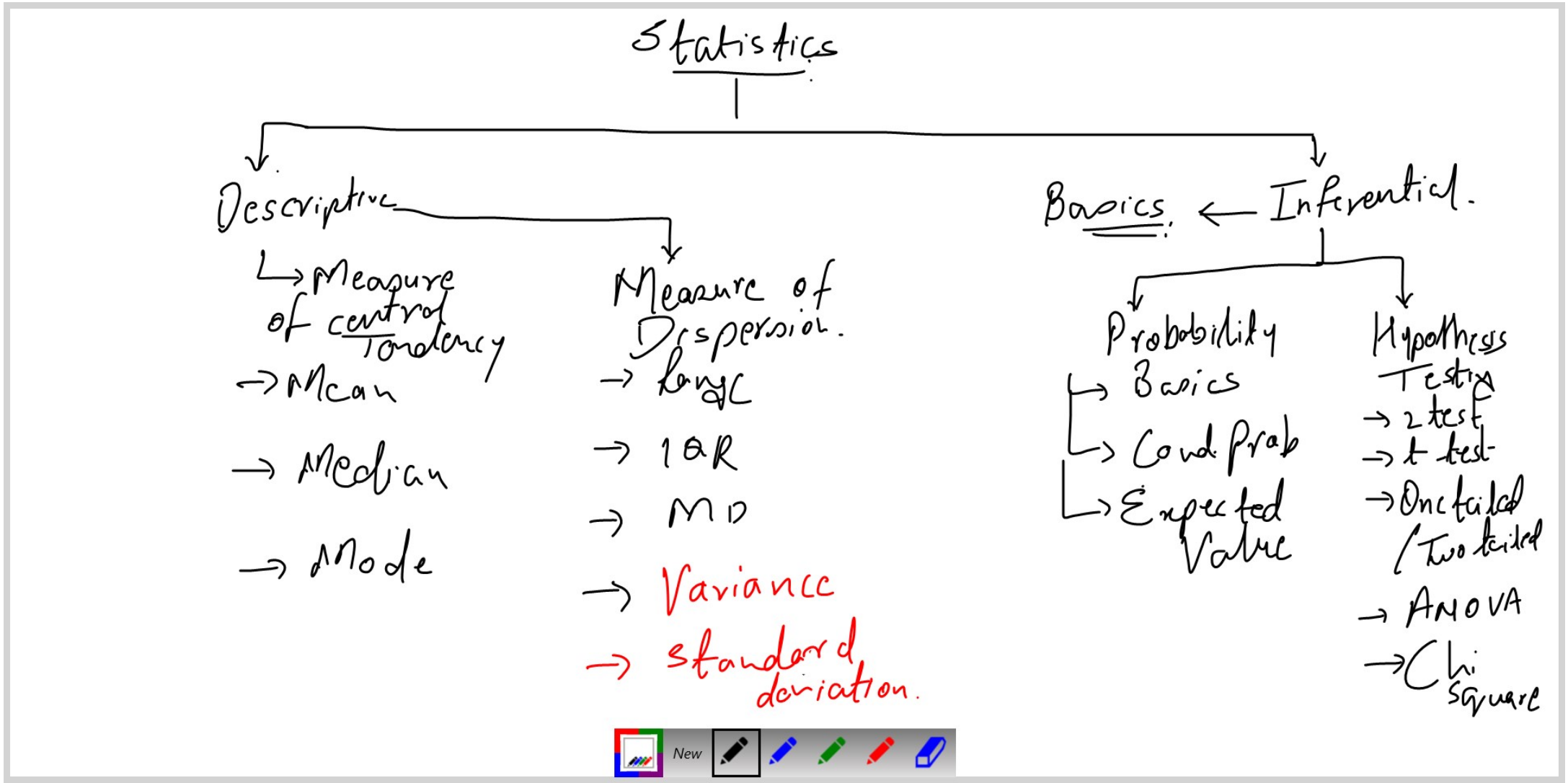

Statistics
Descriptive
Measure of central Tendency
Mean
Median
Mode
Measure of Dispersion.
Range
IQR
MD
Variance
standard deviation.
Inferential.
Basics
Probability
Basics
Cond. Prob
Expected Value
Hypothesis Testing
z test
t test
One tailed / Two tailed
ANOVA
Chi Square
New

Variance:

$$MD = \frac{\sum |x_i - \bar{x}|}{n}$$

15 18 24 26 32

-8 -5 +1 +3 +9

23 0

$$= \frac{26}{5} = 5.2$$

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

Squaring offers a Mathematical Punishment

$1^2 = 1$

$2^2 = 4$

$3^2 = 9$

$7^2 = 49$

MD MD²

23 +1 24 1 1

+3 26 3 9

-1 23 +3

22 24 26

MD = 5/3

= 1.66

-4 23 +8

22 28 31

Var = 90/3 = 30

Var = 11/3 = 4...

St. dev :

$$\text{st.dev} = \sqrt{\text{Variance}}$$

$$\text{Var} = (SD)^2$$

$$S.D = \sqrt{\frac{\Sigma (x_i - \bar{x})^2}{n}}$$

$\bar{x}$ → Mean of Quantities

x_i → i^{th} Quantity

Chances ← Probability. 50% vs 51%

	Tossing a coin	Throwing a die	Drawing a card	
Random Experiment	✓	✓	✓	Any action whose outcome is not fixed
Sample Space	(H, T)	(1, 2, 3, 4, 5, 6)	(1, 2, 3, . . . 52)	Collection of all the possible Outcomes
Event	Occurence of H	Occ of Even 6	Occurence of Red Occu of a face " " Num	One of the possible Outcomes

$$P(E) = \frac{\text{(No. of ways Event can occur)}}{\text{(Total no. of ways)}}$$

→ favourable Outcomes

→ Total Outcomes (# Sample space)

$P(H) = \frac{1}{2}$

$P(T) = 1/2$

→ Toss

→ (H & T)

→ Occ of head

→ $P(H) = \frac{1}{2}$

Toss 2 Coins

→ Tossing 2 Coins.

→ (HH, TT, HT, TH)

→ At least One head came.

→ $P = \frac{3}{4}$

Throw 2 dices

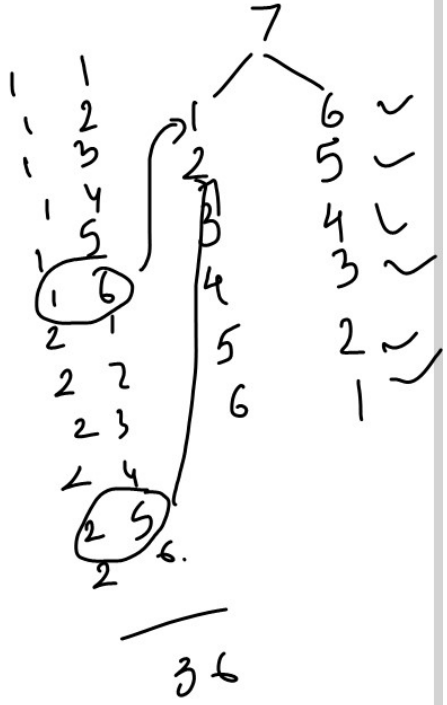
→ Threw 2 dices

→ ((1,1), (1,2), (1,3) . . . → $6 \times 6 = 36$

. . . . (6.6))

→ Sum of 7 will show up.

→ $P = \frac{6}{36}$ 6



Combination

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

→ Now!

8 students
3 stu..

$${}^8C_3 = \frac{8!}{3! \times 5!} = \frac{8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}{3 \times 2 \times 1 \times 5 \times 4 \times 3 \times 2 \times 1} = 56$$

A B C D E f G H

Comb: Selection without Order

Perm: Selection with Order

$${}^{n}C_{r} = \frac{n!}{r! \times (n-r)!}$$

Drawn 3 Cards:

→ R.E ⇒ Drawn 3 Cards

→ Sample space → ${}^{52}C_3$

→ Event → All 3 are kings

→ $P(e) = \frac{{}^{4}C_3}{{}^{52}C_3} = \frac{4}{\frac{52!}{3! \times 49!}}$

$= \frac{4 \times 3 \times 2 \times 49!}{52!}$

$= \frac{24}{52 \times 51 \times 50}$

$= \frac{1}{5525}$

13 spades, 13 clubs → Black; 13 hearts, 13 diamonds → Red.

$K_S \; K_C \; K_D \; K_H$

${}^{4}C_3$

$\frac{4}{3! \times 1}$

1/2

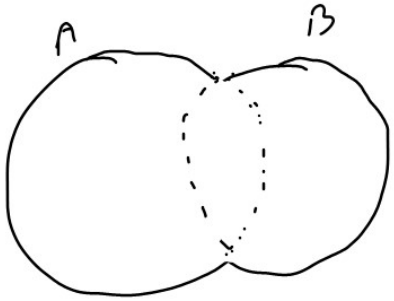
$P(H) = \frac{1}{2}$

Once in every 2 tossed. The outcome is head. in the Long run.

A and/or B:

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$



A ∪ B

16 4

$$P(K \text{ or } Red) = P(K) + P(Red) - P(K \& Red)$$

$$= \frac{4}{52} + \frac{26}{52} - \frac{2}{52} = \frac{28}{52} \quad 13 \quad 7$$

$$P(K \text{ or } Red) = \frac{{}^{4}C_2}{{}^{52}C_2} + \frac{{}^{26}C_2}{{}^{52}C_2} - \frac{1}{52} =$$

1, 2, 3, 4, 5, 6
1, 2, 3, 4, 5, 6

Q: In a throw of 2 dice, find Prob

a) Even or Prime → $\frac{1}{2} + \frac{1}{2} - \frac{1}{6} = \frac{5}{6}$

b) Odd or ~~Composite~~ Prime → $\frac{3}{6} + \frac{3}{6} - \frac{2}{6} = \frac{4}{6}$

c) Prime or Composite. → $\frac{3}{6} + \frac{2}{6} - \frac{0}{6} = \frac{5}{6}$

d) Even or odd → $\frac{3}{6} \quad \frac{3}{6} - \left(\frac{0}{6}\right) - \ldots \rightarrow$

P(Prime and Composite) = 0

A ↓ B → Mutually Exclusive Events

If A occurs B won't & vice versa.

→ Mutually Exclusive Events

A & B are ME if occurrence of A/B ensures non occurrence of B/A.

→ Collectively Exhaustive Events

	A	B	C	D	E
✓ Toss a Coin	Occur of H	Occur of T	X	X	
✓ Draw one Card	Occur of a Red	Occur of a Black.	X	X	
✓ "	Occur of spade	Occur of Hearts	Occur of clubs	Occur of Diamond	
"	~~Red~~ Red	Hearts	~~Black~~ Dia.	clubs	spades

→ Independent Events

A → ✗B A & B

B → ✗A

$$P(A \text{ and } B) = P(A) \times P(B)$$

Toss 1 Toss 2.

$P(H_1 \& H_2) = P(H_1) \times P(H_2)$

$= \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

HH
HT
TT
TH

ME	CE
✓	✓
✓	X
X	✓
X	X

H, T : (odd, Even)

A Prim & B Comp. 1

$P(E) + P(\bar{E}) = 1$

$P(E) + 0.12 = 1$

$P(E) = 1 - 0.12$

$= 0.88$

P (A or B or C)

P (at least one is profitable) = P(Ex1) + P(Ex2) + P(All3)

A	B	C
0.5	0.6	0.4

Ex1: ✓ X X → $0.5 \times 0.4 \times 0.6 = 0.120$

Ex1: X ✓ X → $0.5 \times 0.6 \times 0.6 = 0.180$

Ex1: X X ✓ → ...

Ex2: ✓ ✓ X → ...

Ex2: ✓ X ✓ → ...

Ex2: X ✓ ✓ → ...

All3: ✓ ✓ ✓ → ...

X X X → $(1-0.5) \times (1-0.6) \times (1-0.4)$

$= 0.5 \times 0.4 \times 0.6$

$= 0.120$

Q:

	A	B	C
P (Pro)	0.5 (1/2)	0.6 (3/5)	0.4 (2/5)
Profit	200	500	300

$$E.V = \Sigma P_i \times V_i$$

Expected Pro $= 0.5 \times 200 + 0.6 \times 500 + 0.4 \times 300$

$= 100 + 300 + 120$

$= 520K$

P (100) Q (100) R (100) — 300

P	Q	R
0.3	0.2	0.35
30%	25%	10%

$$E.V = \frac{30\% \times 30 + 25\% \times 20 + 10\% \times 35}{100}$$

$= 30\% \times 0.3 + 25 \times 0.2 + 10\% \times 0.35$

$= 9\% + 5\% + 3.5\%$

$= 17.5\%$

Conditional Probability

$$P(E) = \frac{3}{6} = \frac{1}{2}$$ 50%

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

↑ what is prob of A given that B has occurred

$P(E/No<4)$

$$= \frac{P(\text{'Even' and 'No}<4\text{'})}{P(No<4)}$$

1 (2) 3 4 5 6

$$= \frac{1/6}{3/6} = \frac{1}{\cancel{6}_3} \times \frac{\cancel{6}^2}{3} = \frac{1}{3}$$

$$P(E/No<4) = \frac{2}{3}$$ 67%

$P(\text{Prime}) = \frac{3}{6} = \frac{1}{2}$ (1, 2, 3, 4, 5, 6)

$P(\text{Prime}/\text{Even}) = 1/3$. ((2), 4, 6)

$$P(\text{Prime}/\text{Even}) = \frac{P(\text{Prime and Even})}{P(\text{Even})}$$

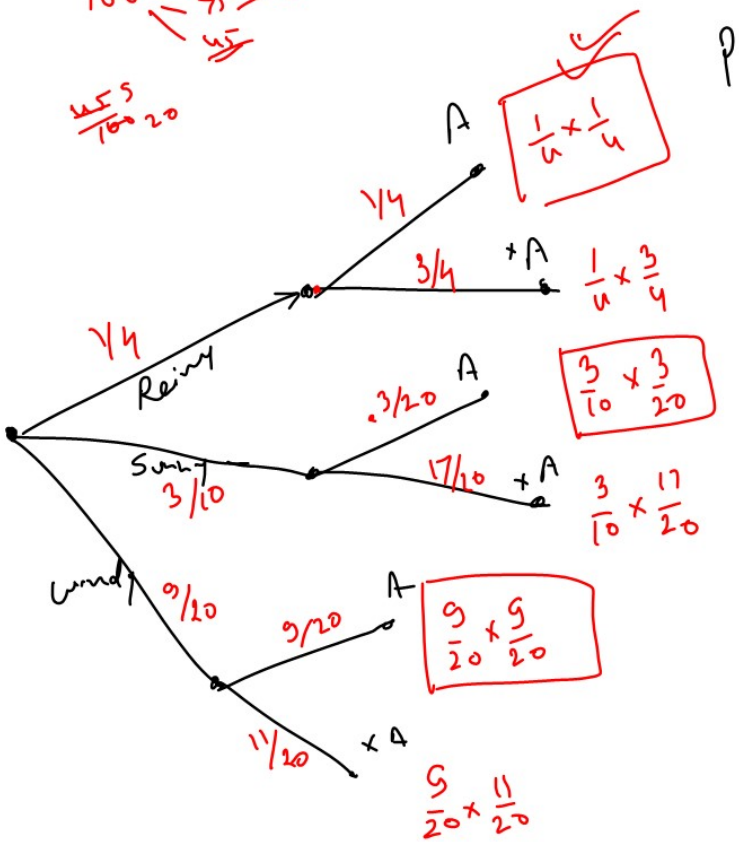
$$= \frac{1/6}{3/6} = \frac{1}{\cancel{6}} \times \frac{\cancel{6}}{3} = \frac{1}{3}$$

25% 75% 30%

100 — 25 — 75 — 30
45

45/100 = 20

0.15 = 15/100 = 3/20



$$P(\text{Rainy/Accident}) = \frac{P(\text{Rainy and Accident})}{P(\text{Accident})}$$

$$= \frac{P(R \& A)}{P(R \& A) + P(S \& A) + P(W \& A)}$$

$$= \frac{\left(\frac{1}{4} \times \frac{1}{4}\right)}{\left(\frac{1}{4} \times \frac{1}{4}\right) + \left(\frac{3}{10} \times \frac{3}{20}\right) + \left(\frac{9}{20} \times \frac{9}{20}\right)}$$

$$\frac{25+18+81}{400}$$

$$= \frac{1/16}{\frac{1}{16} + \frac{9}{200} + \frac{81}{400}}$$

$$= \frac{1}{16} \times \frac{25}{124} = \frac{25}{124}$$

Inferential Statistics

Probability Distribution:

↓

Normal Distribution (Bell Curve)

↓

Standard Normal Distribution

↓

Population & Sample

↓

Hypothesis Testing

- z test → One tailed / Two tailed
- t - test → "
  - Two samples

↓

Chi square

↓

ANOVA.

Tossing two coins

HH → 1/4

HT → 1/4

TH → 1/4

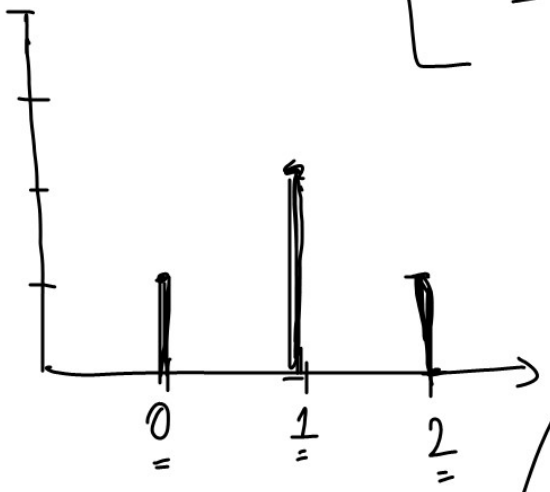
TT → 1/4.

---

0 tails → 1/4

1 tail → 1/2

2 tails → 1/4



[Probability distribution] →

↓

↔ Binomial Distribution

↔ Poissions Distribution.

↔ Normal distribution

Temprature

Discrete

Continuous

[22 ... 37]

[ ]

7 days

Every min:

Probability of temp being 28

Prob of 29.2 - 30

Probility

28 | 29 | 30 | 31 | 32 | 33 | 34

28.3 | 29.2 | μ = 31

31 ± 2.3 σ

15,000

26 - 252/15000

1....

Normal Distribution:

→ Mean = Median = Mode. ✓

→ It has only one peak.

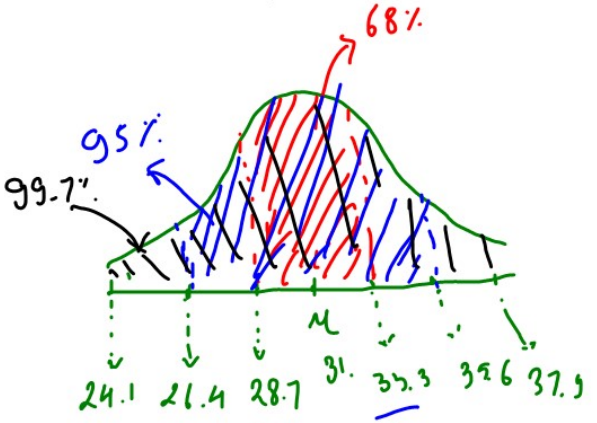
→ 68% of data lies in ±σ

95% of data " " ±2σ

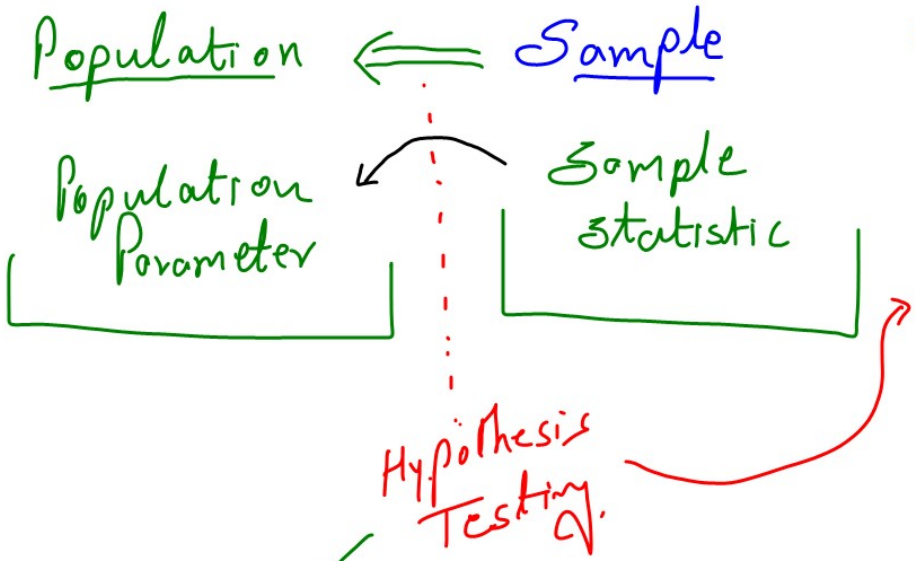
99.7% of " " ±3σ

1500

* What is the probability that temp lies btw 29.2 - 30.



New



* Used to verify a claim. Process is to find out what are the chances of the claim being true.

Sample size ≥ 30.

Step 1: Formulate Null Hypothesis and Alternate hypothesis

→ H_0: Status Quo. Present condition. $\mu \leq \$11000$

H_1: Claim (Trying) to prove. $\mu > \$11000$

Step 2: Confidance → 95% / 99% / 90%.

↓ Given

Level of significance = 100% − conf.

5% / 1% / 10%.

Step 3: Decide on the statistical Test. z-test, t-test, chi sq, ANOVA test of prop → one tailed / two tailed

Step 4: Calculate the Sample statistic: z score, t-score, Chi sq stat, f-statistic

Step 5: Compare it with critical value

Step 6: Accept/Reject H_0

→ Step 1: Formulate the Hypothesis:
- ✗ H_0: Status quo.
- ✓ H_1: Claim (Claimer wants to prove)

→ Step 2: Check for no. of tails.

→ Step 3: Decide on Level of significance (5%, 1%, 10%)

→ Step 4: Decide of the statistical test

→ Step 5: Compute the Sample statistic

→ Step 6: Compare it with critical value of statistical test statistic.

→ Step 7: Sample Statistic ⟶ Acceptance Region / Rejection Region

→ Step 8: Accpt/Reject H_0

→ Step 1: formulat Hyp.
- ✗ H_0: $\mu = \$106000$
- ✓ H_1: $\mu \neq \$106000$

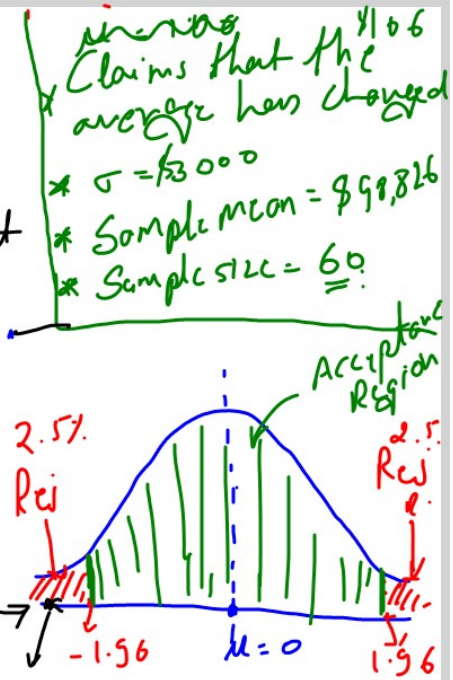
→ Step 2: Two tailed test

→ Step 3: LOS = 5%

→ Step 4: Z score

→ $Z = \frac{98826 - 106000}{3000}$

$= -2.39$



→ Rejection Region.

→ Reject H_0:
Accept H_1:

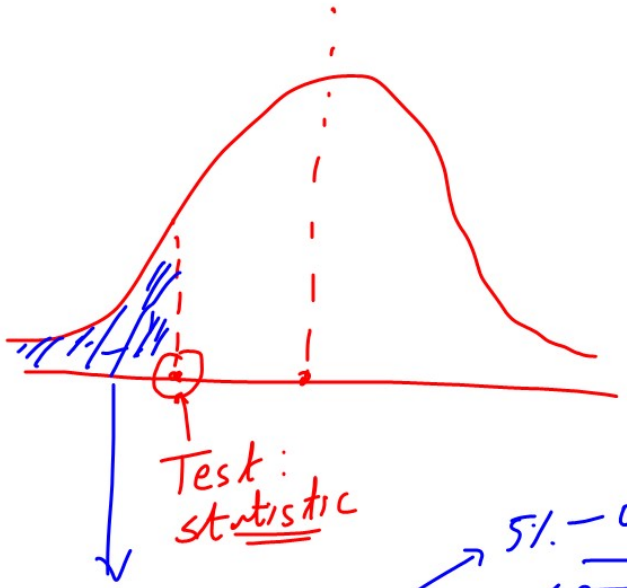
$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ → Population is infinite

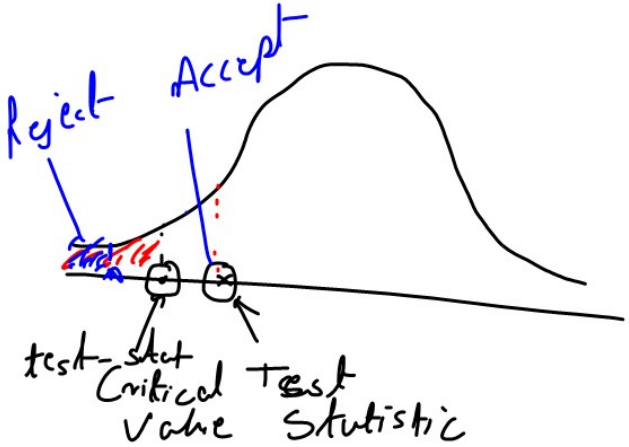
→ Sample size ≤ 30
or
→ Population st. dev is unknown

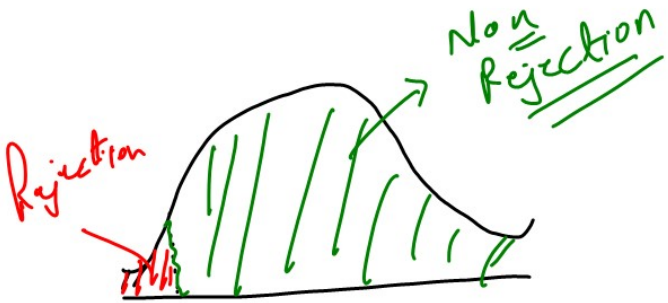
→ t test

→ No longer working with Normal dist!

→ Working with t-distribution.







Area (P value) > Los area (P value) → Accept H_0

5% – 0.05:

Area (P-value) < Los (area) → Reject H_0

If p is low null will go.