Statistics

Fall 2022

Lecture 4

Class QZ 3

Use the Sample below to find

1, 3, 3, 3, 5 $n=5$

1) $\Sigma x = 15$ ✓

$= 1+3+3+3+5 = 15$

2) $\Sigma x^2 = 53$ ✓

$= 1^2+3^2+3^2+3^2+5^2 =$

$= 1+9+9+9+25 = 53$

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

4) $S^2 = \frac{n\Sigma x^2 - (\Sigma x)^2}{n(n-1)} = \frac{5 \cdot 53 - 15^2}{5(5-1)} = \frac{40}{20} = 2$ ✓

Min. = 1 , Max. = 5

Range = max − min = 5 − 1 = 4

Midrange = $\frac{\text{Max} + \text{Min}}{2} = \frac{5+1}{2} = 3$

Mode = 3

Standard deviation

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

Estimate S

$S \approx \frac{\text{Range}}{4} = \frac{4}{4} = 1$

Range Rule-of-thumb

$S \approx 1$

Issues after grading SG 1:

- Please Review Sample SG and resubmit as one file, Pages in order, Portrait.
- If You don't have printer and You don't have tablet, You must submit as page-per-page contents. Your first page should be only Problems from my first page.

Your Second Page " " " " "

" Second " .

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

23	32	40	18	25
19	20	35	50	46
24	30	39	28	44
41	32	19	29	20

Sort this Sample from Smallest to largest.

18	19	19	20	20
23	24	25	28	29
30	32	32	35	39
40	41	44	46	50

$n = 20$

Min. = 18 Max = 50

Range = Max − Min = 32 Midrange: $\frac{\text{Max} + \text{Min}}{2} = 34$

Mode: 19, 20, 32 trimodal

Find class width if we wish to have a freq. table with

1) 3 classes

$CW = \frac{\text{Range}}{\#\text{ classes}}$

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

if decimal → Round-up

CW = 11

2) 4 classes

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

$= \frac{32}{4} = 8$

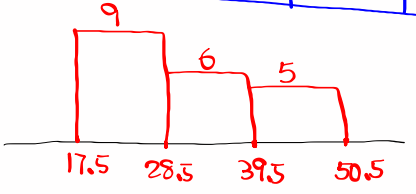
if whole → Add 1

CW = 9

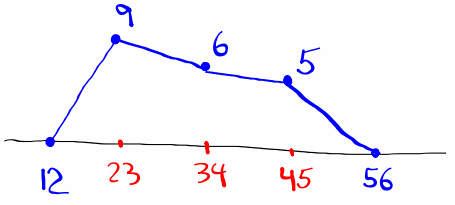
Make a freq. table with 3 classes. CW = 11

Class limits	class BNDRS	class MP	class F	Cum. F	Rel. F ($\frac{f}{n}$)	% F
18 – 28	17.5 – 28.5	23	9	9	.45	45%
29 – 39	28.5 – 39.5	34	6	15	.30	30%
40 – 50	39.5 – 50.5	45	5	20	.25	25%

Histogram
- class BNDRS
- class F



Freq. Polygon
- class MP
- Extra MP one on each side
- class F
- Start and End at 0 level.



Draw STEM Plot

Data must be Sorted

18	19	19	20	20
23	24	25	28	29
30	32	32	35	39
40	41	44	46	50

1	8 9 9
2	0 0 3 4 5 8 9
3	0 2 2 5 9
4	0 1 4 6
5	0

What % of data elements are below 35?

How many data elements are below 35?

13

13 is what percent of 20? ← Sample Size

$$13 = \frac{P}{100} \cdot \frac{20}{5} \qquad 13 = \frac{P}{5} \qquad P = 5(13) = 65$$

65%

Empirical Rule:

Whenever data has a symmetric dist. (ch.6), Empirical rule says

About 68% of data elements fall within $\bar{x} \pm s$.

" 95% " " " " " $\bar{x} \pm 2s$.

" 99.7% " " " " " $\bar{x} \pm 3s$.

Usual Range

Suppose a data set has a symmetric dist with $\bar{x} = 120$, $s = 15$.

68% Range $\Rightarrow \bar{x} \pm s = 120 \pm 15 \Rightarrow$ 105 to 135

95% Range $\Rightarrow \bar{x} \pm 2s = 120 \pm 2(15) = 120 \pm 30$

$\Rightarrow$ 90 to 150

99.7% Range $\Rightarrow \bar{x} \pm 3s = 120 \pm 3(15)$

$\Rightarrow$ 75 to 165

Usual Range

Symmetric dist has a bell-Shape graph. (ch.6)

I randomly selected 80 nurses, age dist was symmetric with $\bar{x}=34$ & $S=6$.

By empirical rule

68% Range $\Rightarrow \bar{x} \pm S = 34 \pm 6 \Rightarrow$ 28 to 40

Usual Range $\Rightarrow \bar{x} \pm 2S = 34 \pm 2(6) \Rightarrow$ 22 to 46

95% Range

How many of these nurses had unusual age?

Unusual | Usual | Unusual

2.5% | 95% | 2.5%

22 | 46

100% − 95% = 5%

5% ÷ 2 = 2.5%

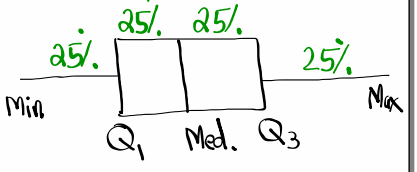
what is 5% of 80?

x = 5% of 80 = .05(80) = 4

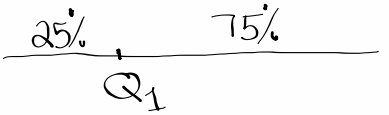
5-Number Summary and Box Plot

Min., Q_1, Med., Q_3, Max

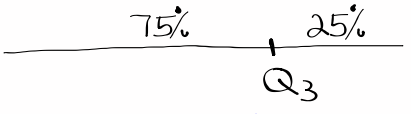
"Data must be Sorted"



Q_1 First Quartile $\Rightarrow$

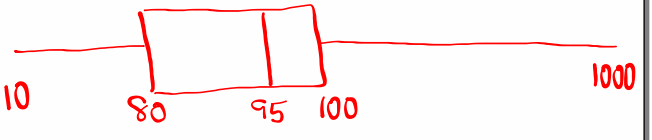


Q_3 Third Quartile



A data set has the following 5-number Summary: 10, 80, 95, 100, and 1000

Min Q_1 Med Q_3 Max



IQR Inter-Quartile-Range

$IQR = Q_3 - Q_1$

Upper Fence $= Q_3 + 1.5(IQR)$

Lower Fence $= Q_1 - 1.5(IQR)$

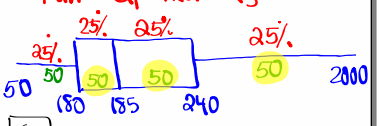
A data set of Size 200 had the following → $n = 200$

5-number Summary 50, 180, 185, 240, 2000

Min Q_1 Med Q_3 Max

$200 \div 4 = 50$

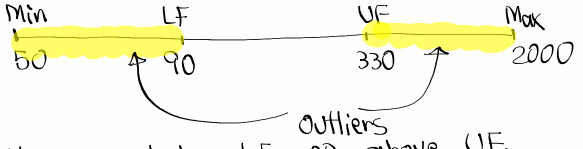
How many are above 180? 150



$IQR = Q_3 - Q_1 = 240 - 180 = 60$

Upper Fence $= Q_3 + 1.5(IQR) = 240 + 1.5(60) =$ 330

Lower Fence $= Q_1 - 1.5(IQR) = 180 - 1.5(60) =$ 90



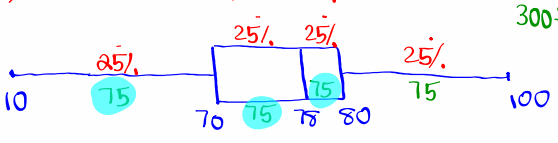
outliers are below LF OR above UF.

I randomly selected 300 exams, 5-number Summary of Scores were 10, 70, 78, 80, and 100.

1) Draw Box Plot, clearly label.

Q_3

$300 \div 4 =$ 75



2) How many Scores were below 80?

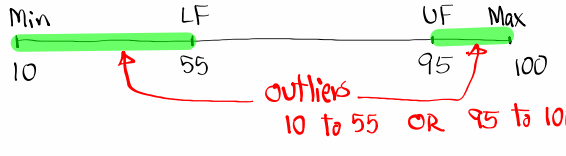
$75 + 75 + 75 =$ 225

3) $IQR = Q_3 - Q_1 = 80 - 70 =$ 10

4) Upper Fence $= Q_3 + 1.5(IQR) = 80 + 1.5(10) =$ 95

Lower Fence $= Q_1 - 1.5(IQR) = 70 - 1.5(10) =$ 55

5) Discuss outliers



Class QZ 4

Given: $n=10$, $\Sigma x=53$, $\Sigma x^2=327$

Find

1) $\overline{x}=5.3$

2) $S=2.3$

} Round to 1-decimal

3) $S^2=\frac{461}{90}$

} Reduced fraction.

$\bar{x}=\frac{\Sigma x}{n}=\frac{53}{10}=\boxed{5.3}$

$S^2=\frac{n\Sigma x^2-(\Sigma x)^2}{n(n-1)}$

$=\frac{10\cdot 327-53^2}{10(10-1)}=\boxed{\frac{461}{90}}$

$S=\sqrt{S^2}=\sqrt{\frac{461}{90}}=2.263$