MEASURES OF DATA

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Measures of data

- Measures of central value/tendency
- Measures of variance/dispersion

Measures of central tendency

- Concept that has to do with the centre of a distribution
  - Mode
  - Median
  - Mean

measures of central tendency

12, 0, 5, 13, 0, 0, 5, 10, 5, 1, 5, 6, 7, 5, 7, 8, 10, 5, 11,14

- arrange in order

0, 0, 0, 1, 5, 5, 5, 5, 5, 5, 6 , 7, 7, 8, 10, 10, 11, 12, 13,14

- Mode is most frequently occuring number
    - mode rarely used
- Median is value that divides data in half

measures of central tendency

12, 0, 5, 13, 0, 0, 5, 10, 5, 1, 5, 6, 7, 5, 7, 8, 10, 5, 11,14

- Mean
  - sum of all observations divided by number of observations

$$\frac{\sum xi}{n}$$

library books illustrations

- Students borrow and return books from a university library regularly

14, 13, 12, 11, 17, 20, 14, 16, 12, 12, 11, 9, 18, 21

- One student borrows a book and forgets to return it
- They re-discover the book 1 year later when moving out of the student accommodation and decide to return the book

14, 13, 12, 11, 17, 20, 14, 16, 12, 12, 11, 9, 18, 21, 365

- What do you think will happen to the mean and median of a data set on borrowing periods?

library books illustration

- The mean is the preferred measure of central tendency when describing a data that do not have outliers.
- A major disadvantage is that it is affected by outliers (i.e. single observations which are very extreme compared with most observations and whose inclusion or exclusion changes results noticeably). -In the presence of outliers, the median is the preferred measure of central tendency

library books illustrations

- Calculation of the median does not involve the use of all available data and is therefore has less power than the mean.

- MEASURES OF DISPERSION
    - Dispersion = variation

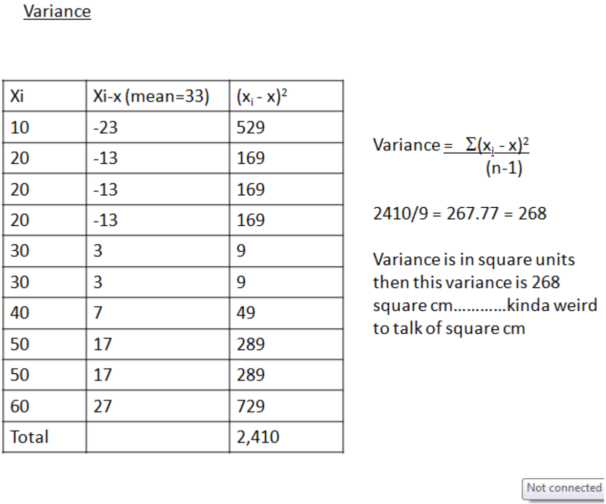
Measures of dispersion

- They give us an idea of the variation or spread of values around the central one.
  - Variance and standard deviation
  - Range
  - Interquartile range

Variance

- Can be defined in terms of how close the scores are to the middle of the distribution(mean)
- This variability or variance can be measured in terms of how far observations are from the mean on average i.e. how far, on average, each observation deviates from the mean.
- variance = by dividing the sum of squares of these deviations by (n-1).
- The formula for the variance is:

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



Variance

Xi	Xi-x (mean=33)	$(x_i - x)^2$
10	-23	529
20	-13	169
20	-13	169
20	-13	169
30	3	9
30	3	9
40	7	49
50	17	289
50	17	289
60	27	729
Total		2,410

$$\text{Variance} = \frac{\Sigma(x_i - x)^2}{(n-1)}$$

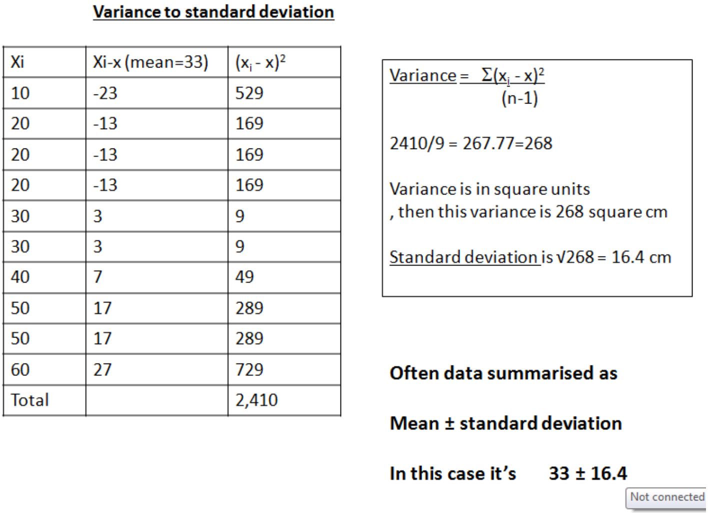
2410/9 = 267.77 = 268

Variance is in square units then this variance is 268 square cm............kinda weird to talk of square cm

Standard deviation

- Standard Deviation (SD): A measure of the average spread of values about the mean.
- It is usually more convenient to express the variation in terms of the original, unsquared units (e.g. grams), i.e. to take the square root of the variance.
- This is then called the standard deviation (SD).
- A small standard deviation indicates that most values lie very close to the mean

variance to standard deviation



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

2410/9 = 267.77=268

Variance is in square units
, then this variance is 268 square cm

Standard deviation is √268 = 16.4 cm

Often data summarised as

Mean ± standard deviation

In this case it's 33 ± 16.4

Measures of dispersion: Range

- The interval between the largest and smallest

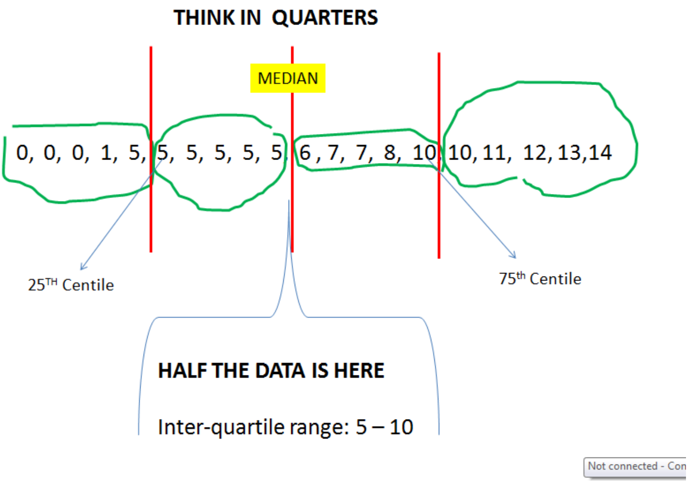
0, 0, 0, 1, 5, 5, 5, 5, 5, 5, 6 , 7, 7, 8, 10, 10, 11, 12, 13,14

- Range is
- based on only two observations and gives no idea of how the observations are arranged between these two.

Measures of dispersion: Inter-Quartile Range

- Shows spread of the middle 50% of the distribution

0, 0, 0, 1, 5, 5, 5, 5, 5, 5, 6 , 7, 7, 8, 10, 10, 11, 12, 13,14



THINK IN QUARTERS

MEDIAN

0, 0, 0, 1, 5, 5, 5, 5, 5, 5, 6 , 7, 7, 8, 10, 10, 11, 12, 13, 14

25TH Centile

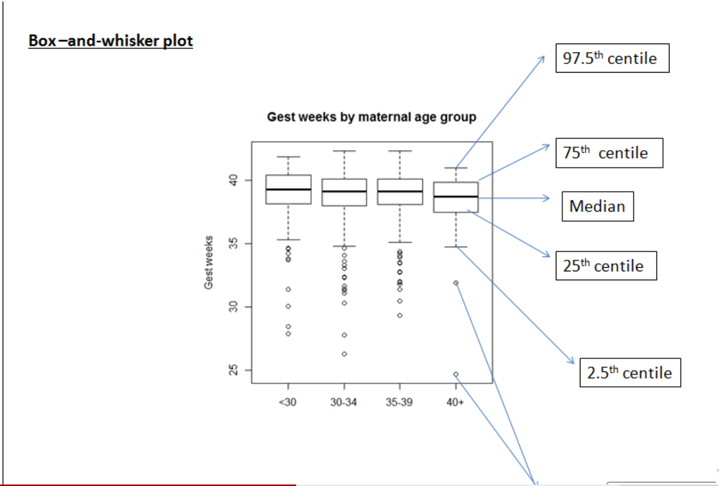
75th Centile

HALF THE DATA IS HERE

Inter-quartile range: 5 – 10

graphically showing variability

- Box and whisker plots for median and Interquartile range
- Can compare several groups



Box–and-whisker plot

97.5th centile

75th centile

Median

25th centile

2.5th centile

graphically showing variability

- Histograms
- Frequency polygons
- Stem and leaf diagrams

Categorical data

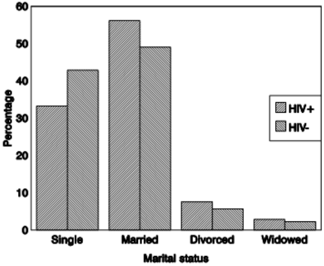
- Marital status
- Blood group
- etc

-Calculating percentages enables one to make comparisons between different groups.

- The frequency distribution of a categorical variable can be presented in a table or graph

Example: marital status of 105 HIV positive TB patients

Bar chart



Frequency distribution

Marital status	Number HIV +ve patients	%
Single	35	33.3%
Married	59	56.2%
Divorced	8	7.6%
Widow	3	2.9%
Total	105	100%

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THANK YOU