(24)

Made up	midpoint (mark)	class boundaries
→ 30 - 38	34	29.5 to < 38.5
→ 39 - 47	43	→ 38.5 to < 47.5
48 - 56	52	47.5 to < 56.5
57 - 65	61	56.5 to < 65.5
66 - 74	70	65.5 to < 74.5

$$\text{Mark} = \frac{\text{lower limit} + \text{upper limit}}{2}$$

$$\frac{30+38}{2} = \frac{68}{2} = 34$$

$$\frac{39+47}{2} = \frac{86}{2} = 43$$

$$\frac{48+56}{2} = \frac{104}{2} = 52$$

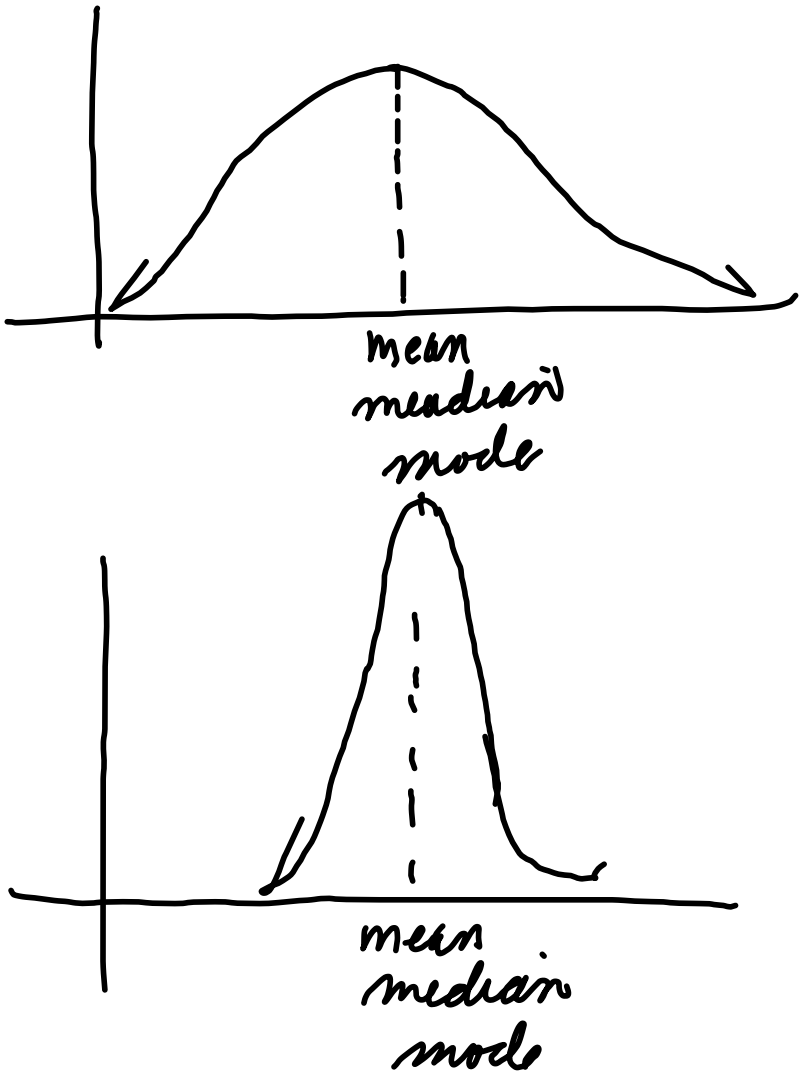
Boundary

$$\frac{\text{upper limit of lower class} + \text{lower limit of next class}}{2}$$

$$\frac{38 + 39}{2} = 38.5$$

This is the upper boundary of the lower class and the lower boundary of the next class up.

3.2 Measures of Dispersion for Ungrouped Data



One measure

The range = largest value − smallest value

for kittens $91 - 37 = 54$

The deviation from the mean

$x - \mu$ or $x - \bar{x}$

$\sum (x - \mu) = 0$ $\sum (x - \bar{x}) = 0$

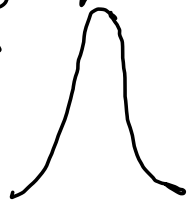
(#4) Test scores 82, 95, 67, 92

$\bar{x} = \frac{82 + 95 + 67 + 92}{4} = 84$

x	$x - \bar{x}$
82	$82 - 84 = -2$
95	$95 - 84 = 11$
67	$67 - 84 = -17$
92	$92 - 84 = 8$
	$\sum (x - \bar{x}) = 0$

Standard deviation (most used measure of spread

small value



large value

$[(x-\bar{x})]^2$ $(x-\mu)$ $\frac{\sum(x-\bar{x})^2}{n-1}$ sample the variance

population

variances

$\sigma^2 = \frac{\sum(x-\mu)^2}{N} = \frac{\sum x^2 - \frac{(\sum x)^2}{N}}{N}$ σ sigma

sigma

σ weird

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

standard deviations

σ standard deviation

$\sigma = \sqrt{\sigma^2} = \sqrt{\frac{\sum(x-\mu)^2}{N}}$

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

Population - population parameters

(μ, σ^2, σ)

Sample - sample statistics

$(\bar{x}, s^2, s)$

Ex 3.50 The # of hotdogs consumed by ten participants in a hotdog eating contest.

Sample

21 17 32 8 20 15 17 23 9 18

Range = 32 − 8 = 24

$\bar{x} = \frac{\sum x}{n} = \frac{180}{10}$

$\bar{x} = 18$

x	$x-\bar{x}$	$(x-\bar{x})^2$	x^2
21	3	9	441
17	−1	1	289
32	14	196	1024
8	−10	100	64
20	2	4	400
15	−3	9	225
17	−1	1	289
23	5	25	529
9	−9	81	81
18	0	0	324
$\sum x = 180$		$\sum (x-\bar{x})^2 = 426$	

$\sum x^2 = 3666$

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

$= \frac{3666 - \frac{(180)^2}{10}}{9}$

$= \frac{3666 - 3240}{9}$

$= \frac{426}{9}$

$= 47.\overline{3}$

$s^2 = \frac{\sum (x-\bar{x})^2}{n-1} = \frac{426}{9} \approx 47.\overline{3}$

$s = \sqrt{47.3} \approx 6.88$

approximately

3.3 Measures of Central Tendency for Grouped Data

$$\mu = \frac{\sum mf}{N} \qquad \bar{x} = \frac{\sum mf}{n}$$

$$\sigma^2 = \frac{\sum f(m-\mu)}{N} = \frac{\sum m^2 f - \frac{(\sum mf)^2}{N}}{N}$$