Statistics

Lecture 4

Feb 19-8:47 AM

Class QZ 1:

Consider the Sample below

2 4 4 6 6 7

1) Median $= \frac{4+6}{2} = \boxed{5}$

2) $\sum x = \boxed{29}$ ✓

3) $\sum x^2 = \boxed{157}$ ✓

4) $\bar{x} = \frac{\sum x}{n} = \frac{29}{6} = \boxed{4.8\overline{3}}$ ✓

whole → 5

1-Dec. → 4.8

2-Dec. → 4.83

Mar 9-4:04 PM

Consider the Sample below

2 3 3 3

5 5 5 6

1) $n = 8$

2) Range $= 6 - 2 = 4$

3) Midrange $= \frac{6+2}{2} = 4$

4) Mode $= 3$ & 5 Bimodal

5) median $= \frac{3+5}{2} = 4$

6) $\sum x = 32$

7) $\sum x^2 = 142$

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

9) $S^2 = \frac{n\sum x^2 - (\sum x)^2}{n(n-1)} = \frac{8 \cdot 142 - 32^2}{8(8-1)} = \frac{112}{56} = \boxed{2}$

10) $S = \sqrt{S^2} = \sqrt{2} \approx \boxed{1.414}$

11) Estimate $S \approx \frac{\text{Range}}{4} = \frac{4}{4} = \boxed{1}$

The range rule-of-thumb.

Mar 11-1:53 PM

I took a survey of 200 students.

their ages had $\underbrace{\text{mean} = \text{Mode} = \text{Median}}_{\text{Data dist. is symmetric}}$.

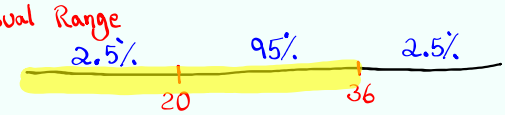
Bell-Shape graph

$\bar{x} = 28$ & $S = 4$

use empirical rule to find

1) 68% Range $\rightarrow \bar{x} \pm S = 28 \pm 4 \rightarrow \boxed{24 \text{ to } 32}$

2) $\underbrace{95\% \text{ Range}}_{\text{usual Range}} \rightarrow \bar{x} \pm 2S = 28 \pm 2(4) \rightarrow \boxed{20 \text{ to } 36}$



3) What % of students were at most 36 yrs old?

$2.5\% + 95\% = \boxed{97.5\%}$

4) How many students were at most 36 yrs old?

97.5% of 200

$= .975(200) = \boxed{195}$

Mar 11-2:07 PM

Given $\bar{x} = 84$ & $S = 8$

1) Find a Z-Score for $x = 95$.

$$Z = \frac{x - \bar{x}}{S} = \frac{95 - 84}{8} = \boxed{1.375}$$

$-2 \le Z \le 2$ usual

$Z > 0$ above $\bar{x}$

2) Find x when $Z = -1.5$.

$Z < 0$ below $\bar{x}$

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

$$-1.5 = \frac{x - 84}{8}$$

Cross-Multiply

$$x - 84 = -1.5(8)$$

$$x = 84 - 12 \quad \boxed{x = 72}$$

usual value $-2 \le Z \le 2$

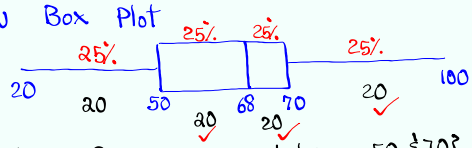
Mar 11-2:19 PM

I gave 80 exams. Scores had the following 5-Number Summary

20	50	68	70	100
Min.	Q_1	Med.	Q_3	Max.

each interval is 25%
$80 \div 4 = 20$

Draw Box Plot



1) What % of Scores were between 50 & 70?

$25\% + 25\% = 50\%$

2) How many of Scores were above 50?

$20 + 20 + 20 = \boxed{60}$

3) IQR $= Q_3 - Q_1 = 70 - 50 = \boxed{20}$

4) Upper Fence $= Q_3 + 1.5(IQR) = 70 + 1.5(20) = \boxed{100}$

5) Lower Fence $= Q_1 - 1.5(IQR) = 50 - 1.5(20) = \boxed{20}$

Discuss outliers: below 20 (LF) **NO**
above 100 (UF) **outliers**

$\boxed{\text{None}}$

Mar 11-2:34 PM

I took 20 students. Here are their ages

18	19	20	20	24
25	25	28	30	32
33	35	35	37	39
40	42	42	48	50

1) $n = 20$

2) Range $= 50 - 18 = 32$

3) Estimate S

$S \approx \frac{\text{Range}}{4} = \frac{32}{4} = 8$

4) Mode 20, 25, 35, 42

Multimodal

5) Make Stem Plot

1	8 9
2	0 0 4 5 5 8
3	0 2 3 5 5 7 9
4	0 2 2 8
5	0

6) How many were below 30?

8

7) What % were below 30?

$\frac{8}{20} \cdot 100 = 40$

Sample Size

$\boxed{40\%}$

Mar 11-2:48 PM

Complete the chart below

class limits	class MP (x)	class F (F)	$f \cdot x$	$f \cdot x^2$
12 – 20	16	3	48	768
21 – 29	25	10	250	6250
30 – 38	34	2	68	2312

1) $\sum f = \boxed{15}$

2) $\sum f \cdot x = \boxed{366}$

3) $\sum f \cdot x^2 = \boxed{9330}$

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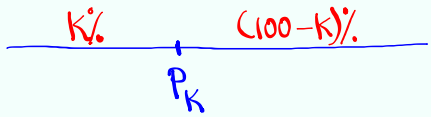
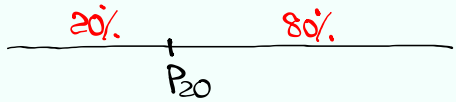
Percentile

"Data must be Sorted"

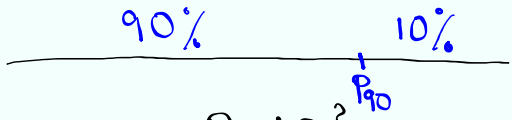
Notation P_K



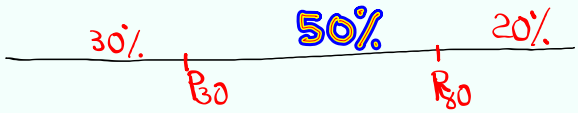
ex: P_{20}



ex: P_{90}



what % fall between P_{30} & P_{80}?



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How to find P_K:

Data must be Sorted

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

Sample Size

location

If decimal → Round-up P_K = Lth number

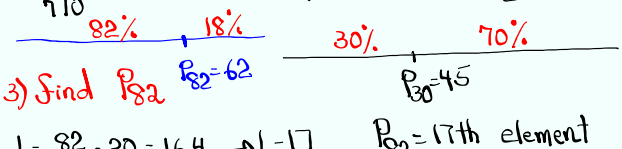
If whole → $P_K = \dfrac{\text{Lth number} + \text{Next number}}{2}$

3	025
4	03558
5	2377789
6	0256
7	0

1) $n = 20$

2) Find $P_{30} = \dfrac{\text{6th element} + \text{Next one}}{2}$

$L = \frac{30}{100} \cdot 20 = 6$ $= \dfrac{45+45}{2} = 45$



3) Find P_{82} $P_{82}=62$

$L = \frac{82}{100} \cdot 20 = 16.4 \rightarrow L = 17$

P_{82} = 17th element = $\boxed{62}$

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Doing Reverse: Find K Such that $P_K = 60$.

Below

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

Sample Size

Round to whole %

$$K = \frac{15}{20} \cdot 100 = 75$$

$$P_{75} = 60$$

75% | 25%

$P_{75} = 60$

Mar 11-3:24 PM

Here are exam scores given in Stem Plot:

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

1) $n = 24$

2) Range $= 100 - 52 = 48$

3) Estimate $S \approx \frac{\text{Range}}{4}$

≈ 12

4) Mode 75 & 82

5) P_{20}

$L = \frac{20}{100} \cdot 24 = 4.8 \rightarrow L = 5$

$P_{20} = 5$th element $= \boxed{63}$

20% | 80%

$P_{20} = 63$

6) $P_{50} = \frac{12\text{th} + \text{Next one}}{2}$

$L = \frac{50}{100} \cdot 24 = 12$

$= \frac{80 + 82}{2} = \boxed{81}$

50% | 50%

$P_{50} = 81 \rightarrow$ Median

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

Find K such that $P_K = 90$

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

B: # below; n: Sample size

Round to whole %

$$K = \frac{18}{24} \cdot 100 = 75 \qquad P_{75} = 90$$

Find K such that $P_K = 75$.

$$K = \frac{7}{24} \cdot 100 = 29.\overline{16} \approx \boxed{29}$$

7: # below

$P_{29} = 75$

29% | 71%

$P_{29} = 75$

SG 5 & 6 ✓

SG 7 & 8 Almost done

Mar 11-3:40 PM

Class QZ 2:

Given $n = 10$, $\sum x = 89$, $\sum x^2 = 895$

Find

1) $\bar{x}$, Round to whole # $\bar{x} = \frac{\sum x}{n} = \frac{89}{10} = 8.9 \approx \boxed{9}$

2) s^2, Reduced fraction $s^2 = \frac{n\sum x^2 - (\sum x)^2}{n(n-1)} = \frac{10 \cdot 895 - 89^2}{10(10-1)}$

$= \frac{1029}{90} = \boxed{\frac{343}{30}}$

3) s, Round to whole # $s = \sqrt{s^2} = \sqrt{\frac{343}{30}} = 3.381$

$\approx \boxed{3}$

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