

Statistics
Winter 2022
Lecture 4



1) Exam 1 \Rightarrow Next Tuesday

SG 1 - SG 12

In person

2) How to submit work \Rightarrow One file only

\Rightarrow Portrait style

\Rightarrow Pages must be in
order.

3) Official Picture ID Needed at the time
of exam.

How to find \bar{x} , S , and S^2 for grouped data:

class limits	class MP	class F
16 - 28	22	4
29 - 41	35	12
42 - 54	48	18
55 - 67	61	6

1) 4 classes
 2) $CW = 29 - 16 = 13$
 $42 - 29 = 13$
 $55 - 42 = 13$
 3) Sample Size
 $n = \sum F = 4 + 12 + 18 + 6 = 40$

class MP = $\frac{\text{+class limits}}{2} = \frac{16+28}{2} = \frac{44}{2} = 22$

Using TI

clear all lists: $2nd$ $+$ 4 :clear All lists $Enter$

clear the screen: $clear$

class MP \rightarrow L1 $STAT$ $Edit$
 class F \rightarrow L2 1 : $Edit$

L1	L2
22	4
35	12
48	18
61	6

Let's quit: $2nd$ $Mode$

$STAT$ \rightarrow $CALC$

1 : 1 -Var Stats

with Menu $2nd$ 1

List: L1

Freq List: L2 $2nd$ 2

No menu
 1-Var Stats L1, L2
 7

$Calculate$

$Enter$

$\bar{x} = 43.45$

$S = 11.229$

$n = 40$

Now let's find S^2

$VARS$ 5 : Statistics 3 : S_x x^2

$Enter$ 126.1

Convert to a reduced fraction

$MATH$ 1 : $Frac$ $Enter$

Exact Ans. $\Rightarrow \frac{1261}{10}$

Let's round \bar{x} and S to a whole #, find
 $\bar{x} \approx 43$ $S \approx 11$

68% Range $\Rightarrow \bar{x} \pm S = 43 \pm 11 \Rightarrow \boxed{32 \text{ to } 54}$

Usual Range $\Rightarrow \bar{x} \pm 2S = 43 \pm 2(11) \Rightarrow \boxed{21 \text{ to } 65}$
 (95% Range)

99.7% Range $\Rightarrow \bar{x} \pm 3S = 43 \pm 3(11) \Rightarrow \boxed{10 \text{ to } 76}$

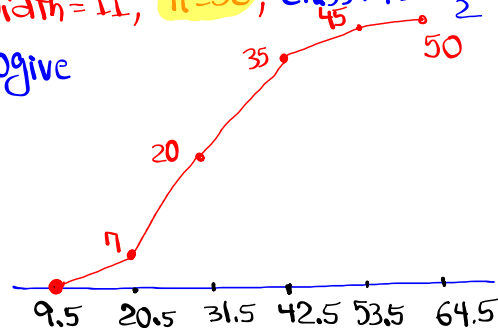
Complete the chart below:

Class limits	Class BNDRS	Class MP	Class F	Cum. F	Rel. F	% F
10 - 20	9.5 - 20.5	15	7	7	.14	14%
21 - 31	20.5 - 31.5	26	13	20	.26	26%
32 - 42	31.5 - 42.5	37	15	35	.30	30%
43 - 53	42.5 - 53.5	48	10	45	.20	20%
54 - 64	53.5 - 64.5	59	5	50	.10	10%

5 classes, class width = 11, $n = 50$, class MP = $\frac{\text{limits}}{2}$

Rel. F = $\frac{f}{n} = \frac{f}{50}$

ogive



Find \bar{x} , S , and S^2

L1	L2
15	7
26	13
37	15
48	10
59	5

Clear all lists
 class MP \rightarrow L1
 class F \rightarrow L2

STAT \rightarrow **CALC**
1: 1-Var Stats

List: L1 No Menu 1-VarStats L1, L2
 FreqList: L2 $\bar{x} = 35.46$ Now find S^2 **Enter**
Calculate $S = 13.149$ in reduced fraction.
 $n = 50$

$\bar{x} \approx 35$, $S \approx 13$
 By Empirical Rule

68% Range
 $\bar{x} \pm S = 35 \pm 13 \Rightarrow$ **22 to 48**

95% Range
 Usual Range
 $\bar{x} \pm 2S = 35 \pm 2(13) \Rightarrow$ **9 to 61**

VARs **5: Statistics**
3: Sx **χ^2**
MATH **1: $\frac{\square}{\square}$** **Enter**

$S^2 = \frac{423621}{2450}$

I randomly selected 25 exams, here are the scores:

72	80	85	96	100
70	82	90	94	65
58	63	100	96	88
79	73	92	86	86
60	70	85	90	84

Clear all lists.
2nd **|** **+** **4: Clear all lists** **Enter**

Reset all lists
STAT **Edit** **5: Setup Editor** **Enter**

Store this sample in L1, then Sort it.

View **L1**
2nd **|** **1** **Enter**

STEM Plot

$\{58 \ 60 \ 63 \ 65 \ \dots \ 100\}$
 $\rightarrow \rightarrow \rightarrow$
 $\leftarrow \leftarrow \leftarrow$

5 | 8
 6 | 0 35
 7 | 0 0 2 3 9
 8 | 0 2 4 5 5 6 6 8
 9 | 0 0 2 4 6 6
 10 | 0 0

STAT **Edit** **2: SortA** **L1** **Enter**

5 | 8
6 | 0 35
7 | 0 0 2 3 9
8 | 0 2 4 5 5 6 6 8
9 | 0 0 2 4 6 6
10 | 0 0

Find \bar{x} & S

STAT → **CALC**
1: 1-Var Stats

Menu NO Menu
List: L1 1-Var Stats
FreqList: **clear** L1 **Enter**
Calculate Box Plot

$\bar{x} = 81.76$
S = 12.404
n = 25

Min = 58
Q1 = 71
Med = 85
Q3 = 91
Max = 100

IQR = $Q_3 - Q_1 = 20$
Upper Fence =
 $Q_3 + 1.5(IQR) = 121$
Lower Fence =
 $Q_1 - 1.5(IQR) = 41$

Find S^2 in reduced fraction
 $S^2 = \frac{46157}{300}$ ✓

No outliers

5 | 8
6 | 0 35
7 | 0 0 2 3 9
8 | 0 2 4 5 5 6 6 8
9 | 0 0 2 4 6 6
10 | 0 0

Percentile (Data must be Sorted)

Notation P_k

$k\%$ $(100-k)\%$

ex: P_{10} 10% 90%
 P_{70} 70% 30%
 P_{99} 99% 1%

$\begin{array}{r l} 5 & 8 \\ 6 & 035 \\ 7 & 00239 \\ 8 & 02455668 \\ 9 & 002466 \\ 10 & 00 \end{array}$	<p>Find P_{10}</p> <p style="color: red;">Sample Size</p> $L = \frac{K}{100} \cdot n$ <p>If L is decimal \Rightarrow Round-up $\Rightarrow P_K = \text{Lth element}$</p> <p>If L is whole $\Rightarrow P_K = \frac{\text{Lth element} + \text{Next one}}{2}$</p>
$L = \frac{10}{100} \cdot 25 = 2.5$ $L = 3$ $P_{10} = \text{3rd element}$ <div style="border: 1px solid blue; padding: 2px; display: inline-block;">$P_{10} = 63$</div>	$P_{80} = \frac{\text{20th element} + \text{Next element}}{2}$ $= \frac{92 + 94}{2} = \boxed{93}$
<p>Find P_{80}</p> $L = \frac{80}{100} \cdot 25 = 20$	

$\begin{array}{r l} 5 & 8 \\ 6 & 035 \\ 7 & 00239 \\ 8 & 02455668 \\ 9 & 002466 \\ 10 & 00 \end{array}$	<p>Find K such that $P_K = 75$ (Reverse)</p> <p style="color: red;">Below</p> $K = \frac{B}{n} \cdot 100 \rightarrow \text{Round to a whole!}$ $K = \frac{8}{25} \cdot 100 = 32 \quad \text{So } \boxed{P_{32} = 75}$
<p>Find K such that $P_K = 90$</p> $K = \frac{B}{n} \cdot 100$ $= \frac{17}{25} \cdot 100 = 68 \quad \text{So } \boxed{P_{68} = 90}$	

I randomly selected 30 students, here are their ages

1		89
2		0 1 3 3 5 7
3		0 2 3 5 5 5 7 8
4		2 3 4 4 6 7 8
5		0 3 5 8
6		0 3

$$n = 30$$

$$\text{Range} = 63 - 18 = 45$$

$$\text{Midrange} = \frac{63 + 18}{2} = 40.5$$

$$\text{Mode} = 35$$

$$\text{Estimate } S \approx \frac{\text{Range}}{4} = \frac{45}{4} = \boxed{11.25}$$

Find class width for

a) 5 classes

$$CW = \frac{\text{Range}}{5} = \frac{45}{5} = 9$$

$$\boxed{CW=10}$$

b) 6 classes

$$CW = \frac{\text{Range}}{6} = \frac{45}{6} = 7.5$$

$$\boxed{CW=8}$$

1		89
2		0 1 3 3 5 7
3		0 2 3 5 5 5 7 8
4		2 3 4 4 6 7 8
5		0 3 5 8
6		0 3

Find P_{20}

$$L = \frac{20}{100} \cdot 30 = 6$$

$$P_{20} = \frac{\text{6th element} + \text{Next element}}{2} = \frac{23 + 25}{2} = \boxed{24}$$

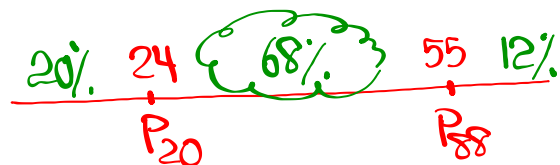
Find P_{88}

$$L = \frac{88}{100} \cdot 30 = 26.4$$

$$L = 27$$

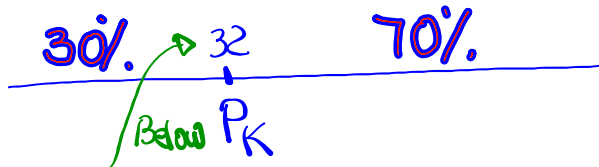
$P_{88} = 27\text{th element}$

$$P_{88} = \boxed{55}$$



1	89
2	013357
3	02355578
4	2344678
5	0358
6	03

Find K such that $P_K = 32$



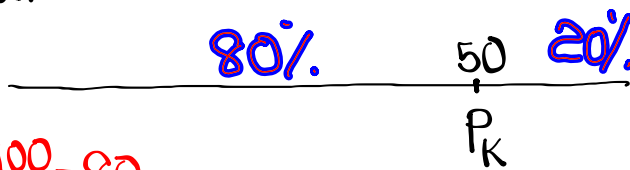
SG 5-8 ✓

$$K = \frac{B}{n} \cdot 100 \quad \text{Round to whole\%}$$

$$= \frac{9}{30} \cdot 100 = 30 \Rightarrow P_{30} = 32$$

Find K such that

$P_K = 50$ Below



$$K = \frac{B}{n} \cdot 100 = \frac{24}{30} \cdot 100 = 80$$

$P_{80} = 50$

Working with ordered-pairs (x, y)

x	y	x^2	y^2	xy	$n=4$ (# of ordered-pairs)
1	2	1	4	2	
2	5	4	25	10	
2	6	4	36	12	
4	5	16	25	20	

$$\sum x = 9$$

$$\sum x^2 = 25$$

$$\sum y = 18$$

$$\sum y^2 = 90$$

$$\sum xy = 44$$

Now using TI:

clear all lists

Reset all lists

$x \rightarrow L1, y \rightarrow L2$

L1	L2
1	2
2	5
2	6
4	5

STAT → **CALC**
2: 2-Var Stats

xlist: L1
ylist: L2
FreqList: (clear)
L1, L2 **Enter**

No Menu
2-Var stats

Calculate

7

$$\sum x$$

$$\sum x^2$$

$$n$$

$$\sum 0$$

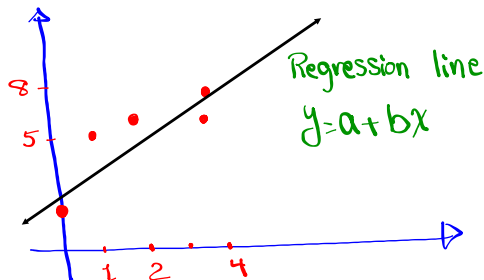
$$\sum y^2, \sum xy$$

Consider the chart below

x	y
0	2
1	5
2	6
4	8
4	6

Clear all lists
 $x \rightarrow L1$, $y \rightarrow L2$
 Use 2-Var Stats
 $\sum x = 11$ $\sum y = 27$
 $\sum x^2 = 37$ $\sum y^2 = 165$
 $n = 5$ $\sum xy = 73$

Plot these Points
 (Scatter Plot)



Turn Diagnostic Key On.

2nd 0 $\downarrow \downarrow \downarrow \dots \downarrow$ ▶ DiagnosticOn Enter Enter

How to find equation of the regression line

Using TI:

$$y = a + bx$$

STAT \rightarrow CALC

8: LinReg(a+bx)

$$\boxed{y \approx 3.1 + 1.1x}$$

with Menu

Xlist: L1

Ylist: L2

clear

calculate

No menu

LinReg(a+bx) L1, L2

enter

$$a = 3.0625$$

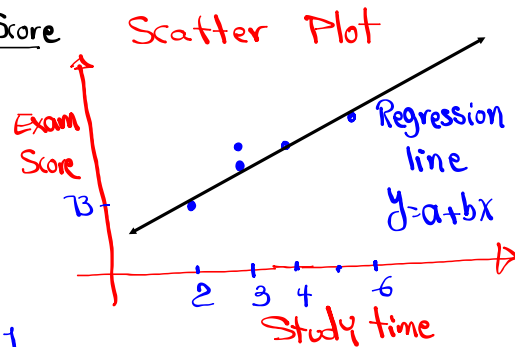
$$b = 1.0625$$

$$r^2 = .753 \Rightarrow \boxed{r^2 \approx 75\%}$$

$$r = .868$$

I randomly selected 5 students:

Study time	Exam Score
2	73
3	85
3	80
4	85
6	92



Study time $\rightarrow x \rightarrow L1$

Exam Score $\rightarrow y \rightarrow L2$

\hat{y} : LinReg($a+bx$)

$$a = 67.739 \approx 68$$

$$b = 4.239 \approx 4$$

$$r^2 = .835 \Rightarrow r^2 \approx 84\%$$

$$r = .914$$

$$\Rightarrow \boxed{y = 68 + 4x}$$

SG 9