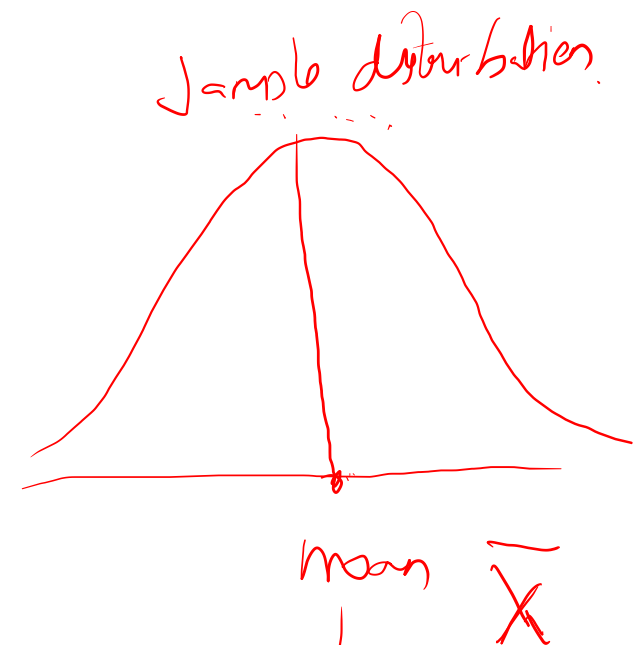
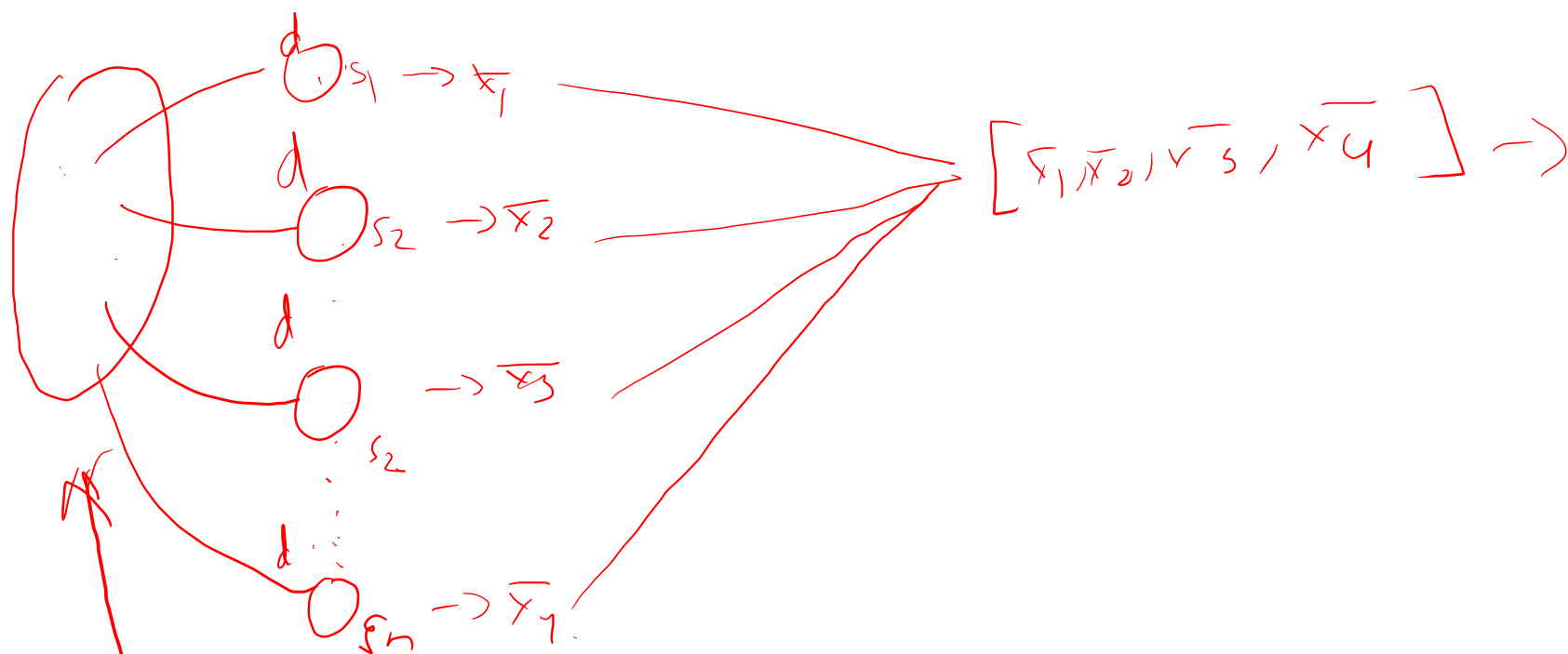


Inferential Statistics

- estimation
- hypothesis testing

CLT

MM



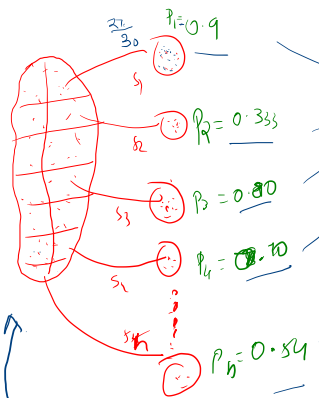
point estimation (or) population parameter.

CU

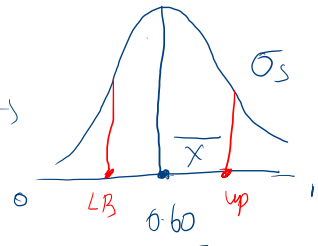
part 1

estimation

Binomial distribution



[0.9, 0.333, 0.80, 0.10, 0.54]



SE =  $\frac{\sigma_s}{\sqrt{n \cdot p}}$   
Standard error

magn of error =  $\frac{1}{\sqrt{n \cdot p}}$

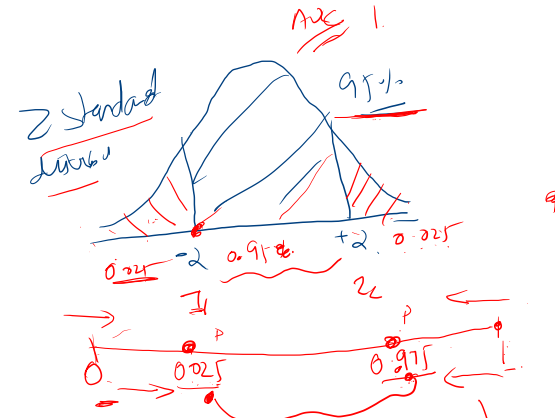
Confidence Interval

(lower bound, upper bound)

$P(z_1 < \bar{X} < z_2) = 0.95$

$z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}}$

$\frac{1-0.95}{2} = 0.025$   
 $\frac{-1.96}{2} \quad \frac{+1.96}{2}$



$P\left(\bar{X} - 1.96 \times \frac{\sigma}{\sqrt{n}} < \bar{X} < \bar{X} + 1.96 \times \frac{\sigma}{\sqrt{n}}\right) = 0.95$   
lower bound upper bound

$P\left(2.1 \times \frac{\sigma}{\sqrt{n}} < \bar{X} - \mu < 2.2 \times \frac{\sigma}{\sqrt{n}}\right) = 0.95$

$$P\left( z_1 \times \frac{\sigma}{\sqrt{n}} \leq \bar{X} - \mu < z_2 \times \frac{\sigma}{\sqrt{n}} \right) = 0.95$$

$\underbrace{\quad}_{\text{LB}} \quad \underbrace{\quad}_{\text{UB}}$

$$\rightarrow P\left( \bar{X} - z_2 \times \frac{\sigma}{\sqrt{n}} < \mu < \bar{X} - z_1 \times \frac{\sigma}{\sqrt{n}} \right)$$

CI = 0.95      LB      UB

$$P\left( \bar{X} - 1.96 \frac{\sigma}{\sqrt{n}} < \mu < \bar{X} + 1.96 \frac{\sigma}{\sqrt{n}} \right) = 0.95$$

$\underbrace{\quad}_{\text{LB}} \quad \underbrace{\quad}_{\text{UB}}$

$$\bar{X} + 1 = 2$$

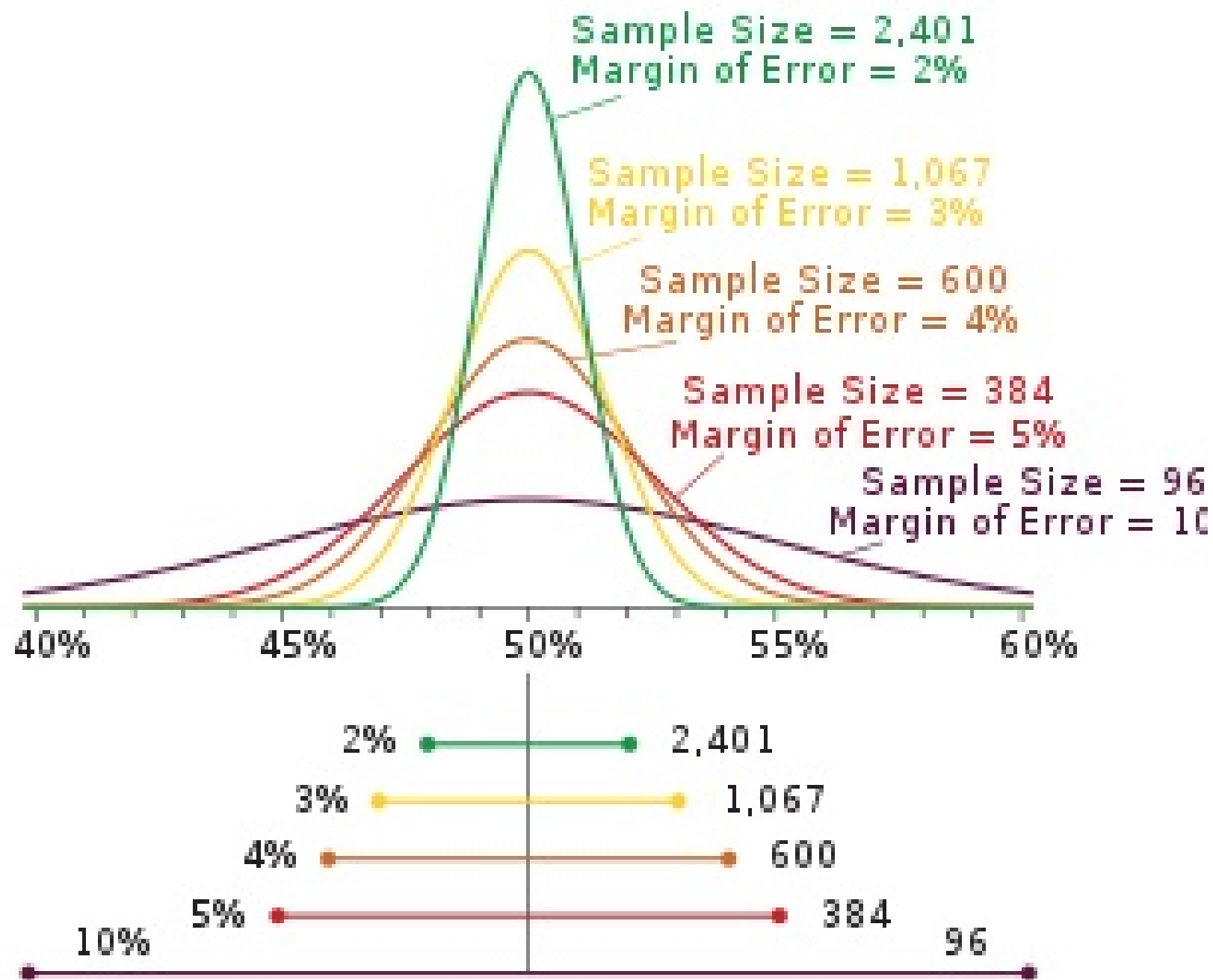
$$1 = 2 - \bar{X}$$

CI = 0.95

$\bar{X} \pm \frac{1.96 \sigma}{\sqrt{n}}$  → margin of error

$\begin{matrix} 99.1 \\ 99.1 \end{matrix}$

$$P\left( z_1 \times \frac{\sigma}{\sqrt{n}} < \bar{X} - \mu < z_2 \times \frac{\sigma}{\sqrt{n}} \right) = 0.95$$



# Hypothesis testing

Scenario  $\mu = 45$   $\sigma = 2$   $CI = 0.95$

Real  $\mu \neq 45$

Null hypothesis:  $\mu = 45$  at 95%

Alternative hypothesis =  $\mu \neq 45$

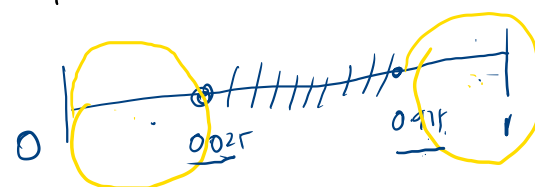
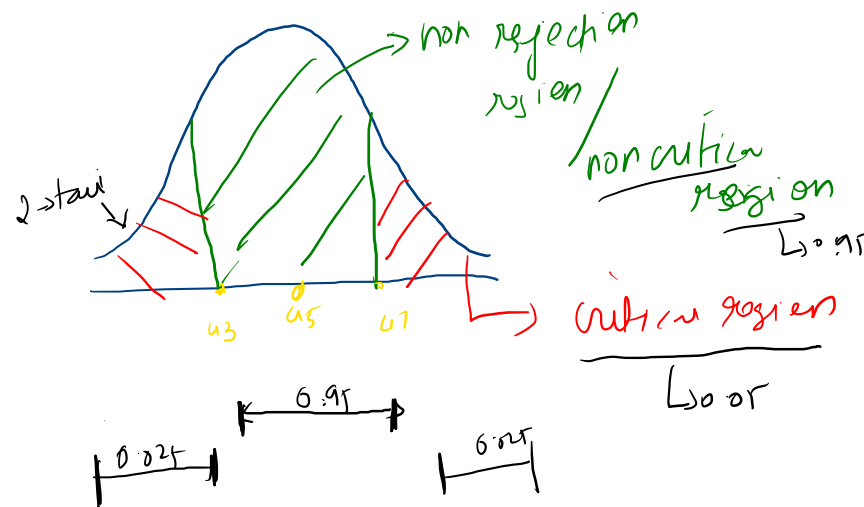
$$\alpha = 1 - CI$$

$$\alpha = 1 - 0.95$$

$$\alpha = 0.05$$

$$\alpha_1 = 0.025$$

$$\alpha_2 = 0.025$$



$s_1$   
 $s_2$   
 $\rightarrow z_1 \rightarrow p\text{-value}$

$\rightarrow z_2 \rightarrow p\text{-value}$

$s_3$

$s_4$   $s_5$

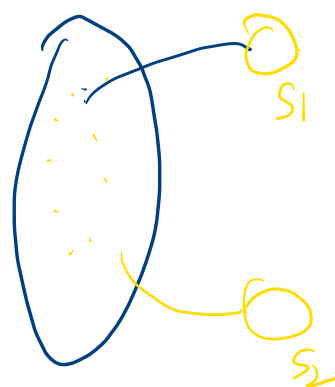
$\vdots$   
 $s_n$

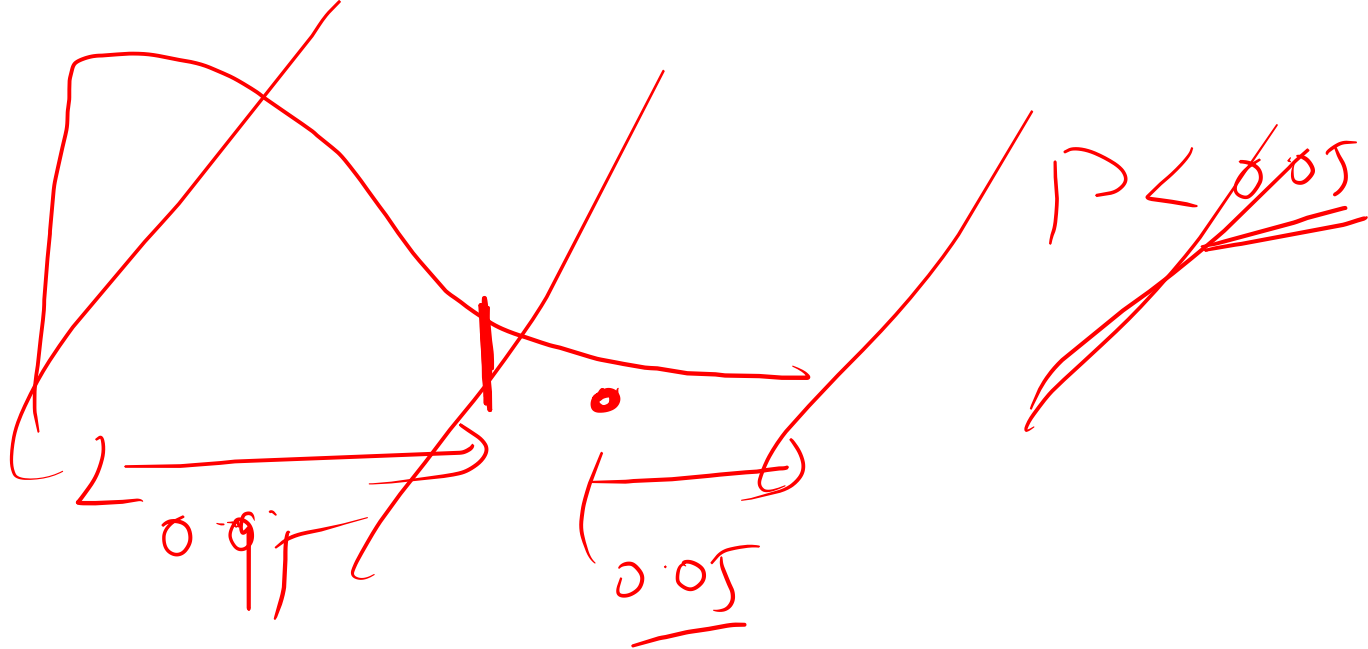
$P\text{-value} < 0.05 \rightarrow \text{reject null}$

$$P_{\text{value}} < \alpha$$

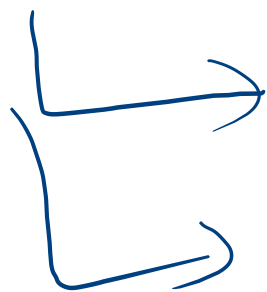
$$P > \alpha$$

$P\text{-value} > 0.05 \rightarrow \text{do not reject null}$





egvian



Type I  
Type II

→ false alarm

→ accepted alternative →

→ accepted null →

↓  
alarm you missed it