Statistics

Lecture 2

Feb 19-8:47 AM

organize data in a freq. table and do some graphs

SG 3 & SG 4

To make a freq. table

1) Max & Min

2) Range = Max − Min

3) class width $CW = \frac{\text{Range}}{\#\text{ classes}}$

if decimal → Round-up to whole #

if whole → Add 1

Sep 5-11:39 AM

Freq. table

class limits	class BNDRS	class MP	class F	Cum. F	Rel. F/. F
Min.					
+CW					
+CW					

Bar chart

Histogram

Ogive

Freq. Polygon

Pie Chart

Sep 5-11:43 AM

I randomly selected 20 students, here are their ages.

18 19 20 20 24

26 26 26 28 30

32 32 32 35 38

40 42 46 50 52

1) Sample Size
$n = 20$

2) Range = Max - Min
$= 52 - 18 = 34$

3) Midrange $= \frac{\text{Max} + \text{Min}}{2} = \frac{52+18}{2} = 35$

4) Mode 26 & 32 Bimodal

5) Find class width for a freq. table with 3 classes.

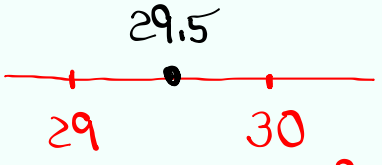
$CW = \frac{\text{Range}}{3} = \frac{34}{3} = 11.\overline{3}$

Decimal → CW = 12

Sep 5-11:47 AM

class limits	class BNDRS	class MP	Class F	Cum. F	Rel. F	% F
18 - 29	17.5 - 29.5	23.5	9	9	.45	45%
30 - 41	29.5 - 41.5	35.5	7	16	.35	35%
42 - 53	41.5 - 53.5	47.5	4	20	.20	20%

n

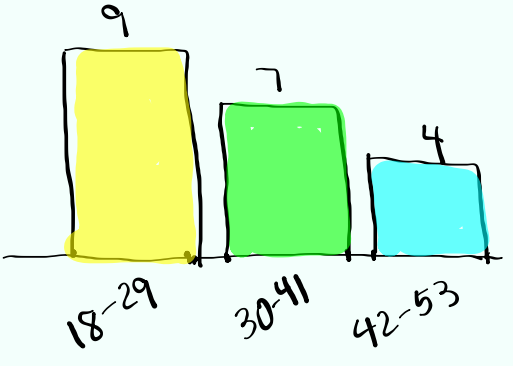


$$\text{class MP} = \frac{\text{+ class limits}}{2}$$

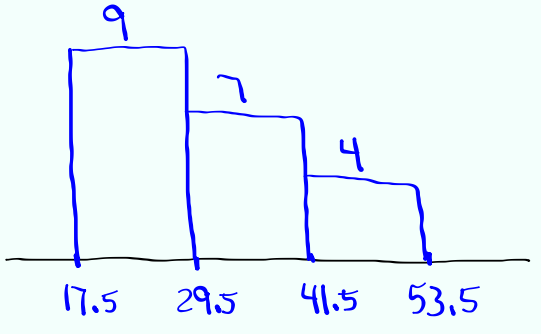
$$\text{Rel. f} = \frac{f}{n} = \frac{f}{20}$$

Sep 5-11:53 AM

Bar Chart
- class limits
- class F

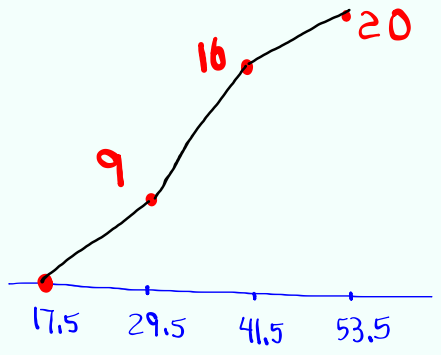


Histogram
- class BNDRS
- Class F

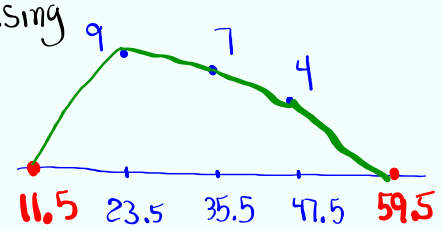


Sep 5-12:07 PM

Ogive
- Class BNDRS
- Cum. F.
- Start at 0 level
- non-decreasing

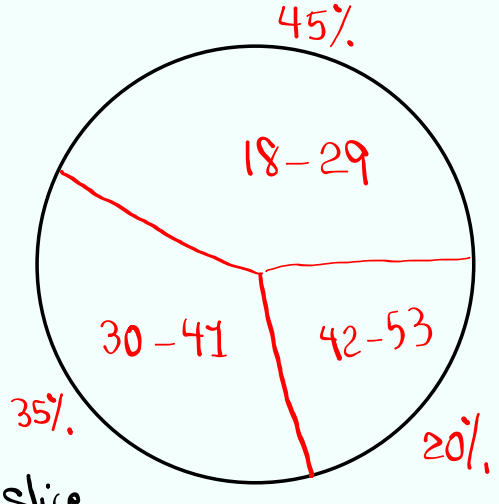


Freq. Polygon
- Class MP
- Class F
- Additional MP, one on each side
- Start & finish at 0 level



Sep 5-12:11 PM

Pie Chart
- Circle
- % F for size of each slice
- Class limits to name each slice



what % of ages were at least 30 Yrs?

35% + 20% = 55%

Sep 5-12:15 PM

I randomly selected 25 exams, here are the Scores:

52	58	60	63
65	65	68	70
72	75	75	75
78	80	83	85
88	88	88	90
92	94	98	100
100			

1) $n = 25$

2) Range $= 100 - 52$
$= \boxed{48}$

3) Midrange $= \frac{100+52}{2}$
$= \boxed{76}$

4) Mode 75 & 88

5) Find class width for a freq. table with 4 classes

$CW = \frac{\text{Range}}{4} = \frac{48}{4} = 12$

whole

$\boxed{CW = 13}$

Sep 5-12:20 PM

52 58 60 63

65 65 68 70

72 75 75 75

78 80 83 85

88 88 88 90

92 94 98 100

100

Make STEM plot

Data must be Sorted

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

Sep 5-12:27 PM

Class limits	class BNDRS	class MP	class F	Cum. F	Rel. F (3-dec)	%F
52 - 64	51.5 - 64.5	58	4	4	.16	16%
65 - 77	64.5 - 77.5	71	8	12	.32	32%
78 - 90	77.5 - 90.5	84	8	20	.32	32%
91 - 103	90.5 - 103.5	97	5	25	.20	20%

n

64.5

64 65

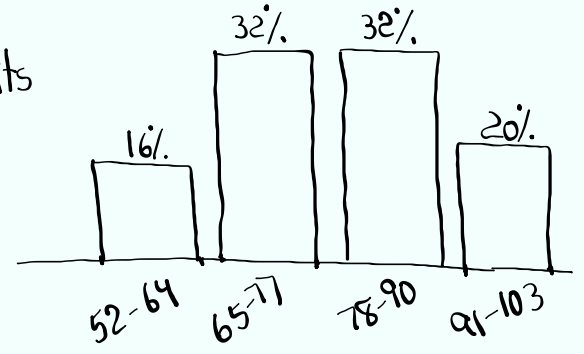
Class MP = $\frac{\text{+ class limits}}{2}$

Rel. $f = \frac{f}{n} = \frac{f}{25}$

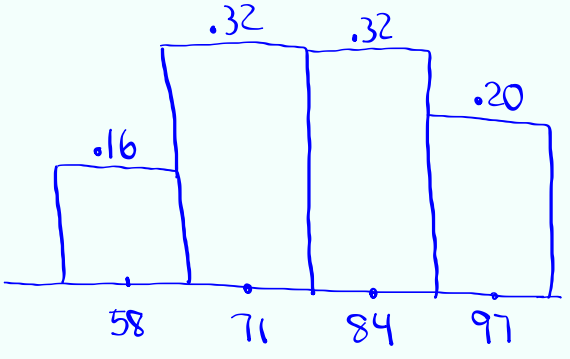
what % of scores are between 65 & 90, inclusive? 64%

Sep 5-12:30 PM

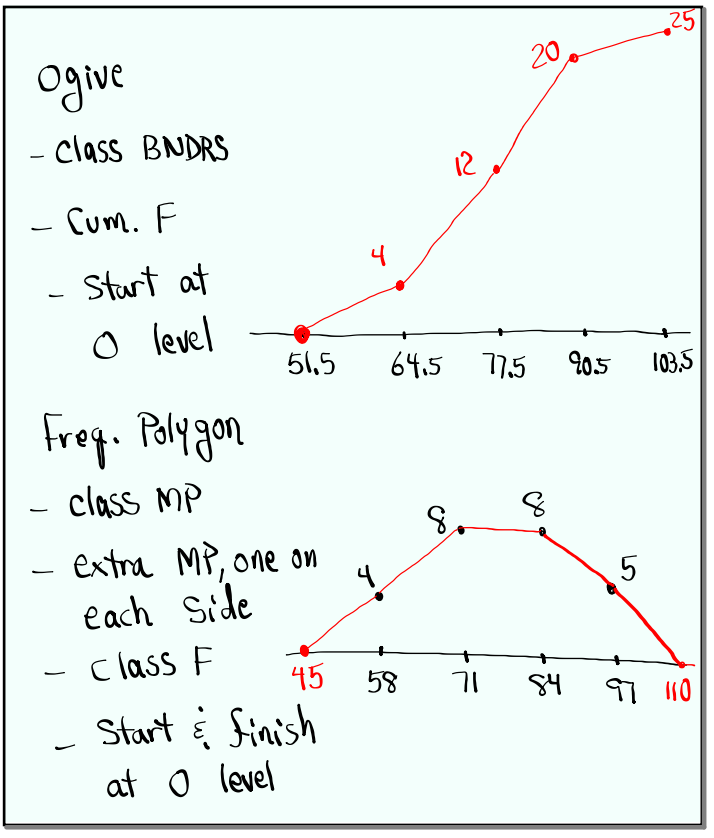
Bar chart
- class limits
- %F



Histogram
- class MP
- Rel. F.



Sep 5-12:43 PM



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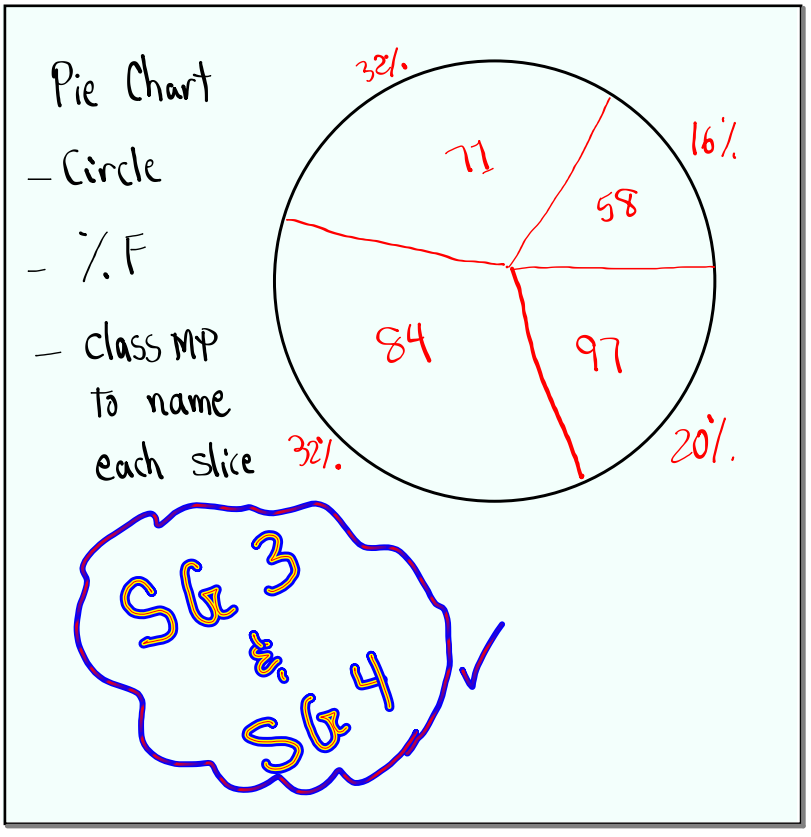


Sep 5-12:53 PM

SG 5

Doing certain Calculations in Statistics:

n → Sample Size

x → Data element

Σx → Sum of data elements

$\bar{x}$ → x-bar → Sample Mean (Average)

$$\bar{x} = \frac{\Sigma x}{n}$$

Consider the Sample below

1, 3, 3, 3, 5

1) $n = 5$

2) Mode 3

3) $\Sigma x = 1+3+3+3+5 = 15$

4) $\bar{x} = \frac{\Sigma x}{n} = \frac{15}{5} = 3$

Range $= 5-1 = 4$, Midrange $= \frac{5+1}{2} = 3$

Sep 5-1:13 PM

Consider the Sample below

2, 4, 4, 6, 6, 8, 10, 10

1) $n = 8$

2) Range $= 10-2 = 8$

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

4) Mode 4, 6, 10

Trimodal

5) $\Sigma x = 2+4+4+6+6+8+10+10 = 50$

6) $\bar{x} = \frac{\Sigma x}{n} = \frac{50}{8} = 6.25$

Round to whole → 6

1-Dec. → 6.3

Round-up to a whole # → 7

Sep 5-1:18 PM

$n \rightarrow$ Sample Size

$x \rightarrow$ data element

$x^2 \rightarrow$ data element squared

$\sum x \rightarrow$ Sum of data elements

$\sum x^2 \rightarrow$ Sum of data elements^2

Square each element then find the Sum

$\bar{x} \rightarrow$ Sample Mean $\quad \bar{x} = \frac{\sum x}{n}$

$s^2 \rightarrow$ Sample Variance

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

Sep 5-1:23 PM

Consider the Sample below

2 4 4 4 6

$n = 5$ Range $= 4$ Midrange $= 4$

Mode $= 4$ $\quad \sum x = 2+4+4+4+6 = 20$

$\sum x^2 = 2^2+4^2+4^2+4^2+6^2 = 88$

$\bar{x} = \frac{\sum x}{n} = \frac{20}{5} = \boxed{4}$

$s^2 = \frac{n\sum x^2 - (\sum x)^2}{n(n-1)} = \frac{5 \cdot 88 - 20^2}{5(5-1)} = \frac{40}{20}$

$\boxed{s^2 = 2}$

$\boxed{s^2 \geq 0}$ Always

Sep 5-1:28 PM

Given $n=8$ $\sum x=32$ $\sum x^2=128$

1) $\bar{x} = \frac{\sum x}{n} = \frac{32}{8} = \boxed{4}$

2) $s^2 = \frac{n\sum x^2 - (\sum x)^2}{n(n-1)} = \frac{8\cdot 128 - 32^2}{8(8-1)} = \frac{0}{56}$

$= \boxed{0}$

Google what we know about Sample when its variance is 0.

Sep 5-1:33 PM

$n=8$ Min. $=2$ Max $=12$

$\sum x = 56$ $\sum x^2 = 464$

1) Range $= \boxed{10}$ 2) Midrange $= \boxed{7}$

3) Mode More info. needed 4) $\bar{x} = \frac{\sum x}{n} = \frac{56}{8} = \boxed{7}$

5) $s^2 = \frac{n\sum x^2 - (\sum x)^2}{n(n-1)} = \frac{8\cdot 464 - 56^2}{8(8-1)}$

$= \frac{576}{56} = \boxed{\frac{72}{7}}$

576 ÷ 56 Math 1:▶Frac Enter

Sep 5-1:37 PM

$\bar{x}$ → Sample Mean $\quad \bar{x} = \frac{\sum x}{n}$

s^2 → Sample Variance

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

s → Sample Standard deviation

$$s = \sqrt{s^2}$$

$s \geq 0$ Always

Ask google what we learn about the Sample when standard deviation is 0.

Sep 5-1:43 PM

Consider the Sample below

3 5 5 5 7

$\sum x = 25 \qquad \sum x^2 = 133$

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

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

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

Google what we know about Sample with Small Standard deviation.

How To estimate s:

$s \approx \frac{\text{Range}}{4}$ the range rule-of-thumb.

Sep 5-1:47 PM

Empirical Rule:

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 $\bar{x} \pm 3s$

Empirical Rule is best when data dist. is Symmetric and bell-Shape.

Sep 5-1:54 PM

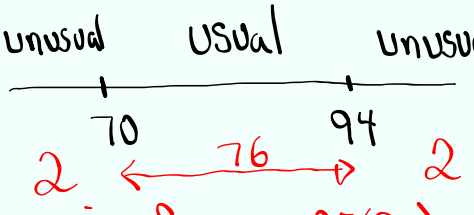
80 exams had a bell-shape dist with $\bar{x} = 82$ and $s = 6$

68% Range $\rightarrow \bar{x} \pm s = 82 \pm 6$

$\Rightarrow$ 76 to 88

95% Range $\rightarrow \bar{x} \pm 2s = 82 \pm 2(6)$

$= 82 \pm 12$



$\Rightarrow$ 70 to 94

95% of 80 = .95(80) = 76

Sep 5-1:58 PM

Lisa is a nurse.

She makes $5000/mo.

Salaries have a bell-shape dist with $\bar{x} = 4000$, $S = 400$

Is her salary usual or unusual?

Usual Range → 95% Range

$\bar{x} \pm 2S$

$4000 \pm 2(400)$

4000 ± 800

Sep 5-2:03 PM

Z - Score

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

Always round to 3-dec. places

If $-2 \leq Z \leq 2$ → data element is usual.

If $Z < -2$ or $Z > 2$ → data element is unusual

Sep 5-2:15 PM

Jose got 90 on exam 1.

$\bar{x} = 80$, $S = 8$

$$z = \frac{x - \bar{x}}{S} = \frac{90 - 80}{8} = \frac{10}{8} = 1.125$$

Since $-2 \leq z \leq 2$ → usual Score

Jose got 85 on exam 2.

$\bar{x} = 74$, $S = 5$

$$z = \frac{x - \bar{x}}{S} = \frac{85 - 74}{5} = \frac{11}{5} = 2.2$$

Since $z > 2$ → this exam Score is unusual.

Jose performed better on exam 2.

Z-Score allows us to compare different Samples.

Sep 5-2:17 PM

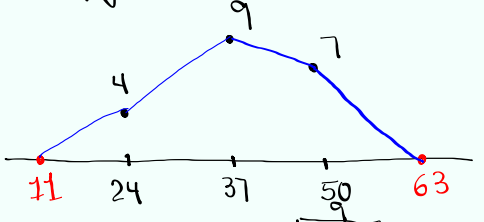
class limits	class MP	class F
18 - 30	24	4
31 - 43	37	9
44 - 56	50	7

+13, +13

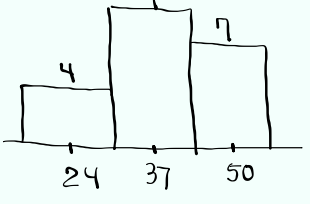
CW = 13

$n = \sum f = 20$

Freq. Polygon



Histogram
- class MP
- class F



Sep 5-2:23 PM