2

Recall

Today's → {Geometric mean}

Central tendency

Concentrated in middle part of the data.

1) Mean ✓
2) Median ✓
3) Mode ✓
4) Geometric mean
5) Harmonic mean

classification of data

Individual observations.

Discrete observation.

Continuous observation.

$$\text{Mean } \overline{X} = \frac{\sum x}{n} \rightarrow \text{Individual observations.}$$

$$\overline{X} = \frac{\sum fx}{\sum f} \rightarrow \text{Discrete observations.}$$

$$d = \frac{m - A}{i}$$

mid pt

length of the C I.

$$\overline{X} = A + \frac{\sum fd}{\sum f} \times i$$

Assumed mean

Median

Individual observation → Median = Size of $\left(\frac{N+1}{2}\right)^{th}$ item.

Discrete observation → " " $N = \sum f$

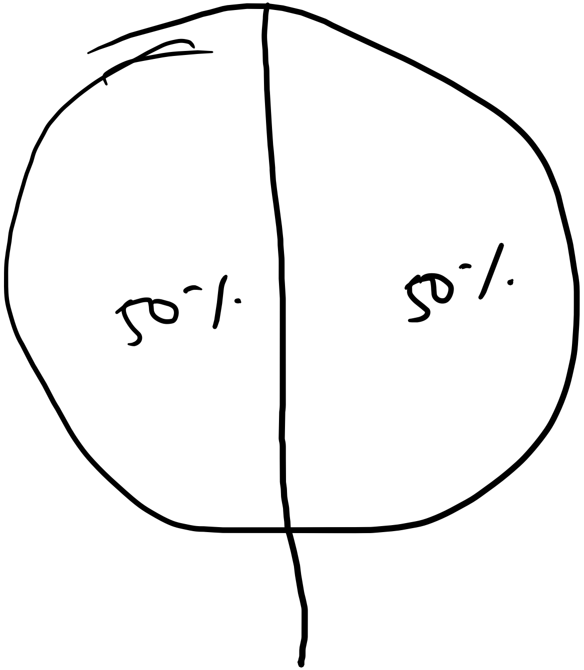
Continuous observations → Median $= L + \dfrac{\frac{N}{2} - cf}{f} \times i$

lower limit of the median class

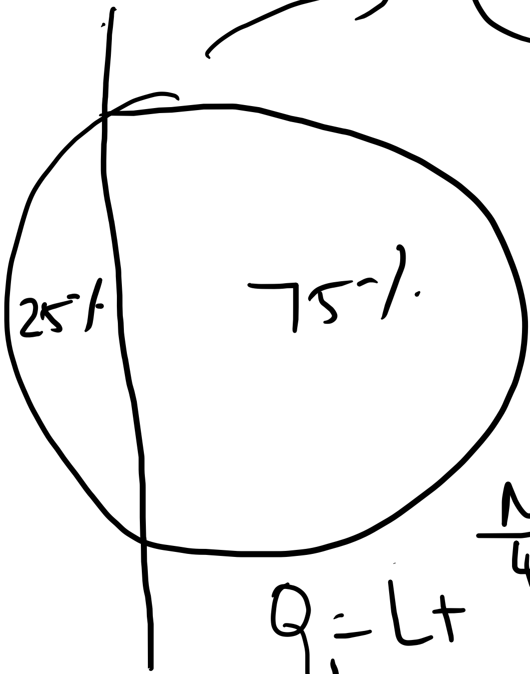
frequency of Median class.

Cumm freq preceding the median class

Partitioning the Values.



Median

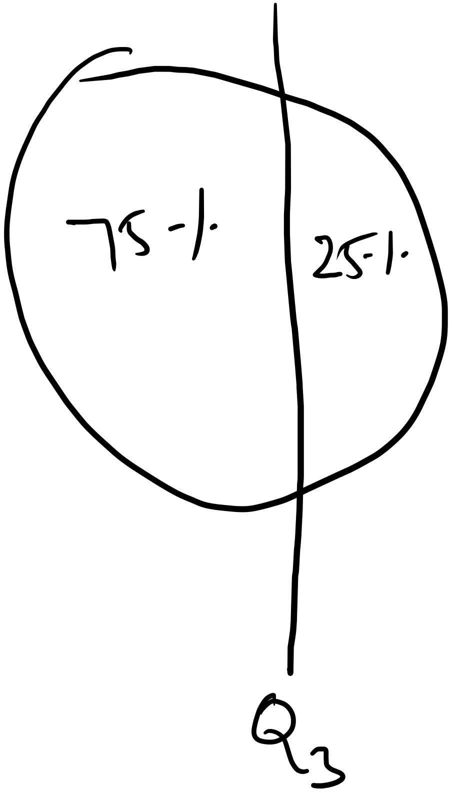


Q_1

First quartile

$$Q_1 = \text{size of } \left(\frac{N+1}{4}\right)^{\text{th}} \text{ item}$$

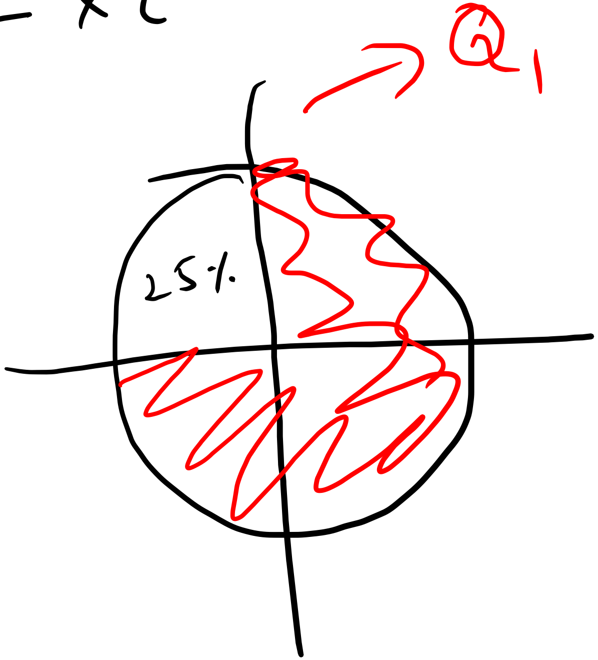
$$Q_1 = L + \frac{\frac{N}{4} - cf}{f} \times i$$



$$Q_3 = \text{Size of } 3\left(\frac{N+1}{4}\right)^{th} \text{ item.}$$

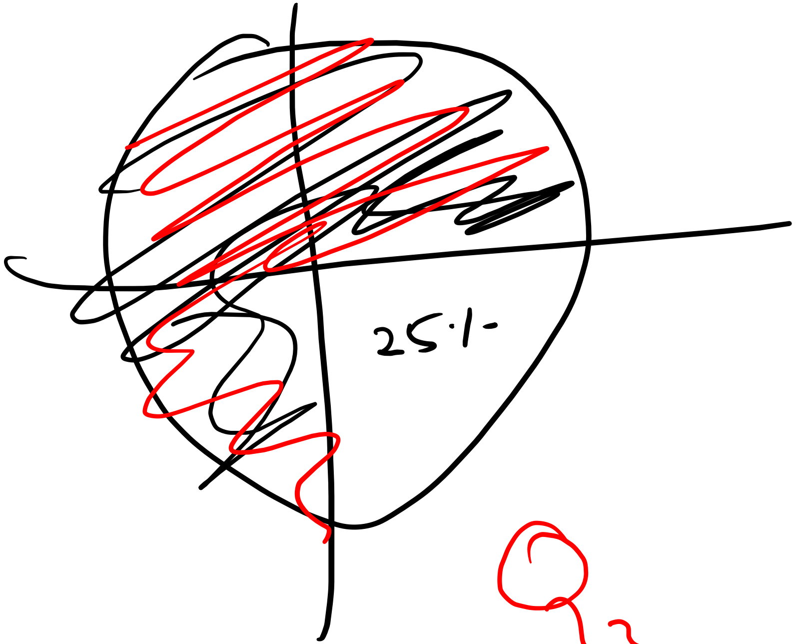
$$Q_3 = L + \frac{\frac{3N}{4} - cf}{f} \times i$$

$L \downarrow$ Lower limit of 3^{rd} Quartile



Percentile.

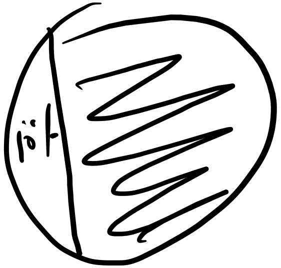
Decile.



Q_3

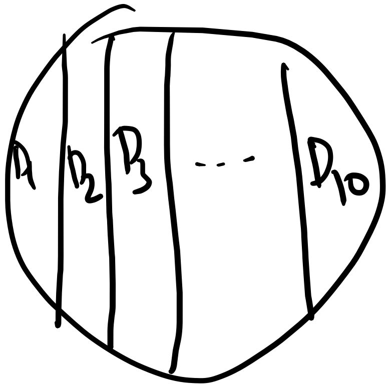
first Decile $= L + \dfrac{\frac{N}{10} - cf}{f} \times i$

k^{th} Decile $= L + \dfrac{\frac{kN}{10} - cf}{f} \times i$

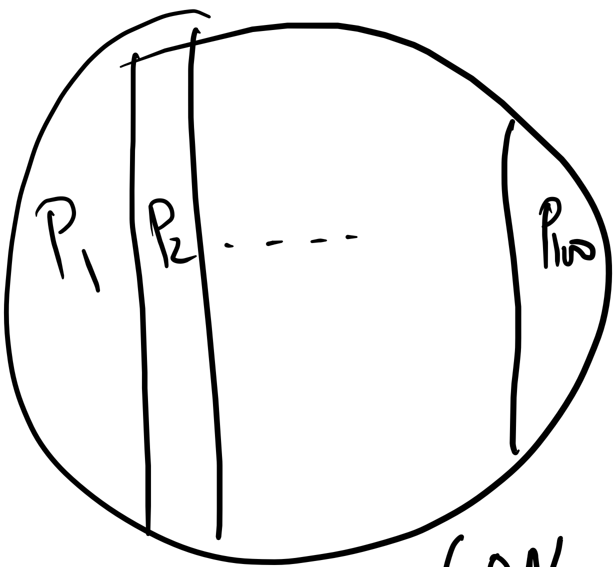


D_1

30% $\longrightarrow$ $k = 3$



Decile



$$50^{th}\ \text{percentile} = L + \frac{\frac{50N}{100} - cf}{f} \times i$$

↓ median

↓ 5^{th} Decile

$$60^{th}\ \text{percentile} = L + \frac{\frac{60N}{100} - cf}{f} \times i$$

↓ 6^{th} Decile

Mode

most Repeated Value.

$$\text{Mode} = L + \frac{\Delta_1}{\Delta_1 + \Delta_2} \times i$$

L → Modal class

Δ_1 → $\Delta_1 = f_1 - f_0$

f_0 → freq preceding the modal class

f_1 → freq of the modal class

Δ_2 → $f_1 - f_2$

f_2 → freq succeeding the Modal class.

Data

outliers

Mode = 3 Median − 2 Mean

Relationship b/w mean, Median & Mode.

Geometric Mean

Geometric mean of a set of n observations is the n^{th} root of their product.

$x_1, x_2, \ldots, x_n$ are the given values.

$$G.M = G = (x_1 x_2 \cdots x_n)^{1/n}.$$

$$\log G = \frac{1}{n}\{\log x_1 + \log x_2 + \cdots + \log x_n\}$$

$$G = \text{antilog}\left\{\frac{1}{n}\sum_{i=1}^{n}\log x_i\right\}.$$

Individual observations

Discrete data

$$G = \text{antilog}\left\{\frac{1}{N}\sum_{i=1}^{n} f_i \log x_i\right\} \quad \& \quad N = \sum_{i=1}^{n} f_i$$

$$\left\{ GM = \left(x_1^{f_1}\, x_2^{f_2} \cdots\cdots x_n^{f_n}\right)^{1/N} \right.$$

$$N = \sum f$$

$$\left\{\begin{array}{lllll} x: & 5 & 15 & 25 & 35 \\ f: & 3 & 4 & 7 & 6 \end{array}\right.$$ {discrete data}.

Convert it into Continuous data.

	5	15	25	35
CI:	0–10	10–20	20–30	30–40
f:	3	4	7	6

Disadvantages in G.M.

1) If one value is -ve then G.M becomes absurd.

2) If any one value is zero, GM = 0.

T.P.T AM $\geq$ GM

a, b are the two values.

$AM = \frac{a+b}{2}$ & $G = \sqrt{ab}$.

TPT AM $\geq$ GM. Equivalently, to prove AM $-$ GM ≥ 0.

Consider A.M $-$ G.M $= \dfrac{a+b}{2} - \sqrt{ab}$

$$= \frac{a+b-2\sqrt{ab}}{2}$$

$$= \frac{(\sqrt{a}-\sqrt{b})^2}{2} \geq 0.$$

$\therefore$ AM $\geq$ GM.

Find the G.M of $-3, -5$.

$GM = \sqrt{15}$ ✗

$GM = -\sqrt{15}$ ✓

$\sqrt{(-1)^2} = 1$?

$i = \sqrt{-1}$

$GM = \sqrt{(-3)(-5)}$

$= -\sqrt{15}$.

$$-1 = i^2 = \sqrt{i^4} = \sqrt{i^2 \cdot i^2}$$

$$= \sqrt{(-1)(-1)}$$

$$= -\sqrt{1}$$

$$= 1.$$

$$\sqrt{(-a)(-b)} = -\sqrt{ab}$$

$$\Rightarrow -1 = 1.$$

Can you identify the flaw here:

Geometric Mean of Combined group.

$$\log G = \frac{n_1 \log G_1 + n_2 \log G_2 + \cdots + n_k \log G_k}{n_1 + n_2 + \cdots + n_k}$$

$$G_1 = (x_{11} x_{12} \cdots x_{1n_1})^{1/n_1} \quad \cdots \quad G_k = (x_{k1} x_{k2} \cdots x_{kn_k})^{\frac{1}{n_k}}$$

$$\log G_1 = \frac{1}{n_1} \left\{ \sum_{i=1}^{n_1} \log x_{1i} \right\}$$

$$n_k \log G_k = \sum_{i=1}^{n_k} \log x_{ki}$$

$$n_1 \log G_1 = \sum_{i=1}^{n_1} \log x_{1i}$$

$$G = \left(x_{11}\, x_{12} \cdots x_{1n_1}\, x_{21}\, x_{22} \cdots x_{2n_2} \cdots x_{k1}\, x_{k2} \cdots x_{kn_k}\right)^{*}$$

$$* \quad \frac{1}{n_1 + n_2 + \cdots n_k}$$

$$\log G = \frac{n_1 \log G_1 + n_2 \log G_2 + \cdots + n_k \log G_k}{n_1 + n_2 + \cdots + n_k}.$$