Statistics

Quantitative Analysis	Qualitative Analysis
Mean, Weighted Mean	Median, Mode, Quartiles, Variance S.D.

According to syllabus, we will Analyse, Raw data and Ungrouped Frequency data.

Arithmetic Mean (A.M)

$$\bar{x} = \frac{\text{Sum of obs.}}{\text{No. of obs.}} = \boxed{\text{Average}}$$

x_i ← observ.	f_i ← Frequency (rept.ⁿ)	$x_i \cdot f_i$
10	5	50
20	10	200
40	5	200
50	5	250
No. of obs. = 25		Sum of obs. = 700

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So, $\bar{x} = \frac{\sum x_i \cdot f_i}{\sum f_i} = \frac{700}{25}$

$= \boxed{28}$

MEDIAN (M)

Divides Data Equally

⇓

First arrange Data

⇓

If Count is odd

$\left(\frac{n+1}{2}\right)^{th}$ obs.

If Count is Even

$\frac{\left(\frac{n}{2}\right)^{th} + \left(\frac{n}{2}+1\right)^{th}}{2}$ obs.

Ex: 8, 12, 7, 1, 26, 3, 5

1, 3, 5, (7), 8, 12, 26

← Divides Equally →

n = 7

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$\left(\frac{7+1}{2}\right)^{th}$ obs. $= 4^{th}$ obs.

$M = 7$

Ex 30, 27, 3, 5, 9, 2

2, 3, 5, 9, 27, 30

$M = \frac{5+9}{2} = 7$

$n = 6$

$$\frac{\left(\frac{6}{2}\right)^{th} + \left(\frac{6}{2}+1\right)^{th} \text{ obs.}}{2}$$

$$= \frac{3^{rd} + 4^{th} \text{ obs.}}{2}$$

$$= \frac{5+9}{2} = 7$$

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Ex:

Below are the Marks Obtained by 5 Students, Who passed the Exam. If a total of 7 students appeared in the Exam. Find Median Score of the Exam?

68, 97, 84, 55, 76

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Below are the Marks Obtained by 5 Students, who passed the Exam. If a total of 7 students appeared in the Exam. Find Median Score of the Exam?

68, 97, 84, 55, 76

Sol:

$F_1, F_2, 55, (68), 76, 84, 97$

$M = 68$

$M = \left(\frac{7+1}{2}\right)^{th}$ obs. $= 4^{th}$ obs.

$= 68$

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Q.

$A \geq B \geq C \geq D \geq E$

$\bar{x} = 100; \quad M = 50$

All Natural Number. Find Minimum value that 'A' can hold ?

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Frequency (repetition) Based

x_i	f_i	cf_i (Cummulative)	
10	5	5	upto 5^{th} obs. → 10
20	5	10	6^{th} to 10^{th} obs. → 20
30	4	14	11^{th} to 14^{th} obs. → 30
40	3	17	15^{th} to 17^{th} obs. → 40

17 ← Total No. of obs.

10, 10, 10, 10, 10, 20, 20, 20, 20, 20, 30, ------

↓ 5^{th} ↓ 6^{th} ↓ 10^{th} ↓ 11^{th}

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$$M = \left(\frac{17+1}{2}\right)^{th} \text{ obs.}$$

$$= g^{th} \text{ obs.}$$

$$\boxed{M = 20}$$

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x_i	f_i
10	12
8	18
12	9
15	20

Find $M = ?$

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MODE (z)

Highest repetitive obs.

Ex 4, 3, 3, 7, 17, 4, 2, 9, 3

$z = 3$

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Ex 15, 30, 4, 5, 6, 5, 4

$Z = 4, 5$

(Bi-Modal Mode)

Ex:

2, 3, 4, 5, 6

$$Z = 3M - 2\bar{x}$$

here, data is arranged and in A.P

So, $M = \bar{x} = 4$

$Z = 3(4) - 2(4)$

$= 4$

Note: If data is evenly spread, then

$$\bar{x} = M = Z$$

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Range (R)

In the Given Set

$R = \{\text{Greatest obs.} - \text{Smallest obs.}\}$

Ex:

$A = \{5, -5, 3, 0, 8\}$

$R = 8 - (-5) = 13$

Ex:

A

Range of multiples of 10 (First Five multiples)

B

Range of set, having Elements that are multiples of 5, but not of 10. (First Five multiples)

Answer →

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→ Percentiles 100 parts

→ Deciles 10 parts

→ Quintiles 5 parts

→ Quartiles 4 parts

measuring data on the basis of some parameters.

⇒ In Quartiles, data is divided in 4 parts on basis of some parameter.

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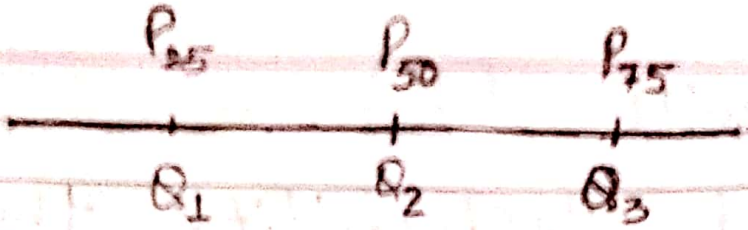


Quartiles for Raw Data

Ex: 15, 20, 20, 13, 7

7, 13, 15, 20, 20

2 obs. | $Q_2 = 15$ | 2 obs.

$Q_1 = \frac{7+13}{2}$

$= 10$

$Q_3 = \frac{20+20}{2}$

$= 20$

Ex: 10, 15, 12, 6, 25, 6

6, 6, 10, 12, 15, 25

$Q_1 = 6$ | $Q_2 = \frac{10+12}{2} = 11$ | $Q_3 = 15$

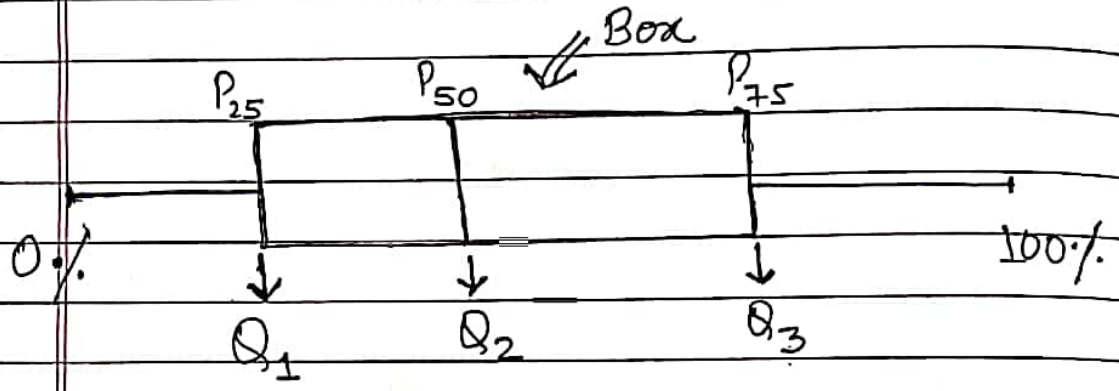
Ex: 5, 6, 7, 7, 8, 9, 9

3 obs. | $Q_2 = 7$ | 3 obs.

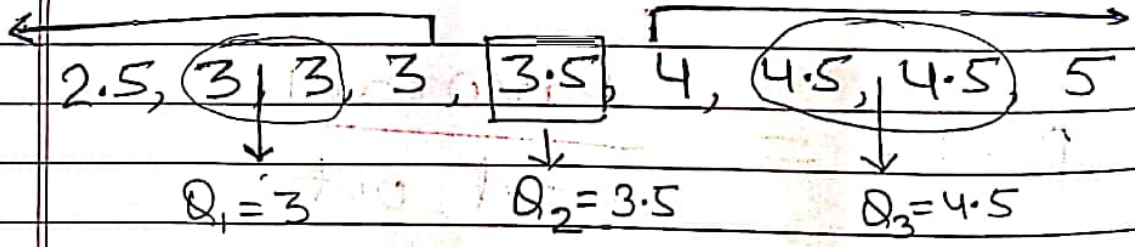
$Q_1 = 6$ | $Q_3 = 9$

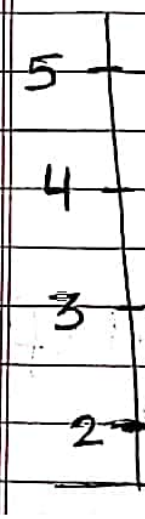
* $I.Q.R = |Q_3 - Q_1|$

Quartiles can also be represented by Box-Whisker plot.



Ex- Some AWA scores →





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Standard Deviation (S.D)

Measures Dispersion (distance) of data from central value

central value → measurement point

$\sqrt{\text{Variance}} = \sqrt{\sigma^2} = \text{S.D}$

σ → Sigma.

$$\text{Deviation} = x_i - \bar{x}$$

x_i ↙ Observation

$\bar{x}$ ↓ measurement point

Ex- Suppose, Mean of a given set ($\bar{x}$) = 5

One obs. in Set = 2

Deviation = ?

other obs. = 8

Deviation = ?

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General Formula of S.D

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

$$\sqrt{\frac{\sum (\text{deviation})^2}{n}}$$

When obs. follows A.P then

$$\sigma = |d| \sqrt{\frac{n^2 - 1}{12}}$$

d = Common difference
n = no. of obs.

When Square of Obs. is given

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

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Ex-

x_i	$x_i - \bar{x}$ (Deviation)	$(x_i - \bar{x})^2$ (Dev.n)^2
1	−2	4
2	−1	1
3	0	0
4	1	1
5	2	4
		10

$\bar{x} = 3.$

$$\sigma = \sqrt{\frac{10}{5}} = \sqrt{2}$$

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A

S.D of

{-10, -5, 0, 5, 10}

B

S.D of

{100, 105, 110
115, 120}

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For a Given Set

(a) If new observation is added to the set

	$x_i - \bar{x}$	S.D (σ)
Near to Mean	Less	Less
Far from Mean	More	More

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

(b) If existing obs. is removed from the set

	$x_i - \bar{x}$	S.D (σ)
Near to Mean	More	More
Far from Mean	Less	Less

Ex: $A = \{100, 105, 110, 115, 120\}$

$S.D = |d| \sqrt{\frac{n^2-1}{12}}$

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$d = 5$.

$n = 5$

$$\sigma = \frac{1}{5}\sqrt{\frac{(5)^2-1}{12}} = 5\sqrt{2}$$

Now,

(#) If 110, or, 105, or, 115 is removed, which is near to Mean 110. then New S.D $> 5\sqrt{2}$

And If 100, or, 120 is removed which is far from mean 110. then New S.D $< 5\sqrt{2}$

(#) If new obs. near to Mean $\to$ 110; is added (inserted) New S.D $< 5\sqrt{2}$

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For a Given Set :

(Effect)

New S.D

Each obs. $+x$

Each obs. $-x$

$\rightarrow$ No Effect

Each obs. $\times x \rightarrow$ Old S.D $\times x$

Each obs. $\div x \rightarrow$ Old S.D $\div x$

Ex: $A = \{P, Q, R\}$

$\sigma_A = m$

then find σ_B ?

$B = \{3P+1, 3Q+1, 3R+1\}$

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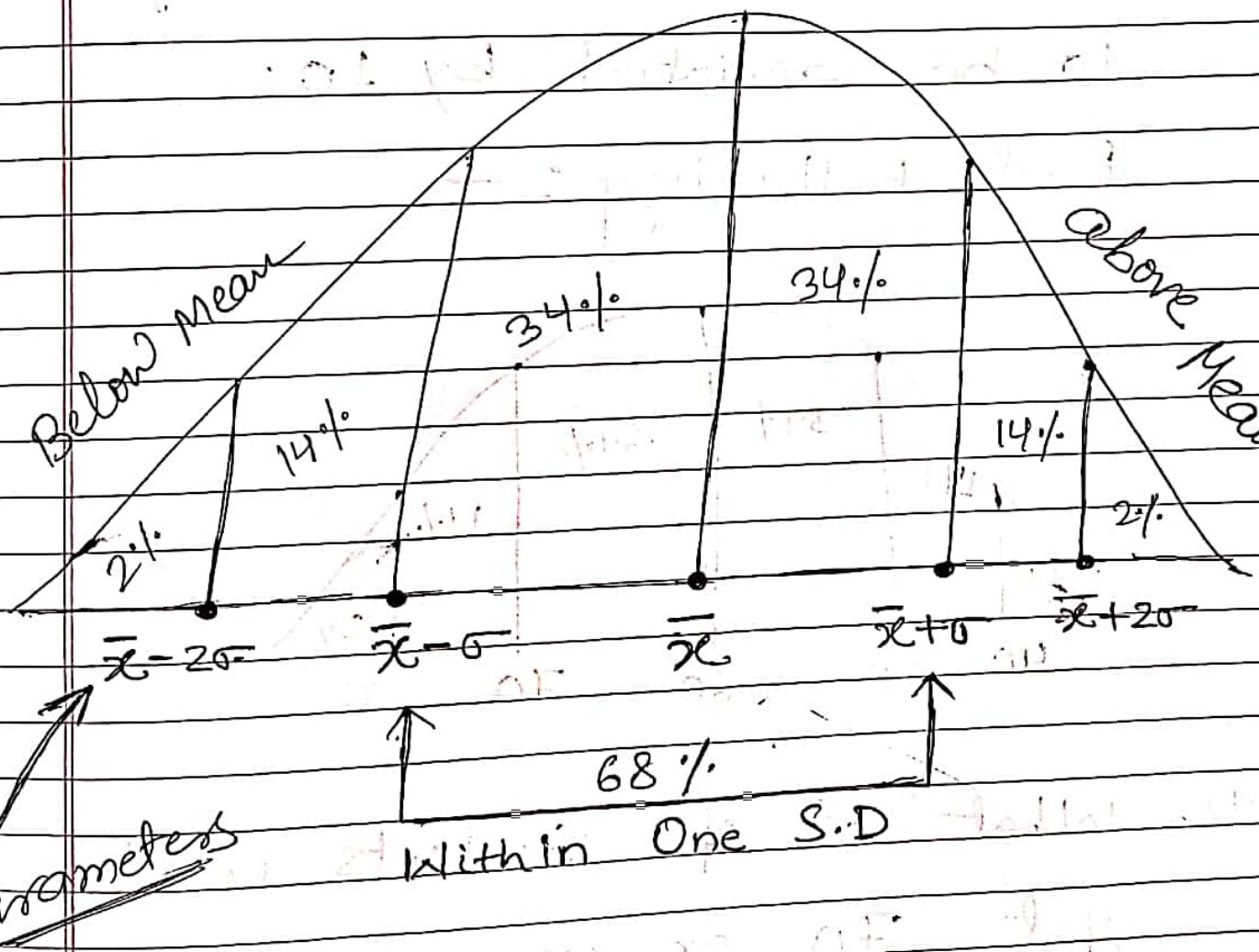
Normal Distribution Curve

It is a bell-shape curve that divides data evenly in hundred percentile on the basis of some parameter.



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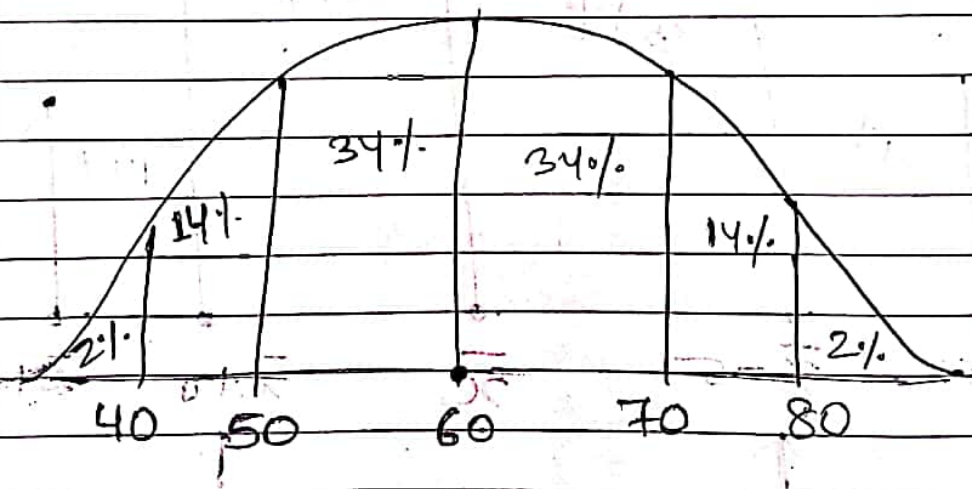
Ex- In an Exam, Score of 500 Students are found normally distributed with a mean score of 60. If their marks are found to be deviated by 10. find following :-



(i) What % of Students Could get 70 or, more marks? (atleast 70 marks)

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(ii) How many Students scored 50 or, less marks ?
(atmost 50 marks).

(iii) Find probability of Students Could score atmost 40 ?

$$\text{Prob.} = \frac{\text{favorable}}{\text{Total outcome}}$$

$$= \frac{\square}{100\%} =$$

* Solve Manhattan 5LB.pdf
Ch - 21, 22.

+ Concept Book

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Co-efficient of S.D (σ)

$$CoV = \frac{S.D}{|\bar{x}|}$$

$CoV > 1$; S.D ↑ ;

Data is widely spread, so less consistent and less stable

$CoV < 1$ S.D ↓

Data is contracted, so more stable and consistent.

Q. For Same Job :-

	Labor 1	labor 2
Average Time (In hours)	20	30
S.D (σ)	4	5

Which labor is more Consistent?

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In a bag, there are 8 balls marked 1 through 8.

4 balls are picked one by one. Find Prob. to get

(a) Range '5'.

(b) Median '5'

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