Statistics

Lecture 2

Feb 19-8:47 AM

I randomly selected 20 students and here are their ages. SG 3 & 4

18 19 20 20 24
25 25 25 29 30
30 32 33 36 38
40 41 45 48 50

1) $n = 20$

2) Min. = 18, Max = 50

3) Range = Max − Min
$= 50 - 18 = 32$

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

5) Mode = 25

6) Median $= \frac{30+30}{2} = 30$

7) Make a freq. table with 3 classes.

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

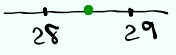
CW = 11

Jan 7-4:33 PM

class limits	class BNDRS	class MP	class F	Cum. F	Rel. F	%F
18 – 28	17.5 – 28.5	23	8	8	.40	40%
29 – 39	28.5 – 39.5	34	7	15	.35	35%
40 – 50	39.5 – 50.5	45	5	20	.25	25%

Class limits begin with Min. value. $18+11=29$

Add CW to go to next class. $29+11=40$



Add CW to go forward
Subtract CW to go backward.

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

$n = 20$

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

$$\%F = \text{Rel. F}\,(100)$$

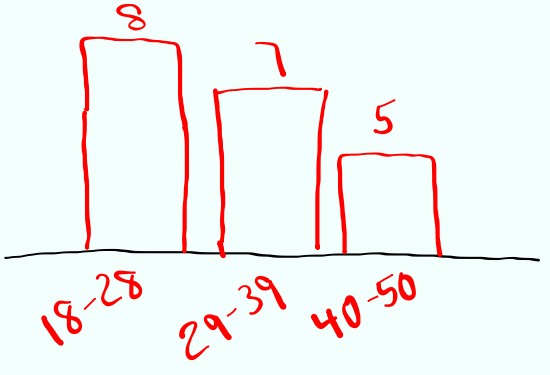
move decimal point to the right twice.

Jan 7-4:40 PM

Bar Chart

– class limits

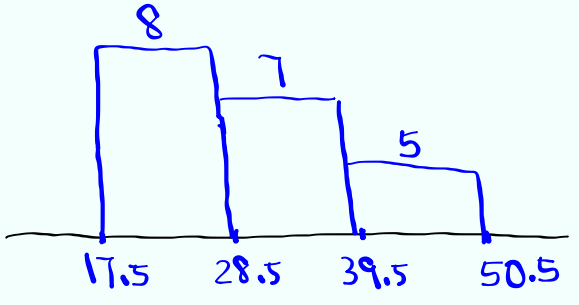
– class F



Histogram

– class BNDRS

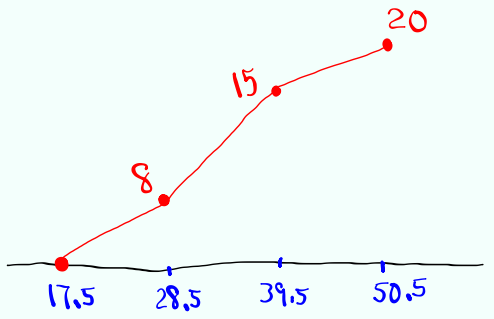
– class F



Jan 7-4:52 PM

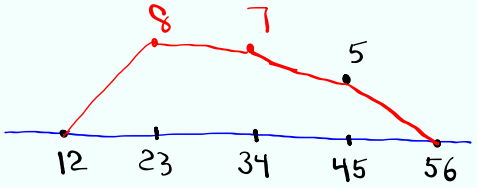
Ogive

- Class BNDRS
- Cum. F
- Start at 0 level



Freq. Polygon

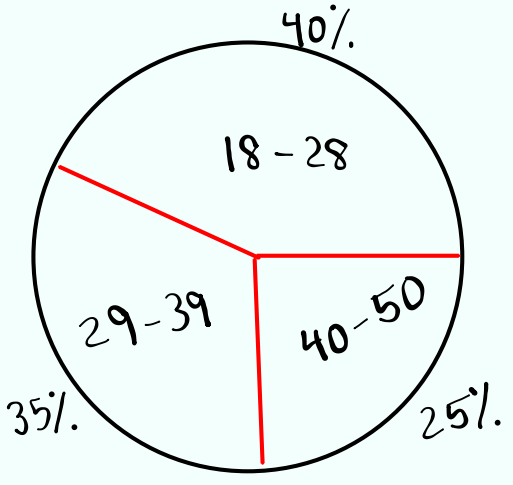
- Class MP
- Class F
- one additional MP on each side
- Start & finish at 0 level.



Jan 7-4:56 PM

Pie Chart

- Circle
- class limits
- % F for size of each slice



what % of students were below 40 Yrs old?

35% + 40% = 75%

Jan 7-5:01 PM

I randomly selected 25 exams. Here are the scores.

55	58	60	62	68
70	72	75	75	75
78	79	80	82	83
85	85	85	88	90
93	95	98	100	100

1) $n = 25$

2) Min = 55, Max = 100

3) Range = $100 - 55 = 45$

4) Midrange = $\frac{100+55}{2} = 77.5$

5) Mode 75 & 85 Bimodal

6) Median 80

Make a freq. table with 3 classes.

Class width = $\frac{\text{Range}}{3} = \frac{45}{3} = 15$

CW = 16

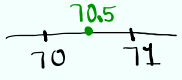
Jan 7-5:07 PM

Class limits	class BNDRS	Class MP	class F	Cum. F	Rel. F	% F
55 - 70	54.5 - 70.5	62.5	6	6	.24	24%
71 - 86	70.5 - 86.5	78.5	12	18	.48	48%
87 - 102	86.5 - 102.5	94.5	7	25	.28	28%

$n = 25$

class limit begins with min. value

Add CW = 16 to go forward



Add CW to go forward
Subtract CW to go backward

Class MP = $\frac{\text{+ class limits}}{2} = \frac{\text{+ class BNDRS}}{2}$ Add CW = 16

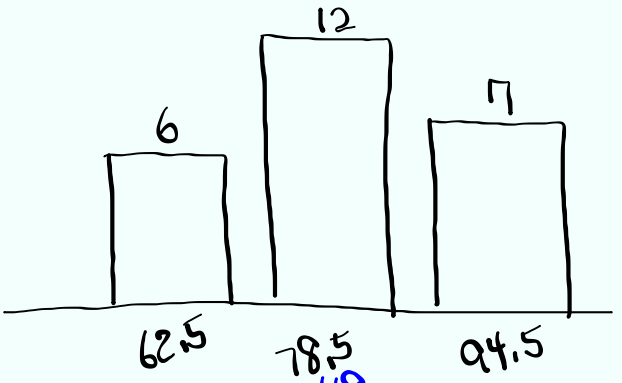
Rel. F = $\frac{f}{n} = \frac{f}{25}$

What % of scores were above 70?

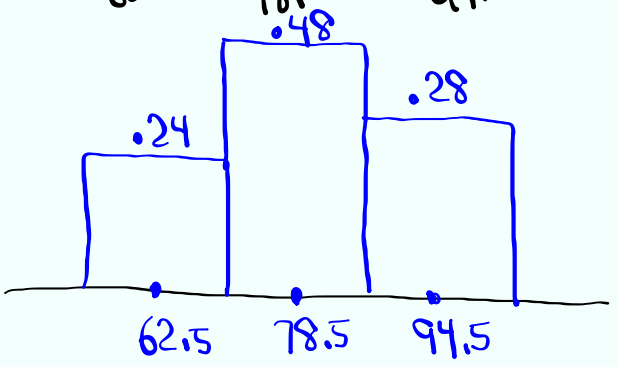
48% + 28% = 76%

Jan 7-5:14 PM

Bar chart
- class MP
- class F

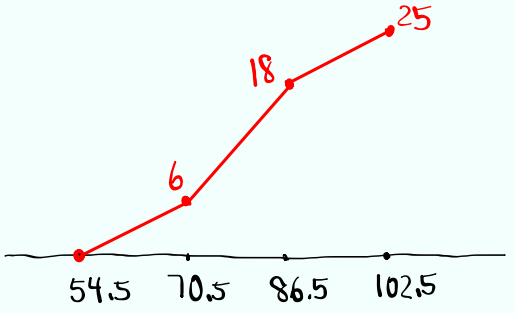


Histogram
- class MP
- Rel. F

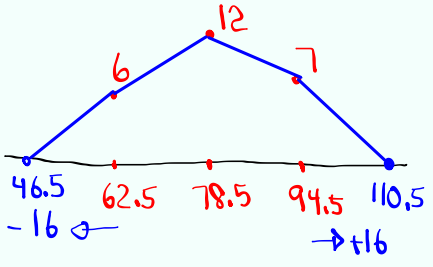


Jan 7-5:27 PM

Ogive
- class BNDRS
- Cum. F
- start at 0 level



Freq. Polygon
- class MP
- class F
- one additional MP on each side
- start & finish at 0 level



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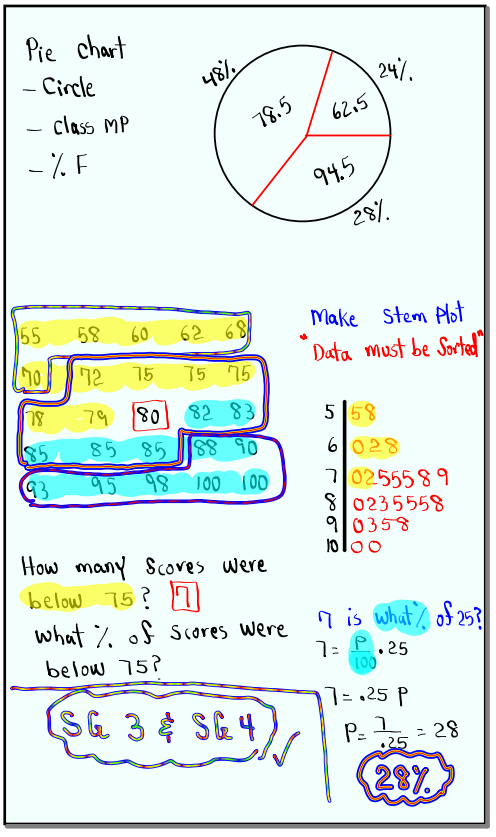

Jan 7-5:38 PM

Basic Computations in Statistics:

x → Data elements

$\sum x$ → Sum of data elements

n → Sample Size

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

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

Jan 7-6:03 PM

Consider the Sample below

2 3 5 5 6 8 10 11

$n = 8$

Mode = 5

Median $= \frac{5+6}{2} = 5.5$

Range $= 11 - 2 = 9$

Midrange $= \frac{11+2}{2} = 6.5$

$\sum x = 2+3+5+5+6+8+10+11 = \boxed{50}$

$\bar{x} = \frac{\sum x}{n} = \frac{50}{8} = \boxed{6.25}$

whole → 6

1-Dec. → 6.3

Round-up to whole # → 7

Jan 7-6:05 PM

Consider the Sample below

3 5 7 **7** 9 9 12

$n = 7$ Mode = 7 & 9 Range = 12 − 3 = 9

Midrange $= \frac{12+3}{2} = 7.5$ Median 7

$\sum x = 3+5+7+7+9+9+12 = \boxed{52}$

$\bar{x} = \frac{\sum x}{n} = \frac{52}{7} = 7.429$

whole → 7

1-dec. → 7.4

2-dec. → 7.43

Round-up to a whole # → 8

Jan 7-6:11 PM

$x \rightarrow$ Data element

$x^2 \rightarrow$ Square of data elements

$n \rightarrow$ Sample Size

$\sum x \rightarrow$ Sum of data elements

$\sum x^2 \rightarrow$ Sum of Squares of data element

$\bar{x} \rightarrow$ Sample Mean (Average)

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

$s^2 \rightarrow$ Sample Variance

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

Jan 7-6:16 PM

Consider the Sample below

1 3 3 3 5

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

Mode $= 3$ Median $= 3$

$\sum x = 1 + 3 + 3 + 3 + 5 = 15$

$\sum x^2 = 1^2 + 3^2 + 3^2 + 3^2 + 5^2 = 53$

$\bar{x} = \frac{\sum x}{n} = \frac{15}{5} = \boxed{3}$

$s^2 = \frac{n\sum x^2 - (\sum x)^2}{n(n-1)} = \frac{5 \cdot 53 - 15^2}{5(5-1)} = \frac{40}{20} = \boxed{2}$

Jan 7-6:21 PM

Given: $n = 8$, $\sum x = 58$, $\sum x^2 = 460$,
Min. $= 3$, Max $= 10$

1) Range $=$ Max $-$ Min $= 10 - 3 = \boxed{7}$

2) Midrange $= \dfrac{\text{Max} + \text{Min}}{2} = \dfrac{10+3}{2} = \boxed{6.5}$

3) $\bar{x} = \dfrac{\sum x}{n} = \dfrac{58}{8} = \boxed{7.25}$

4) $s^2 = \dfrac{n\sum x^2 - (\sum x)^2}{n(n-1)} = \dfrac{8 \cdot 460 - 58^2}{8(8-1)}$

$= \dfrac{316}{56} \approx \boxed{5.643}$

Jan 7-6:28 PM

Consider the Sample below

2 4 5 6 6 6 7 8 9 10

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

4) Mode $= \boxed{6}$ 5) Median $= \dfrac{6+6}{2} = \boxed{6}$

6) $\sum x = \boxed{63}$ 7) $\sum x^2 = \boxed{447}$

8) $\bar{x} = \dfrac{\sum x}{n} = \dfrac{63}{10} = \boxed{6.3}$

9) $s^2 = \dfrac{n\sum x^2 - (\sum x)^2}{n(n-1)} = \dfrac{10 \cdot 447 - 63^2}{10(10-1)}$

$= \dfrac{501}{90} \approx \boxed{5.567}$

Jan 7-6:35 PM

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

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

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

s → Sample Standard deviation

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

Jan 7-6:43 PM

Consider the Sample below

1 3 5 7 9

1) $n = \boxed{5}$ 2) Range $= 9-1 = \boxed{8}$ 3) Midrange $= \frac{9+1}{2} = \boxed{5}$

4) Mode $\boxed{\text{None}}$ 5) Median $= \boxed{5}$

6) $\sum x = \boxed{25}$ 7) $\sum x^2 = \boxed{165}$

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

9) $s^2 = \frac{n\sum x^2 - (\sum x)^2}{n(n-1)} = \frac{5 \cdot 165 - 25^2}{5(5-1)} = \frac{200}{20} = \boxed{10}$

10) $s = \sqrt{s^2} = \sqrt{10} \approx \boxed{3.162}$

Jan 7-6:45 PM

Given $n=10$, $\sum x=50$, $\sum x^2=250$

Find

1) $\bar{x}=\frac{\sum x}{n}=\frac{50}{10}=\boxed{5}$

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

$=\frac{10\cdot 250-50^2}{10(10-1)}$

$=\frac{0}{90}=\boxed{0}$

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

$=\sqrt{0}=\boxed{0}$

When $s=0$, All data elements are the same and equal to $\bar{x}$.

Jan 7-6:53 PM

How to estimate s:

$$s\approx\frac{\text{Range}}{4}$$

Range rule-of-thumb.

A data set has a min of 25 and max. of 65. Estimate its standard deviation. Range = Max − Min = 65 − 25 = 40

$$s\approx\frac{\text{Range}}{4}=\frac{40}{4}=\boxed{10}$$

Jan 7-6:58 PM

Complete the freq. table below

class limits	class BNDRS	class MP	class F	Cum. F	%F
18 - 26	17.5 - 26.5	22	3	3	7.5%
27 - 35	26.5 - 35.5	31	7	10	17.5%
36 - 44	35.5 - 44.5	40	18	28	45%
45 - 53	44.5 - 53.5	49	12	40	30%

classes 4 CW = 9 n = 40

$$\text{Rel. F} = \frac{f}{n} = \frac{f}{40}$$

what % are between 27 & 44?

17.5% + 45% = **62.5%**

Jan 7-7:02 PM