Inferential statistics

Probability :- Probability is the likelihood of the event.

$$Pr = \frac{\text{no. of way it can happen}}{\text{Total no. of outcome}}$$

Coin = H | T

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

$$= 50\%$$

Dice = 1, 2, 3, 4, 5, 6

$$Pr_{(5)} = \frac{1}{6}$$

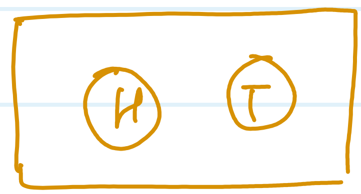
$$= 0.16$$

$$= 16\%$$

Type of probability

① mutually exclusive
② Non-mutually exclusive

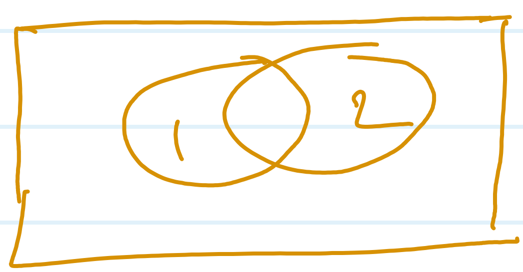
① mutually exclusive –
(single outcome)



Coin = H/T
Dice = 1/2/3/4/5/6
T/F = 1/0

② Non-mutually exclusive
(more than one outcome)

Deck of card



♡ ◇ ♤ ♧
K, J, Q, A, 2, 3 10

$$Pr_{(K)} = \frac{4}{52}$$

$$Pr_{(K \text{ and } \diamond)} = \frac{4}{52} + \frac{13}{52}$$

Rule of Probability

1. Additive rule
2. multiplicative rule.

1. Additive rule

Type- I mutually exclusive

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

Eg:- In a Dice probability of 2 and 5

$$p(2 \text{ or } 5) = P(2) + P(5)$$

$$= \frac{1}{6} + \frac{1}{6}$$

$$= \frac{2}{6}$$

$$= \frac{1}{3} \Rightarrow 0.33 \doteq 33\%$$

Type - II non-mutually exclusive

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

eg:- calculate probability of king and club in cards.

$$P(K \text{ or } \clubsuit) = P(K) + P(\text{club}) - P(K \text{ and club})$$

$$= \frac{4}{52} + \frac{13}{52} - \frac{1}{52}$$

$$= \frac{16}{52}$$

$$= \frac{4}{13}$$

$$= 0.307$$

$$= 30.7\%$$

② multiplicative rule

Type - I Independent even

$P(A)$ or $P(B)$ = $P(A) . P(B)$

Eg:- Coin (H) and Dice (4)

$P(H)$ and $P(4)$ = $\frac{1}{2} \times \frac{1}{6}$

= $\frac{1}{12}$

= 0.08

= 8%

Type - II Dependent event

$P(A)$ or $P(B)$ = $P(A) . P(B/A)$

Eg:- $P(J)$ and $P(K)$

$P(J)$ and $P(K)$ = $\frac{4}{52} \times \frac{4}{51}$

$$= \frac{4}{663}$$

$$= 0.006$$

$$= 0.6\ \%$$

① Combination

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

$$n = 4$$
$$r = 2$$

$$= \frac{4!}{2!(4-2)!}$$

$$= \frac{4!}{2! \cdot 2!}$$

$$\Rightarrow \frac{\cancel{4}^{2} \times 3 \times \cancel{2 \times 1}}{(\cancel{2} \times 1)\ \cancel{(2 \times 1)}}$$

$$\Rightarrow 6$$

$n = 8$

$r = 3$

$$\Rightarrow \frac{8!}{3!\,(8-3)!}$$

$$\Rightarrow \frac{8 \times 7 \times \cancel{6} \times \cancel{5} \times \cancel{4} \times \cancel{3!}}{\cancel{3!} \times \cancel{5} \times \cancel{4} \times \cancel{3} \times \cancel{2} \times 1}$$

$$\Rightarrow 56$$

(2) Permutation :-

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

$n = 6$

$r = 2$

$$\Rightarrow \frac{6!}{(6-2)!} \Rightarrow \frac{6 \times 5 \times \cancel{4!}}{\cancel{4!}}$$

$$\Rightarrow 30$$

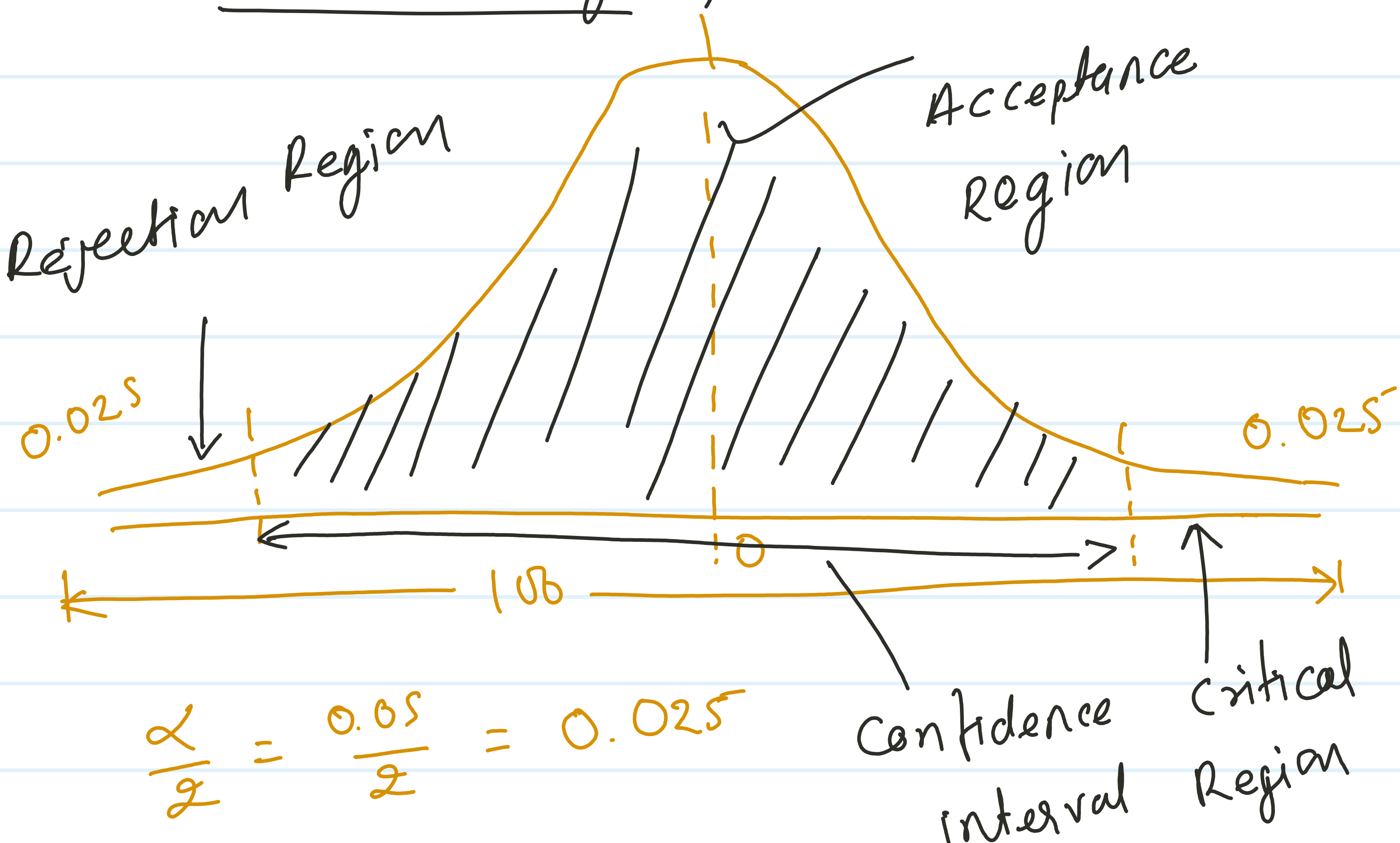
Confidence Interval

Dataset → 1000

α = Domain expert

= 5 % = 0.05

Critical region



$\frac{\alpha}{2} = \frac{0.05}{2} = 0.025$

$1 - 0.05 = 0.95$

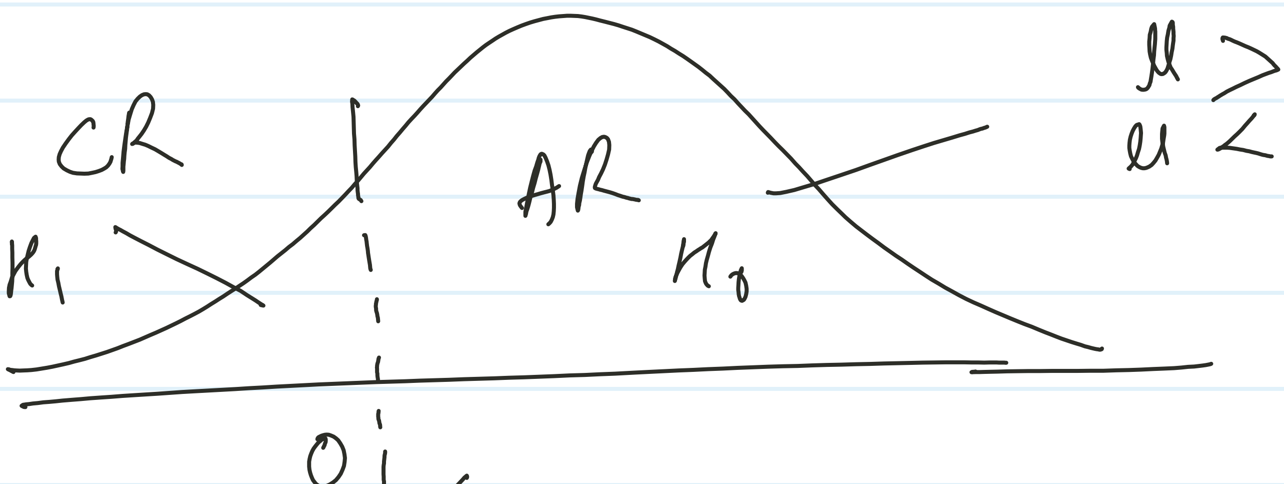
Given $\bar{x} = 92$

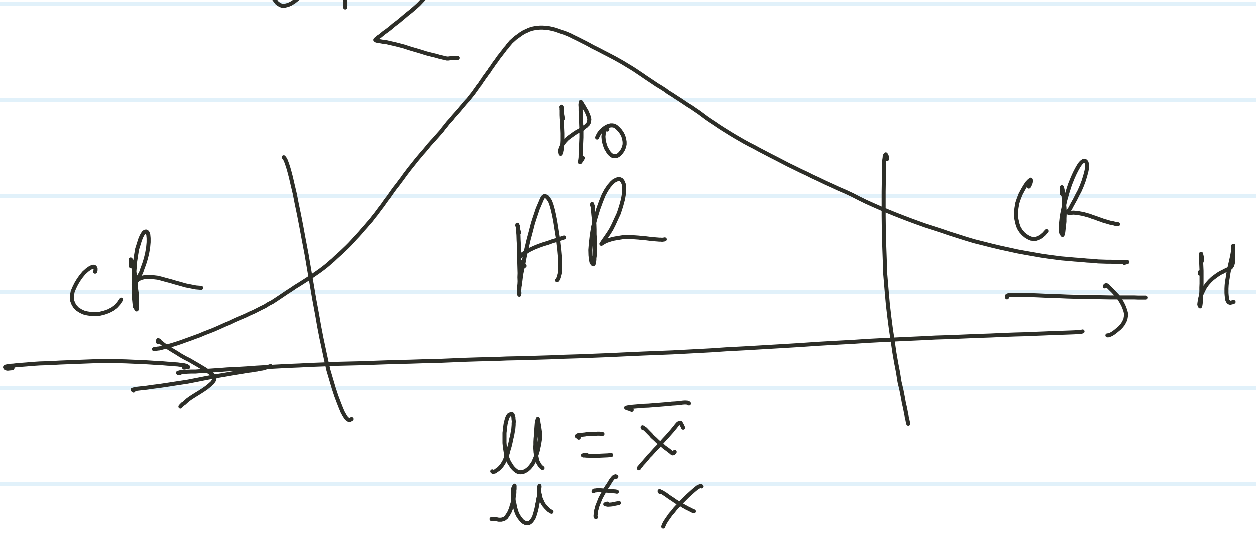
After $\bar{x} = 112$.

$\mu = \bar{x} \rightarrow H_0$ null hypo

$\mu \neq \bar{x} \rightarrow H_1$ Alternet

Two tail and one tail





$$P = \alpha$$

$$P > \alpha \Rightarrow H_0$$

$$P < \alpha \Rightarrow H_1$$

Hypothesis testing

H_0 – Null hypothesis
H_1 – Alternet hypothesis

- Parametric test
Non-parametric test

(i) PT – Z test, t-test, Binomial, poisson.

(ii) NPT – chi-square test, Anova testing
F-test

medication of headach

80%

$\mu = 80$

$\bar{x} = 55$

$\bar{x} = \mu$

Proove - null hypothesis —

We fail to reject null hypothesis

Proove - Alternet hypothesis

We reject null hypothesis
and accept alternet hypothesis.