

# Inferential statistics

Probability :- Probability is the likelihood of the event.

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

$$\text{Coin} = H / T$$

$$\begin{aligned} Pr(H) &= \frac{1}{2} \\ &= 50\% \end{aligned}$$

$$\text{Dice} = 1, 2, 3, 4, 5, 6$$

$$\begin{aligned} Pr(5) &= \frac{1}{6} \\ &= 0.16 \\ &= 16\% \end{aligned}$$

# Type of probability

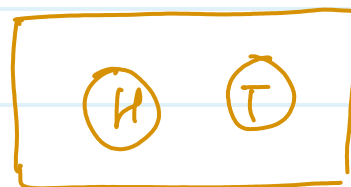
- ① mutually exclusive
- ② Non-mutually exclusive

① mutually exclusive -  
(single outcome)

$$\text{Coin} = H/T$$

$$\text{Dice} = 1/2/3/4/5/6$$

$$T/F = 1/0$$

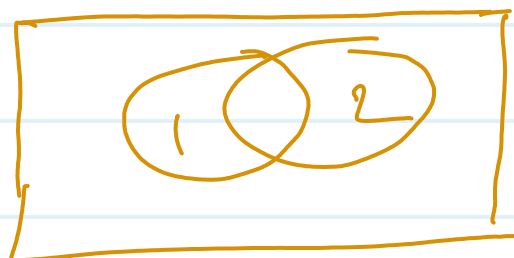


② Non-mutually exclusive  
(more than one outcome)

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 exclude

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

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

$$\begin{aligned} P(K \text{ or } \clubsuit) &= P(K) + P(\text{club}) - P(K \text{ and club}) \\ &= \frac{4}{52} + \frac{13}{52} - \frac{1}{52} \\ &= \frac{16}{52} \\ &= \frac{4}{13} \\ &= 0.307 \\ &= 30.7\% \end{aligned}$$

## ② multiplicative rule

Type-I Independent even

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

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

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

$$= \frac{1}{12}$$

$$= 0.08$$

$$= 8\%$$

Type-II Dependent event

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

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

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

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

$$= 0.006$$

$$= 0.6\%$$

## ① Combination

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

$$n = 4$$

$$r = 2$$

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

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

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

$$\Rightarrow 6$$

$$n = 8$$

$$r = 3$$

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

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

$$\Rightarrow 56$$

③ Permutation :-

$${}_n P_r = \frac{n!}{(n-r)!}$$

$$\begin{array}{l} n = 6 \\ r = 2 \end{array} \Rightarrow \frac{6!}{(6-2)!} \Rightarrow \frac{6 \times 5 \times \cancel{4} \times \cancel{3} \times \cancel{2} \times \cancel{1}}{\cancel{4} \times \cancel{3}}$$

$$\Rightarrow 30$$

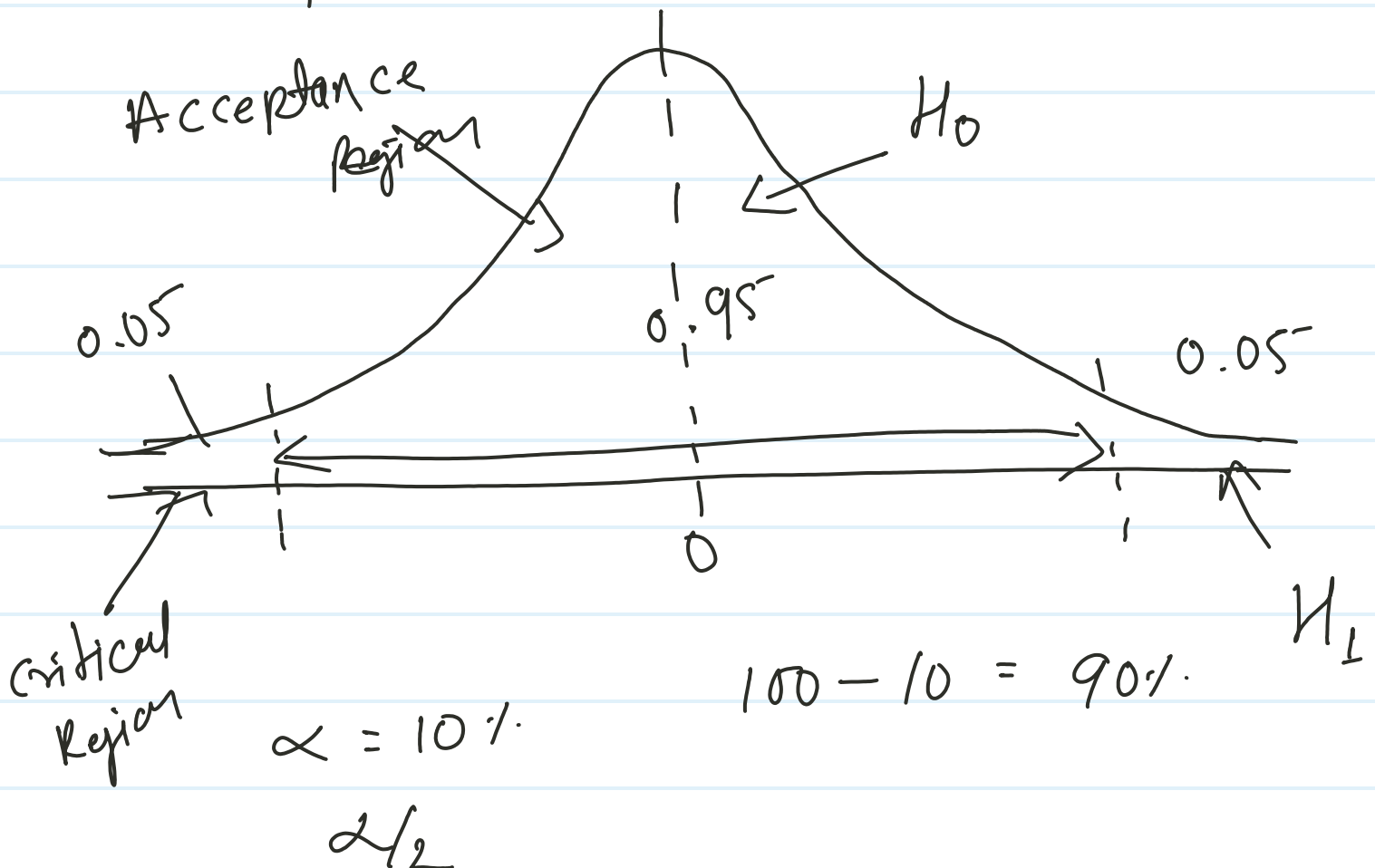
# Confidence Interval

Dataset  $\rightarrow$  1000

$\alpha$  = Domain expert  
= 5%.

## Critical region

$$100 - 5 = 95\%$$



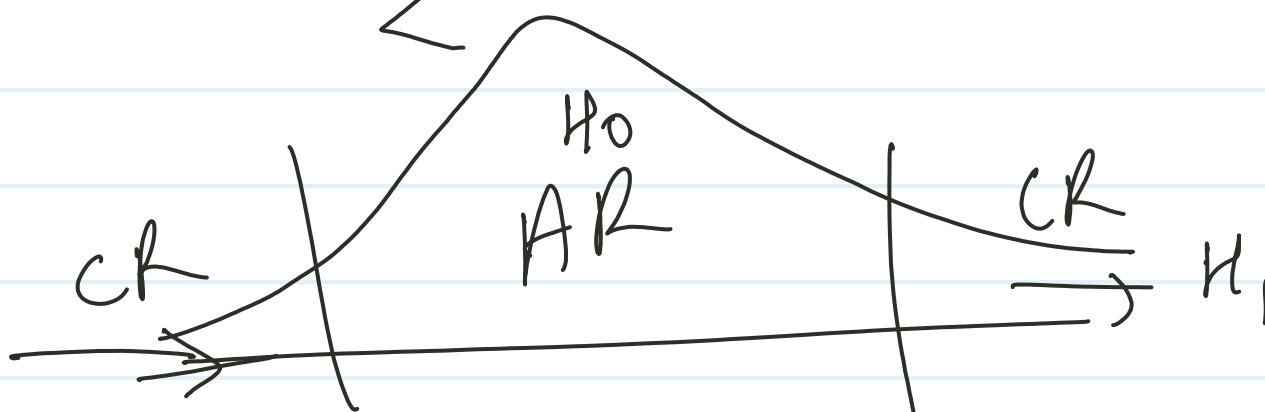
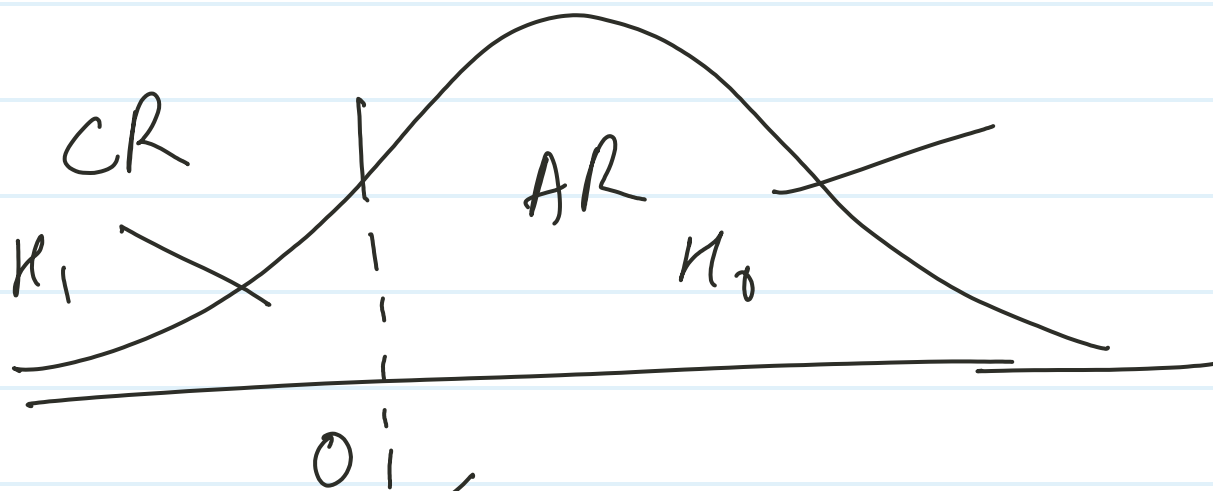


Before  $\bar{x} = 92$   
 After  $\bar{x} = 112$

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

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

Two tail and one tail



$$p = \alpha$$

$$0.06 > 0.05$$

$$H_0$$

$$0.03 < 0.05$$

$$H_1$$