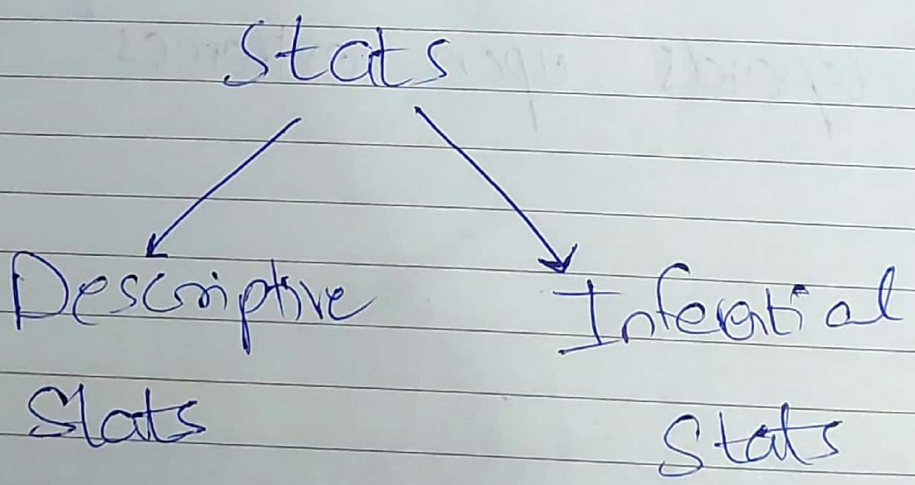
Statistics

Date:

1. collect data
2. Summarize/organize
3. Analyze /Descriptive Stat
4. Inferential Statistic



Chapter

Measure of central tendancy

① Mean — average $= \frac{\sum x_i}{n}$ = Sum / count

② Median — Middle value

③ Mode —

Mean

- data , accumulate around point
- depends upon extremes

Median :

Chapter 01

Date:

Organizing and Summarizing data

data

- Qualitative data
- Quantitative data
  - Quantitative variable
    - Discrete
    - Continuous

Organizing qualitative data:

- tabular
- graphical

Frequency Distribution:

Color	freq	Relative freq	freq/total	Relative Percentage freq
B	5	5/16		(5/16)×100
R	4	4/16		(4/16)100
G	7	7/16		(7/16)100
Total	16	1		

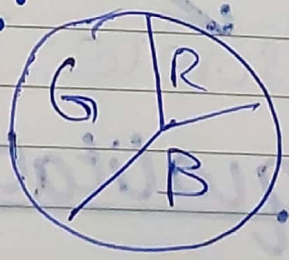
Relative freq:

- R-freq is lie blw 0-1
- Its total is 1
- Relative precentage freq = Rf × 100%

Graphs

Pie Chart:

- eg:-



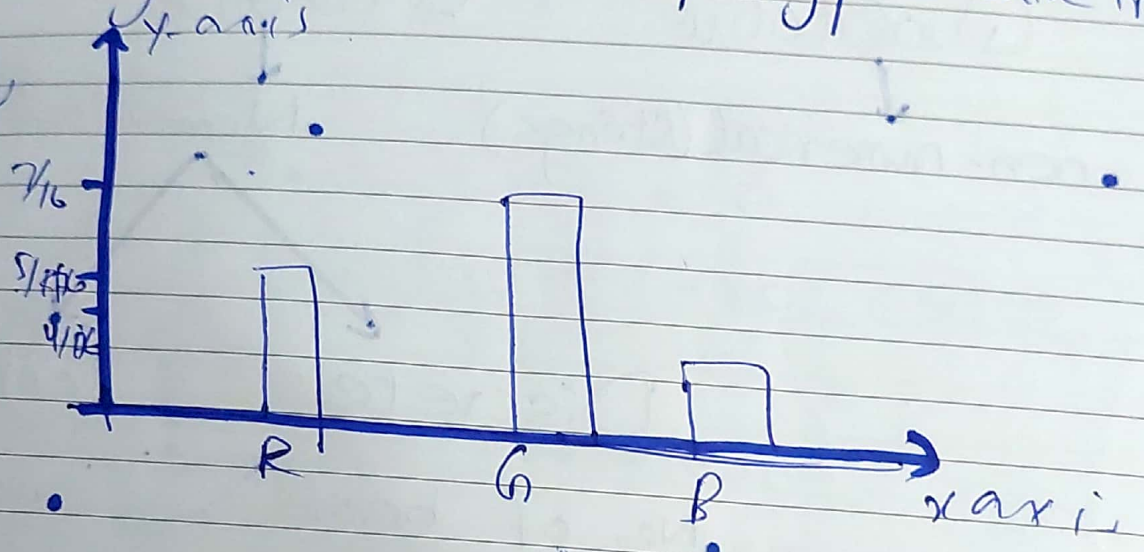
formula:

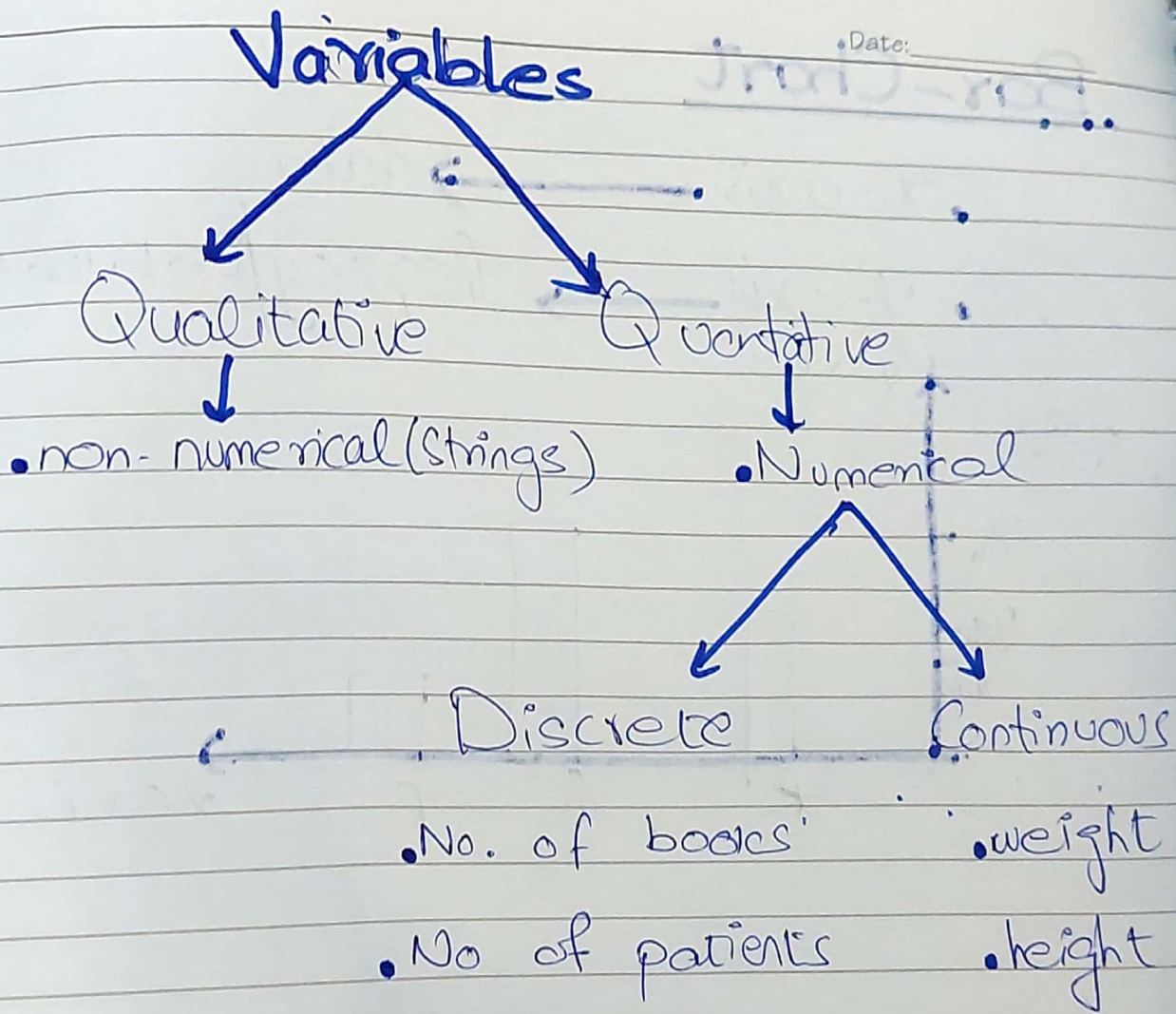
- $\frac{\text{freq}}{\text{Total freq}} \times 360^\circ$

Date:

Bar-Chart

- x-axis ⟶ data
- y-axis ⟶ Frequency / Relative freq





Measurement of scales

Qualitative

- **Nominal:** Non-numerical categorical
  eg:
  - gender
  - religion
- **Ordinal:** Order, ranking

Date:

Quantitative

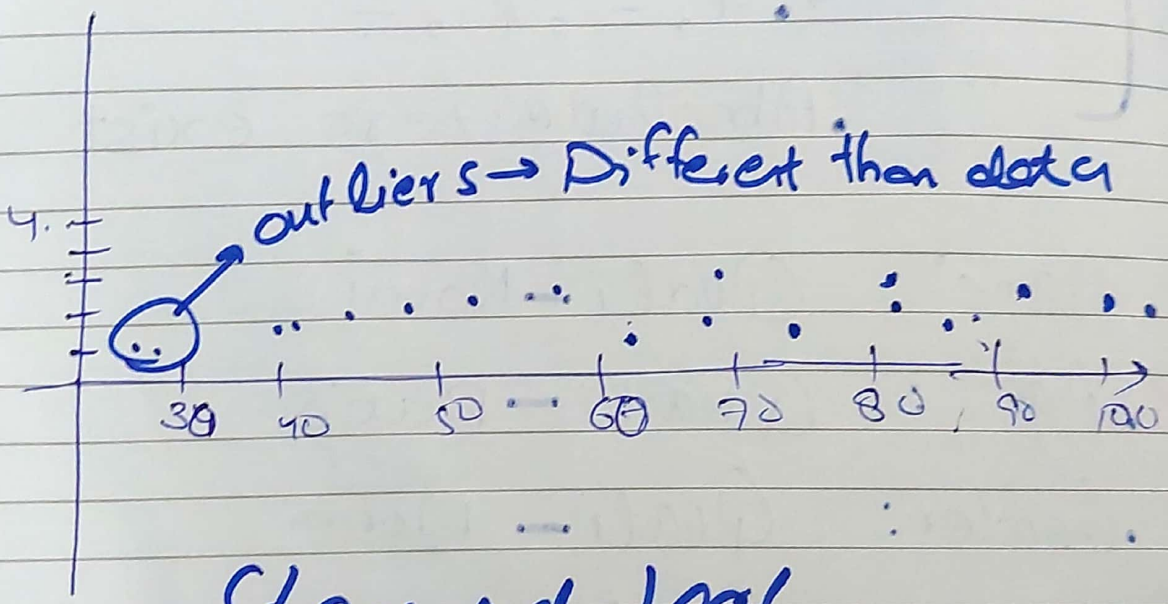
- **Interval:**
  - addition, subtract allowed
  - Absoulute zero not exis
- **Ratio:**
  - +, −, *, ÷
  - Absolute zero exist

- Name : Quali – Normi
- Age : Quanti – Ratio
- Gender: Quali – Normi
- City: Quali – Normi
- Weight: Quanti – ~~Normi~~ Ratio
- Postal code: ~~Quali – Ratio~~ Normi
- Qualification: Quali – Normi
- Marital Status: Quali – Normi

Dot-Plot

Date:

88 82 89 70 85
68 100 86 67 38
90 96 76 34 81
64 75 84 89 96



Stem and Leaf

step	leaves	f	CI
3	9 4 9	3	30-60
4		2	61-69
5		2	70-
6	3 7		
7	0 6		
8	2 4 5 6 8 9 5 1		
9	0 6 6		
	0		

CI	f	Midpoint (m)	fx	C.F
30-39	4	34.5	f(x)	4
40-49	8	44.5		12
50-59	10	54.5		22
60-69	7	64.5		29
70-79	7	76.5		36
80-89	4	84.5		40
89-99	3	94.5		
	40		2720	

Mean = $\frac{2+4+6}{3} = 4$

Median = $\left(\frac{n+1}{2}\right)^{th} \Rightarrow 2^{nd} = \left(\frac{3+1}{2}\right) = 2$

1, 2, 3, 4.

Median = $\frac{4+1}{2} = \frac{5}{2} = 2.5 \Rightarrow$ So take $\left(\frac{2^{nd} \text{ and } 3^{rd}}{2}\right)$

Mod = Repetitive

$M = \frac{\Sigma f(x)}{\Sigma f} = \frac{2720}{40}$ — OR

14th Feb 24

Short term investment

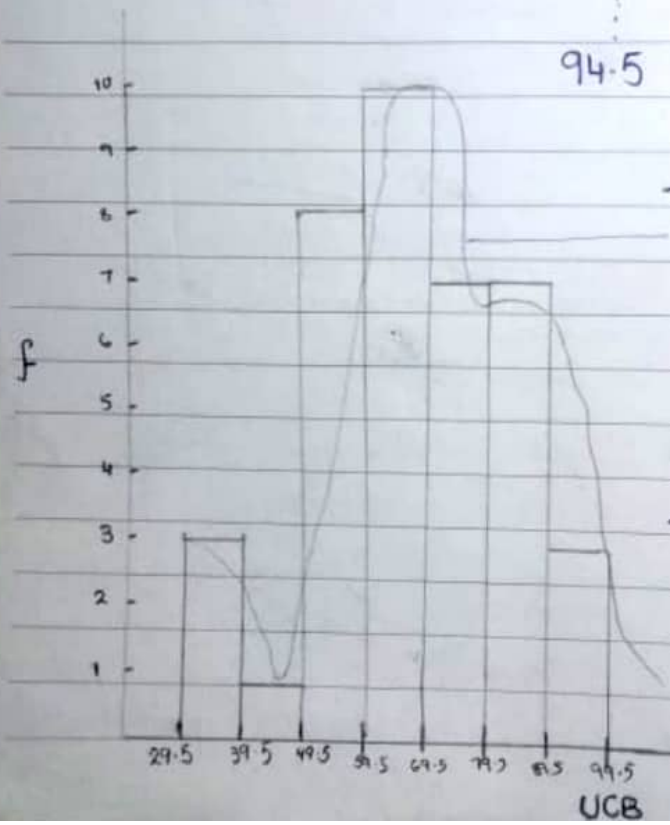
70	64	99	55	64	89	87	65
62	38	67	70	60	69	78	34
75	56	71	51	99	68	95	86
57	53	47	50	55	81	80	98
51	36	63	66	85	74	83	70

GROUP FREE DISTRIBUTION

Class interval	f	CF (<)	CF (>)	relative freq	CB
30 - 39	3	3	40	3/40	29.5 - 39.5
40 - 49	1	4	37	1/40	39.5 - 49.5
50 - 59	8	12	36	8/40	⋮
60 - 69	10	22	28	⋮	⋮
70 - 79	7	29	18	⋮	⋮
80 - 89	7	36	11	⋮	⋮
90 - 99	4	40	4	4/40	89.5 - 99.5
Total =	40				

Mid point $(x)\left(\frac{a+b}{2}\right)$

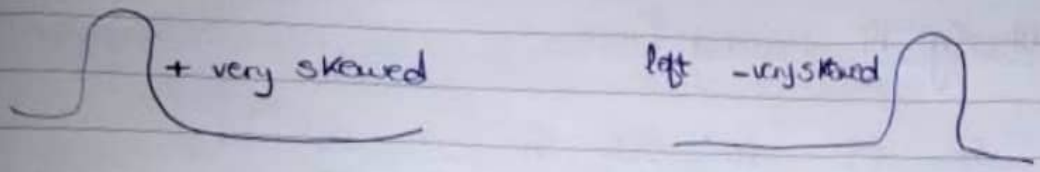
34.5
44.5
54.5
⋮
94.5



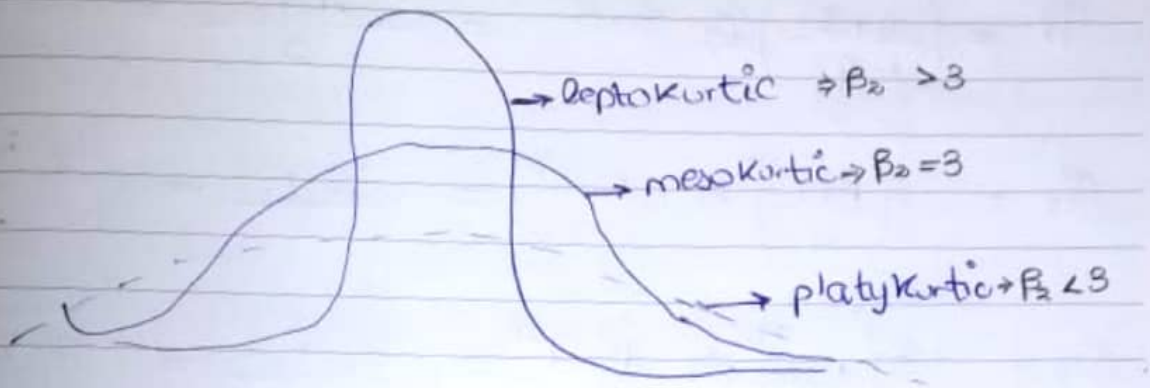
- bell shaped frequency polygon

Mean = Median = Mode

- single peak
- unimodal

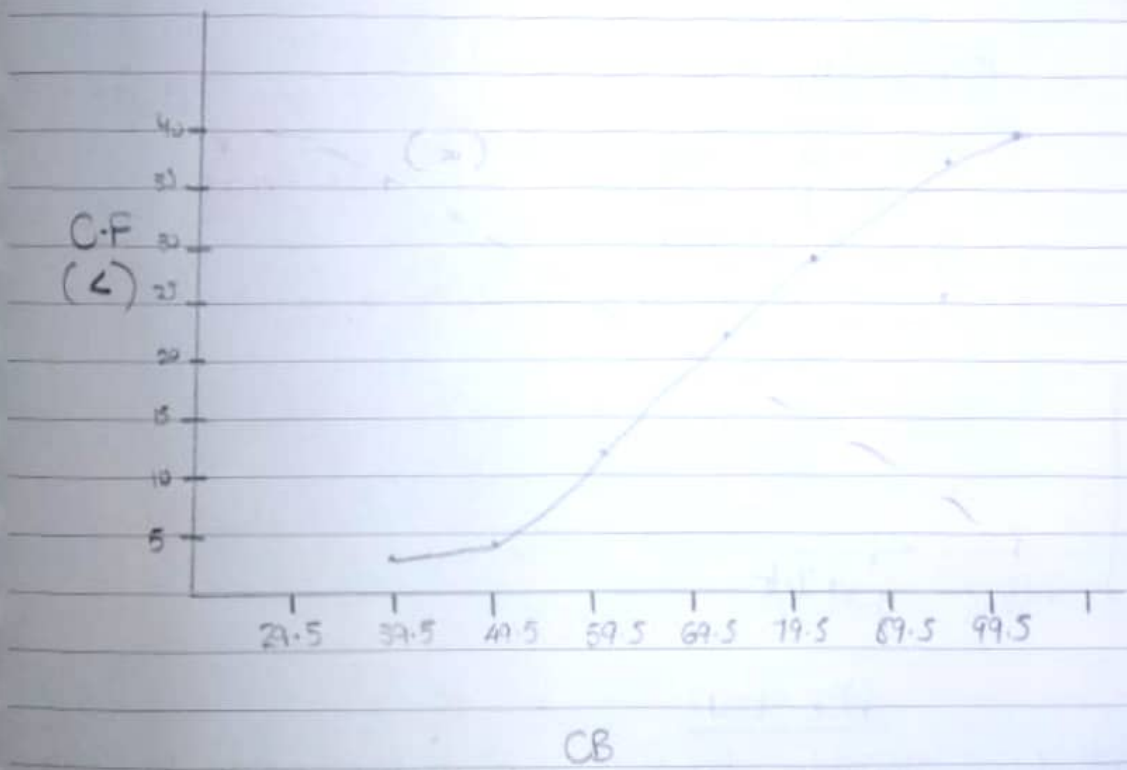


mean > median > mode mode > median > mean



Outliers Sudden large or small values (eg 1, 2, 3, 20)

OGIVE Cummulative freq graph



Median $= l + \frac{h}{f}\left(\frac{\Sigma f}{2} - cf\right)$

Median = LCB + UCB

h → class size.

$\frac{\Sigma f}{2} = \frac{40}{2} = 20$

Media $= 59.5 + \frac{10}{10}\left[\frac{40}{2} - 12\right]$

Mod = $= l + h\left[\frac{fm - f1}{2fm - f1 - f2}\right]$

l = L. - CB of Median

h = Change

f = freq

Date:

C.F = Preceding f.

$$Q_1 = l + \frac{h}{f}\left[\frac{\Sigma f}{4} - C.F\right]$$

Q2 = Median

Q3 = ~~[illegible]~~

$$l + \frac{h}{f}\left[\frac{3\Sigma f}{4} - C.F\right]$$

Box-Plot

$Q1 = \left(\frac{n+1}{4}\right)^{th}$.

$Q2 = \left(\frac{n+1}{2}\right)^{th}$

$Q3 = \frac{3(n+1)^{th}}{4}$

n = no. of terms

Example 17:

$Q1 = \frac{(n+1)^{th}}{4} = \left(\frac{20+1}{4}\right)^{th} = \frac{21}{4} = 5.3$

So, $\frac{21+25}{2} = 23$, so $\left(\frac{5^{th}+6^{th}}{2}\right)$ terms

$Q2 = \left(\frac{n+1}{2}\right)^{th} = 10.5 = \frac{30+31}{2} = 30.5$

$Q3 = \frac{3(n+1)}{2} = \frac{3(21)^{th}}{4} = 15.7 = \frac{35+3}{2}$

$= 36$

Date:

$L = Q_1 - 1.5(IQR)$

$U = Q_3 + 1.5(IQR)$

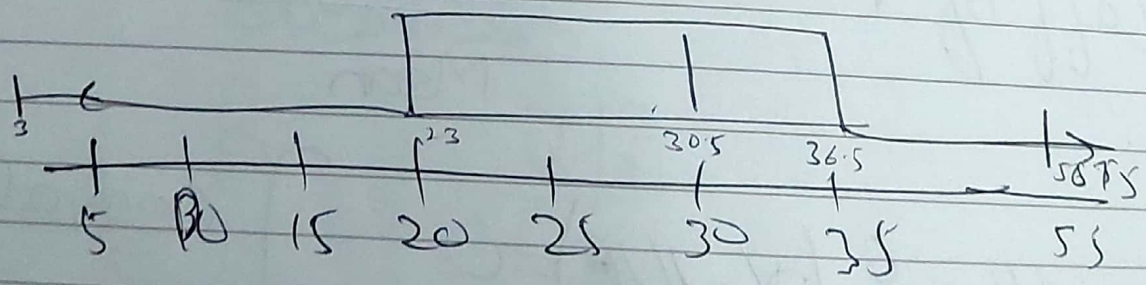
$IQR = Q_3 - Q_1$

$IQR = Q_3 - Q_1$

$IQR = 36.5 - 23$

$L = 2.75$ → outliers less than

$U = 56.75$ → Outliers more than



Date:

Example 19:

Variance

mean
x − mean
$(x-m)^2$
$\sum f($ $)$

$$= \frac{\sum (x-\mu)^2}{n} \Rightarrow \text{for ungroup}$$

$$= \frac{\sum f(x-\mu)^2}{\sum f} \Rightarrow \text{for group}$$

$\frac{\sum}{n}$

$$\text{Coff of variance} = \frac{\text{standard dev} \times 100}{\text{Mean}}$$

$$\mu_1 = \sum (x-\mu) = 0$$

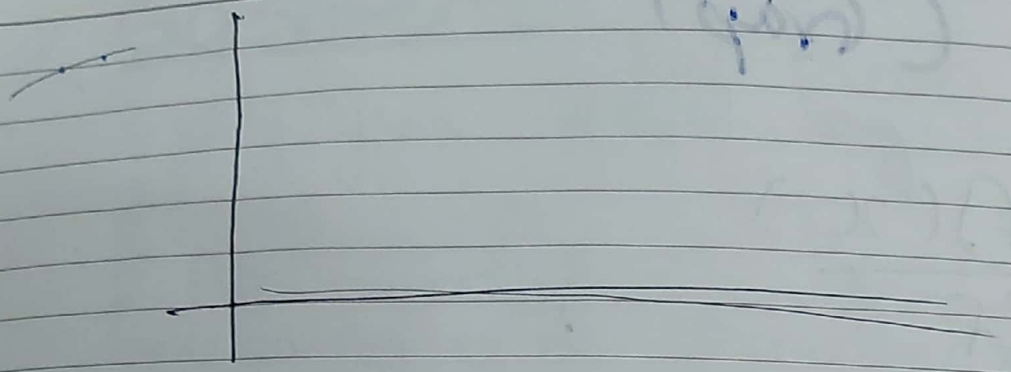
$$\mu_2 = \frac{\sum (x-\mu)^2}{n} = 0$$

$$\mu_3 = \frac{\sum (x-\mu)^3}{n} = 0$$

$$\mu_4 = \frac{\sum f(x-\mu)^4}{n} = 0$$

central movement

Date:



$$\text{Mean} = \mu = \frac{\Sigma x}{n}$$

$$\text{Mean} = 193.125$$

Standard Deviation

$$\sqrt{\sigma^2} = \sqrt{\text{Variance}}$$

Skewness

$$\beta_1 = \frac{\mu_3^2}{\mu_2^2}$$

Kertosis

$$\beta_2 = \frac{\mu_4}{\mu_2^2}$$

Date:

Media (Grap)

$$\frac{(\Sigma f)(x)}{\Sigma f}$$

Date:

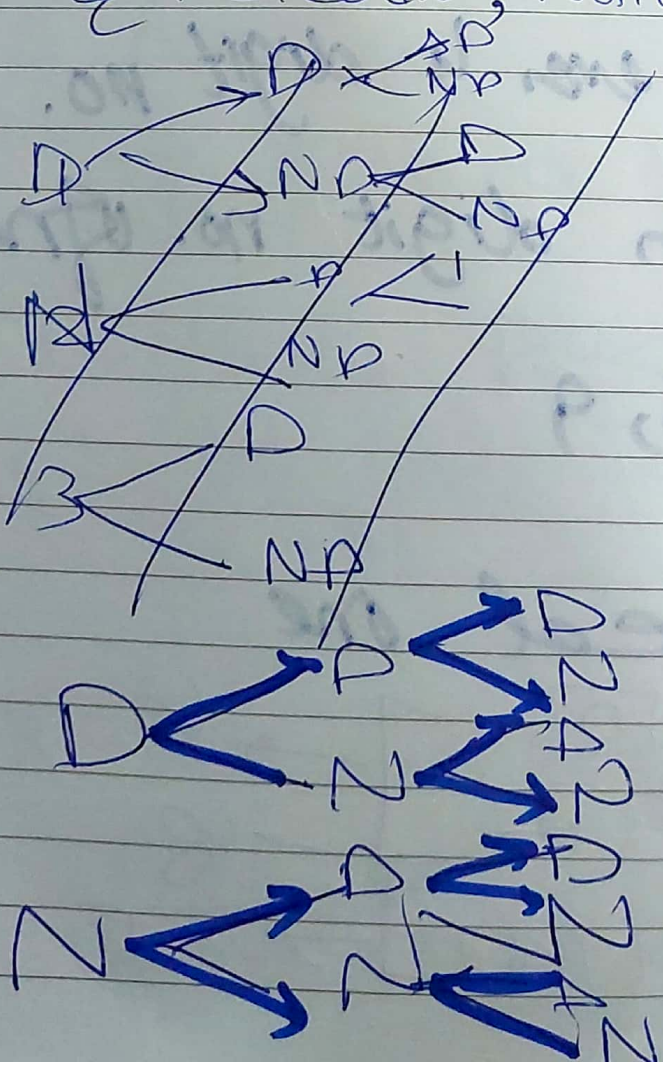
Experiment: Any process or activity 'gives data'. **eg:** Rolling dice

- All possible outcomes of experiment is sample space.

eg: Rolling dice = {0, 1, 2, 3, 4, 5, 6}

Q: Suppose 3 items: Defective, Non-defective

{Defective, Nondefective}



Mutually exclusive

$A \cap B = \phi$

No. from 2, 4, 6, 8

i) Rep allowed

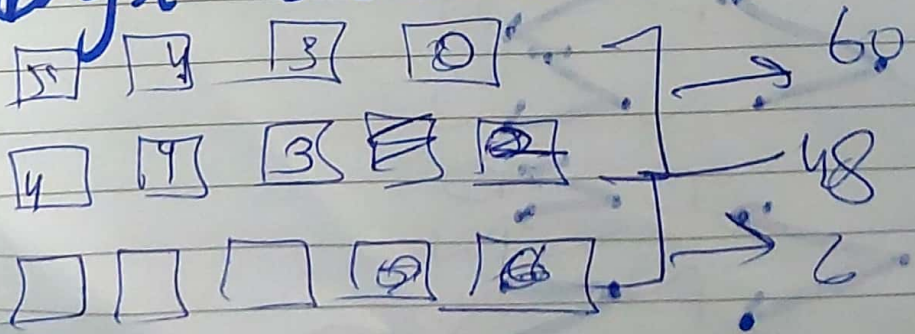
$4 \times 4 \times 4 = 64$

ii) Rep Not allowed

$4 \times 3 \times 2 = 24$

Q: How many even 4 digit no. form from digit no. 0, 1, 2, 5, 6, 9

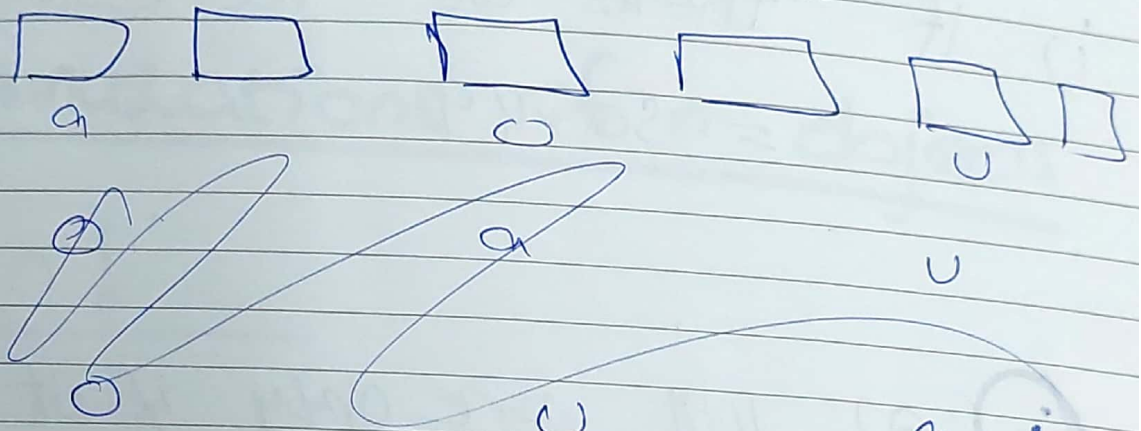
i) digit used one



Date:

Q Favour FAVOUR

So, vowels occupy even space



Combination and Permutation

Arrangment

order does not matter

Arrangement

Order matter

Q State Maths, Physics

$= 3!$

^nC_r ^nP_r

$\frac{n!}{r!(n-r)!}$ $3!$

$= 6$

Q If 2 books are

$\frac{n!}{(n-r)!} = \frac{3!}{(3-2)!} = 6$

$^nC_r \quad ^nP_r \quad \frac{n!}{n(n-r)!} \quad \frac{n!}{r!(n-r)!}$

No. of items = 50

Chose = 2

~~No of~~

i) If there are nd restricted

= 50 x 49

(ii) P' will score only if it predict

B and C score together or not

2 ~~48 x 48~~ + 48 x 47

=

D & E not score together

ore tog = 2

All = 50 x 49

Nd = (50 x 49) - 2 =

Date:

- If to be in circle fix $(n-1)!$

Permutations of n objects

$$\frac{n!}{n_1!\, n_2! \cdots n_r!}$$

total object = 4

for 9995 no. of permutation = $\frac{4!}{3!\,1!}$ total

3 → 9 (same)

1 → 5 (one)

- No. of permutation of STATISTICS = $\frac{10!}{3!\,3!\,2!}$

Date:

- In how many 2R, 3B, 4G,

So, no. same color together = $\frac{9!}{2!3!4!}$

- 10. B, 6G

3 $\downarrow_2$

Probability

Date:

Measurement of chance

subjective

- personal experience
- judgments
- expertise

objective

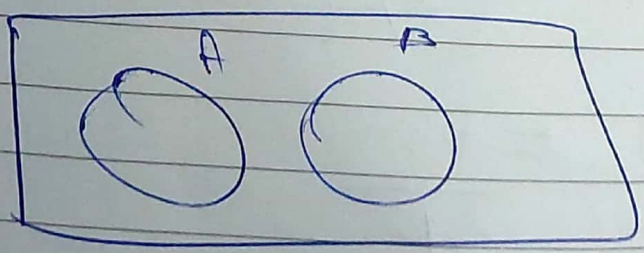
- Classical approach
- P(event) = Favourable value / all probality

$0 \leq P(E) \leq 1$

- Sum of posibites = 1

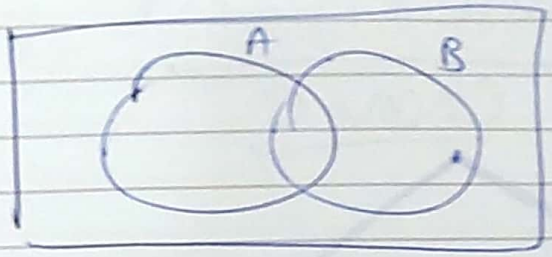
Mutually exclusive

- $P(A_1 \cup A_2) = P(A_1) + P(A_2)$



Non-Mutually

$$P(A_1 \cup A_2) = P(A_1) + P(A_2) - P(A_1 \cap B_2)$$



Q1: A coin is tossed twice. What is probability of Head

= HH, TH, HT, TT

$P(\text{At least 1 Head}) = \frac{3}{4}$

$P(1 \text{ Head}) = \frac{1}{2} = \frac{2}{4}$

$P(TT) = \frac{1}{4}$

$P(HH) = \frac{1}{4}$

$P(\text{Not } 1) = 1 - \frac{1}{4} = \frac{3}{4}$

Date: 1, 2, 3, 5, 6

Q2 A dice rolled once

$P(\text{Even}) = \frac{3}{6}$

$P(<3) = \frac{2}{6}$

$P(4 \text{ or higher}) = \frac{3}{6}$

$P(a 7) = 0$.

$P(1 \text{ to } 6) = 1$

Q3 A die is loaded such that even number is twice as likely to occur

If E is event then no. less than 4 occur.

$\{1, 2, 3, 4, 5, 6\}$

$\{w, 2w, wt 2w + wt 2w\}$

$w = \frac{1}{9}$

$$P(E) = P(x < 6) = \frac{1}{9} + \frac{2}{9} + \frac{1}{9}$$

$$= \frac{4}{9}$$

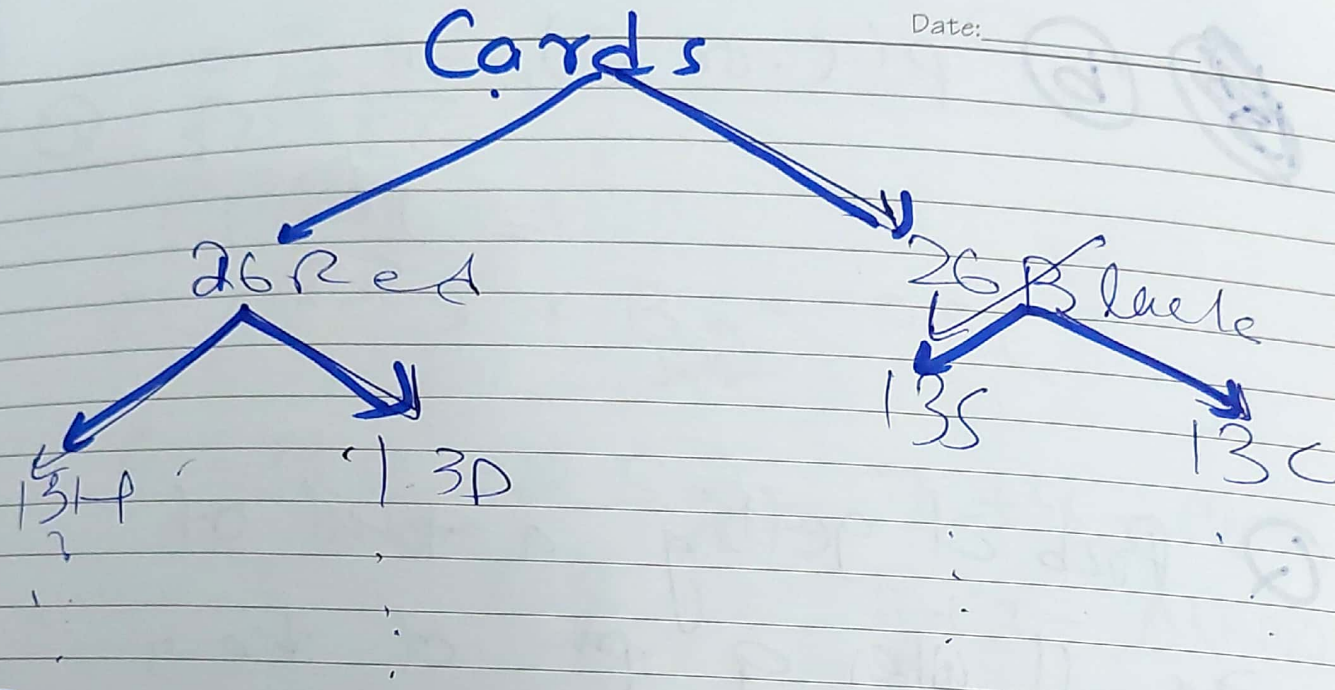
Q4 two balance diced are rolled once

$S = \{(1,1), (1,2), (1,3), (1,4), (1,5), (1,6)$
$(2,1), (2,2), (2,3), (2,4), (2,5), (2,6)$
$(3,1), (3,2), (3,3), (3,4), (3,5), (3,6)$
$(4,1), (4,2), (4,3), (4,4), (4,5), (4,6)$
$(5,1), (5,2), (5,3), (5,4), (5,5), (5,6)$
$(6,1), (6,2), (6,3), (6,4), (6,5), (6,6)\}$

(a) $P(\text{sum of } 11) = \frac{2}{36}$

(b) P(same ~~error~~ on ~~both~~ dice $= \frac{6}{36}$

$P(\text{sum of } 13) = 0$



Q A card is drawn Random

(a) $P(\text{Jack}) = \frac{4}{52}$

(b) $P(\text{Not Jack}) = 1 - \frac{4}{52} = \frac{48}{52}$

Q 25 Industrial 10 Mathematics 10 Chemistry

Total = 53.

(a) $P(\text{Industry}) = \frac{25}{53}$

(b) $P(C \text{ or } E) = \frac{8}{53} + \frac{10}{53}$

$= \frac{18}{53}$

Q Prob of getting a total of 7 or 11 when a pair of dice is rolled

$P(7 \text{ or } 11) = \frac{8}{36} = \frac{4}{18} = \frac{2}{9}$

Q $P(\text{spec}) = 0.99$

$P(\text{for dup}) = \frac{1 - 0.99}{2}$

$P(\text{larger than } 1940) = 1 - P(\text{small})$

$= 1 - 0.005$

$= 0.995$

Date:

Q $P(S) = 7$

$P(B) = 4$.

$P(\text{either } S \text{ or } B \text{ or both}) = 0.8$

(a) $P(B \text{ or both } S \text{ or}) = 7 + 4 - P(A \cap B)$

$0.8 = 7 + 4 - A(A \cap B)$

$= 0.3$.

(b) $P(\sim \text{Both}) = 1 - 0.8$.

0.2

Q: $P(\text{brake defect}) = 0.25$

$P(\text{transmission}) = 0.18$

$P(\text{fuel sy}) = 0.17$

$P(\text{Other}) = 0.40$

$P(B \cap F) = 0.15$

(a) $P(\text{Brake or fuel}) = 0.43 - 0.15$

$= 0.27$

Product Rule

Date:

Independent Event $= P(AB) = P(A) \cdot P(B)$

For dependent Event $= P(A) P(B|A)$

$$P(B|A) = \frac{P(B \cap A)}{P(A)}$$

Q 20 fuses

2

15 ~~Defective~~

SD

$= P(F_1 \cap F_2)$

$= P(F_1 \cdot F | F_1)$

$= \frac{5}{20} \cdot \frac{4}{19}$

$\frac{1}{10}$

Date:

Q: ~~2/52~~

(B) $= P(S_1) \cdot P(S_2)$

$= \left(\frac{13}{52}\right)\left(\frac{12}{51}\right)$

$=$

Q 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 $= 8$

$= \frac{5}{8} \times \frac{4}{7}$

Q

$P(M) = 0.25$

$P(S) = 0.15$

$P(M \cap S) = 0.10$

(A) $P(M|S)$

$= \frac{P(M \cap S)}{P(S)}$

$= \frac{0.10}{0.15}$