 32 = 16$

$P_{50} = \frac{16\text{th element} + \text{Next element}}{2} = \frac{84 + 84}{2} = 84$

50% | 50%

$P_{50} = 84$

P_{50} = median

Find K such that $P_K = 90$

$K = PR = \frac{B}{n} \cdot 100 = \frac{21}{32} \cdot 100$ (Below)

Round to whole %.

$K = 65.625 \approx 66\%$

66% | 34%

$P_{66} = 90$

Jun 15-10:59 AM

I randomly selected 25 nurses here are their ages:

34	40	46	28	50
30	25	36	38	42
60	55	58	50	48
42	35	29	25	43
62	54	58	46	37

Store in L1
Sort L1
View L1
Make Stem Plot

2	5 5 8 8
3	0 4 5 6 7 8
4	0 2 2 3 6 6 8
5	0 0 4 5 8 8
6	0 2

Find P_{30}

$L = \frac{30}{100} \cdot 25 = 7.5 \rightarrow L = 8$

P_{30} = 8th element = 36

30% | 70%

$P_{30} = 36$

Find P_{60}

$L = \frac{60}{100} \cdot 25 = 15$

$P_{60} = \frac{15\text{th element} + \text{Next element}}{2} = \frac{46 + 46}{2} = 46$

60% | 40%

$P_{60} = 46$

Find K such that $P_K = 55$ (Below)

$K = PR = \frac{B}{n} \cdot 100$

$= \frac{20}{25} \cdot 100 = 80$

$P_{80} = 55$

80% | 20%

$P_{80} = 55$

Jun 15-11:10 AM

Complete the chart below

class limits	class MP	class F
12 – 25	18.5	5
26 – 39	32.5	12
40 – 53	46.5	18
54 – 67	60.5	5

+cw → +cw → +cw

cw = 14

$n = \Sigma F = 40$

class MP → L1

class F → L2

No Menu

Use 1-Var Stats

L1, L2 enter

1

with Menu

List: L1

FreqList: L2

Calculate

$\bar{x} = 40.55$

$S = S_x = 12.233$

$n = 40$

S^2 (Reduced fraction) = $\frac{19\,453}{130}$

Jun 15-11:30 AM

Class QZ 5

Consider the Sample below

12	18	15	15	10
10	8	20	16	9

Use your TI calc to find

$\bar{x} = 13.3$

$s = 4.084$ } Round to 3-decimal

$s^2 = \frac{1501}{90}$ } Reduced Fraction

Jun 15-11:40 AM