Statistics

Lecture 4

Feb 19-8:47 AM

Consider the Sample below

3 4 4 4
5 5 5 6

1) $n = 8$

2) Range $= 6 - 3 = 3$

3) Midrange $= \frac{6+3}{2} = \frac{9}{2} = 4.5$

4) Mode $= 4$ & 5

5) Median $= \frac{4+5}{2} = 4.5$

6) $\Sigma x = 36$

7) $\Sigma x^2 = 168$

8) $\bar{x} = \frac{\Sigma x}{n} = \frac{36}{8} = \boxed{4.5}$

9) $s^2 = \frac{n\Sigma x^2 - (\Sigma x)^2}{n(n-1)} = \frac{8 \cdot 168 - 36^2}{8(8-1)} = \frac{48}{56} \approx \boxed{.857}$

10) $s = \sqrt{s^2} = \sqrt{.857} \approx \boxed{.926}$

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Given $n=5$, Min $=10$, Max $=16$, $\Sigma x=64$, $\Sigma x^2=840$

1) $\bar{x} = \frac{\Sigma x}{n} = \frac{64}{5} = \boxed{12.8}$

2) $s^2 = \frac{n\Sigma x^2 - (\Sigma x)^2}{n(n-1)} = \frac{5 \cdot 840 - 64^2}{5(5-1)} = \frac{104}{20} = \boxed{5.2}$

3) $s = \sqrt{s^2} = \sqrt{5.2} = \boxed{2.280}$

4) Estimate $s = \frac{\text{Range}}{4} = \frac{16-10}{4} = \frac{6}{4} = \boxed{1.5}$

Round $\bar{x}$ & s to a whole #, then find

$\bar{x} \approx 13$

$s \approx 2$

1) 68% Range → $\bar{x} \pm s = 13 \pm 2 \rightarrow \boxed{11 \text{ to } 15}$

2) 95% Range → Usual Range $\bar{x} \pm 2s = 13 \pm 2(2) = 13 \pm 4 \rightarrow \boxed{9 \text{ to } 17}$

3) 99.7% Range → $\bar{x} \pm 3s = 13 \pm 3(2) = 13 \pm 6 \rightarrow \boxed{7 \text{ to } 19}$

Empirical Rule

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I randomly Selected 20 exams, here are the Scores:

63	67	70	72	75
75	78	80	80	80
85	88	90	90	92
95	98	100	100	100

1) $n = \boxed{20}$

2) Range $= 100 - 63 = \boxed{37}$

3) Mode $= 100$ & 80

4) Median $= \frac{80+85}{2} = \frac{165}{2} = \boxed{82.5}$

5) Stem Plot

6	37
7	02558
8	00058
9	00258
10	000

$\Sigma x = 1678$, $\Sigma x^2 = 143338$

6) $\bar{x} = \frac{\Sigma x}{n} = \frac{1678}{20} = 83.9 \approx \boxed{84}$

7) $s^2 = \frac{n\Sigma x^2 - (\Sigma x)^2}{n(n-1)} = \frac{20 \cdot 143338 - 1678^2}{20(20-1)} = \frac{51076}{380} = \boxed{134.411}$

8) $s = \sqrt{s^2} = \sqrt{134.411} = \boxed{11.594}$ ✓

✓✓ Estimate s

$s \approx \frac{\text{Range}}{4} = \frac{37}{4} = \boxed{9.25}$

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

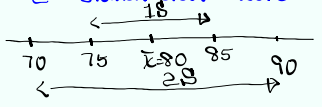
it measures how many standard dev. is the data element away from $\bar{x}$.

Always round to 3-dec. Places.

Given $\bar{x}=80$ $S=5$, find Z for $x=90$.

$Z = \frac{x - \bar{x}}{S} = \frac{90-80}{5} = \frac{10}{5} = \boxed{2}$

90 is 2 Stand. dev. above 80.



Find the x value if $Z=-1.6$.

$Z = \frac{x-\bar{x}}{S}$ $-1.6 = \frac{x-80}{5}$

Cross-multiply

$x - 80 = 5(-1.6)$

$x - 80 = -8$

$x = -8 + 80$ $\boxed{x=72}$

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Z Score is a method to standardize data elements, then we can compare data element from different Samples.

$-2 \leq Z \leq 2$ Usual data element

$Z < -2$ or $Z > 2$ Unusual data element.

John got 92 on exam 1. $\bar{x}=84$, $S=5$.

$Z = \frac{x-\bar{x}}{S} = \frac{92-84}{5} = \frac{8}{5} = \boxed{1.6}$ Usual Score

He got 82 on exam 2. $\bar{x}=70$ & $S=4$.

$Z = \frac{x-\bar{x}}{S} = \frac{82-70}{4} = \frac{12}{4} = \boxed{3}$ Unusual Score

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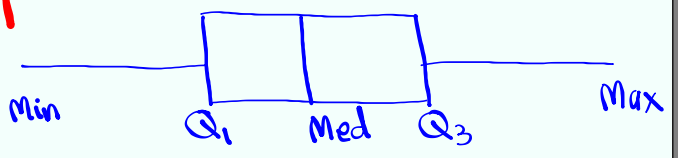
5 - Number Summary

Min Q_1 Med. Q_3 Max

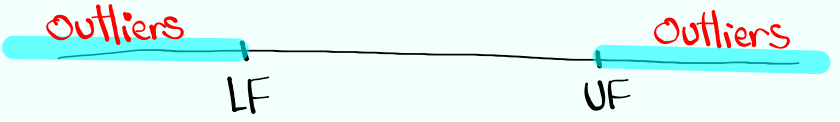
Box Plot



IQR (Inter-Quartile -Range) = $Q_3 - Q_1$

Upper fence = $Q_3 + 1.5(IQR)$

Lower fence = $Q_1 - 1.5(IQR)$



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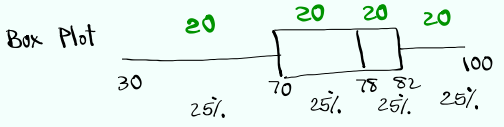
I randomly selected 80 exams. Here are the 5-Number Summary of Scores

80 ÷ 4 = 20

30 (Min) 70 (Q_1) 78 (Med) 82 (Q_3) 100 (Max)



How many Scores above 70? 60

What % of Scores above 70? 75%

IQR = $Q_3 - Q_1$ = 82 − 70 = 12

Upper Fence = $Q_3 + 1.5(IQR)$
= 82 + 1.5(12) = 100

Lower Fence = $Q_1 - 1.5(IQR)$
= 70 − 1.5(12) = 52

30 − 52 Outliers

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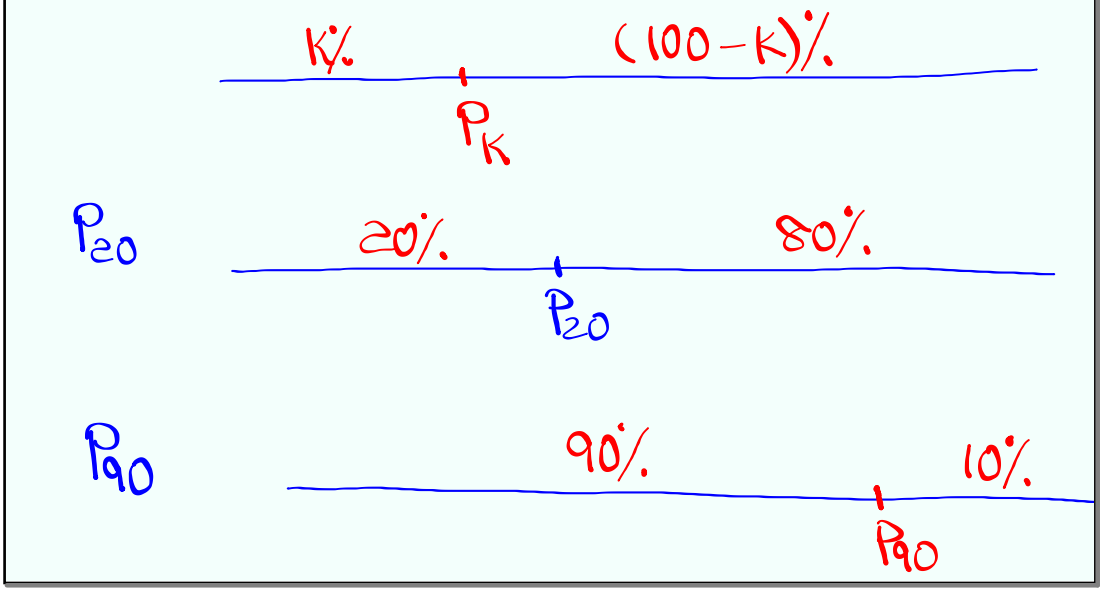
Percentile "Data must be Sorted"

Notation P_K



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How to find P_K

1) Find its Location (Sample Size)

$$L = \frac{K}{100} \cdot n$$

if decimal → Round-up → P_K = Lth element

if whole # → P_K = $\frac{\text{Lth element} + \text{next element}}{2}$

Consider the Stem Plot below

1	025
2	013358
3	02555889
4	2358
5	02

$n = 23$

P_{10}

$L = \frac{10}{100} \cdot 23 = 2.3 \rightarrow L = 3$

P_{10} = 3rd element = 15

10% | 90%

15

Find P_{80}

$L = \frac{80}{100} \cdot 23$

$= 18.4 \rightarrow L = 19$

P_{80} = 19th element

$= 43$

80% | 20%

43

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Stem Plot below is for ages of 30 students

Stem	Leaf
1	89
2	03557
3	2355 6668
4	0255 79
5	02348
7	246
8	8

1) $n = 30$

2) Mode = 36

4) Estimate $S \approx \frac{\text{Range}}{4} = \frac{88-18}{4}$

$= \frac{70}{4} = \frac{35}{2} = \boxed{17.5}$

5) P_{20} $\quad L = \frac{20}{100} \cdot 30 = 6$

20% | 80%

$P_{20} = 26$

$P_{20} = \frac{6\text{th element} + \text{Next element}}{2}$

$= \frac{25+27}{2} = \boxed{26}$

6) P_{50} $\quad L = \frac{50}{100} \cdot 30 = 15$

50% | 50%

Median $\rightarrow$ 39

$P_{50} = \frac{15\text{th element} + \text{Next element}}{2}$

$= \frac{38+40}{2} = \boxed{39}$

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Doing Reverse

Find K Such that $P_K = 50$.

$K = \frac{B}{n} \cdot 100$ (B: Below), Round to whole %

$= \frac{21}{30} \cdot 100 = 70$ $\quad \boxed{P_{70} = 50}$

70% | 30%

50

Find K Such that

$P_K = 40$.

$K = \frac{B}{n} \cdot 100 = \frac{15}{30} \cdot 100 = 50$ (B: Below)

50% | 50%

40

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Complete the chart below

class limits	F: class F	x: class MP	f·x	f·x²
12 - 20	4	16	64	1024
21 - 29	6	25	150	3750
30 - 38	8	34	272	9248
39 - 47	2	43	86	3698

$\sum f \cdot x = 572$ $\sum f \cdot x^2 = 17720$

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TI Instructions:

1) To clear the Screen

[clear]

2) To quit

[2nd] [MODE]

3) To clear all lists.

[2nd] [+] [4:clearall lists] [Enter]

4) To Reset all lists.

[STAT] Edit [Enter]

5: Setup Editor

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How to store data in a list.

Store

15 8 20 25 18

12 5 30 24 25

in a list.

STAT Edit

1:Edit

L1

15 enter

8 enter

20 "

⋮

25 enter

quit & Clear Screen

2nd Mode Clear

How to view L1:

2nd 1 Enter

{15 8 20 25 ... 25}

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How to Sort a list:

STAT Edit

2:SortA(

2nd 1 Enter

Let's view L1 again:

2nd 1 Enter

{5 8 12 15 18 → → → 30}

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How to find $\bar{x}$ & S:

STAT → CALC

1: 1-Var Stats

with Menu

List: L1

Freq List: Blank

Calculate

2nd 1

No Menu

L1 Enter

$\bar{x} = 18.2$

$S = S_x = 8.135$

$n = 10$

↓

↓

↓

↓

$Min = 5$

$Q_1 = 12$

$Med = 19$

$Q_3 = 25$

$Max = 30$

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How about S^2?

VARS 5: Statistics 3: S_x x^2 enter

$S^2 = 66.1\overline{7}$

Convert to a reduced fraction

Math 1: ▶Frac Enter

$$S^2 = \frac{2978}{45}$$

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