M T W T F S DATE: ________

STA301

Lec#23

* How to find probability.

x	$P(x)$
3	6
4	
5	
6	
$\sum x = 18$	

$\therefore p(x) = \frac{x}{\sum x} \therefore \frac{\cancel{3}}{\cancel{18}\ 6}$

* $\mu = \sum x p(x)$ $\therefore \mu = E(x) =$ Expected value.

* variance $= \sigma^2 = \sum x^2 p(x) + \left(\sum x p(x)\right)^2$

* Standard Deviation $= \sigma = \sqrt{\sum x^2 p(x) + \left(\sum x P(x)\right)^2}$

$E(ax + b) = aE(x) + b$

M T W T F S Lect # 24 DATE:

* Chebchev's Theoram

$(\mu - k\sigma < x < \sigma + k\sigma) \geq 1 - \frac{1}{k^2}$

* $\int_{\infty}^{\infty} f(x)\,dx$.

Lect # 25

* moments. $\mu_1' = E(X)$

$\mu_2' = E(X^2)$

$\mu_3' = E(X^3)$

$\mu_4' = E(X^4)$

$\therefore \int_{-\infty}^{\infty} x f(x)\,dx$

To find mean

* $\mu_1 = 0$

$\mu_2 = \mu_2' - (\mu_1')^2$

(2)

M T W T F S DATE:

* Moment Ratio $=$ 1st $= \beta = \frac{\cancel{\mu}}{\mu_2^3}$ $\frac{\mu_3^2}{\mu_2^3}$

2nd $= \beta = \frac{\mu_4}{\mu_2^2}$

* Joint probability distribution:

$g(x_i) = \sum_{j=1}^{n} f(x_i, y_j)$ $\because j = 1, 2 \ldots n$

$h(y_j) = \sum_{i=1}^{m} f(x_i, y_j)$ $\because i = 1, 2 \ldots m$

* $P(A/B) = \frac{P(A \cap B)}{P(B)}$ $\because f(y_j/x_i) = \frac{f(x_i, y_j)}{g(x_i)}$

$f(x_i/y_j) = \frac{f(x_i, y_j)}{h(y_j)}$

$\therefore \sum f(x_i/y_j) = 1$

$\therefore f(x_i/y_j) \geq 0$

$P(A \cap B) = P(A) \cdot P(B)$

$f(x,y) = g(x) \cdot h(y)$ Independent

$f(x,y) \neq g(x) \cdot h(y)$ non-Independent

3

lect#26

$E(X+Y) = E(X) + E(Y)$

$E(X-Y) = E(X) - E(Y)$

$E(XY) = E(X) \cdot E(Y) \Rightarrow$ for Independent

$E(X) = \sum x g(x)$

$E(Y) = \sum y h(y)$

$E(X^2) = \sum x^2 g(x)$

$E(Y^2) = \sum y^2 h(y)$

variance $(X) = \sigma^2 = E(X^2) - [E(X)]^2$

variance $(Y) = \sigma^2 = E(Y^2) - [E(Y)]^2$

$E[XY] = \sum\sum x \cdot y \, f(x,y)$

Lect#27

$$g(x) = \int_{-\infty}^{\infty} f(x,y)\,dy$$

$$h(y) = \int_{-\infty}^{\infty} f(x,y)\,dx$$

$$\mu = \mu_1' = E(X) = \int_{-\infty}^{+\infty} x \cdot g(x)\,dx$$

$$\mu = \mu_2' = E(X^2) = \int_{-\infty}^{\infty} x^2 g(x)\,dx$$

* $$E(XY) = \int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty} (x,y)\, f(x)\,dy\,dx$$

* $cov(X,Y) = E(XY) - E(X).E(Y)$

(4)

Lect#28

Binomial Distribution:

* $P(X=x) = {}^{n}C_{x}\, p^{x} q^{n-x}$

$\because x = 0,1,2, \ldots n$

It has two parameters n & p

* $\mu = np$ * $\sigma^2 = npq$
* $\mu = E(X)$ * $\sigma = \sqrt{npq}$

* If value of p & q is ~~p~~ equal it is called Sysmetrical B.D.

* If $p<q$ it is called positivily skewed
* If $p>q$ it is negativily skewed

Lect#29

Hyper Geometric Experiment:-

$$P(X=x) = \frac{{}^{k}C_{x}\; {}^{N-k}C_{n-k}}{{}^{N}C_{n}}$$

It has 3 paramtrs N, n, k

* $\mu = n.\frac{k}{N}$

* $\sigma^2 = n.\frac{k}{N} . \frac{N-k}{N} . \frac{N-n}{N-1}$

* $C.V = \frac{\sigma}{\mu} \times 100$

* in with Replacement → trials become independ
⇓ Binomial distribution lgta hai

*

(8)

Sampling \ population	Finite	Infinite
with replacement	BD	BD
without Replacement	H.GD	BD

* if $n < \frac{5}{100} N$ (WOR) then Binomial formula
* if $n > \frac{5}{100} N$ (WOR) then Hypergeometric.

* Poison Distribution

$$P(X=x) = \frac{e^{-\mu}\mu^{x}}{x!} \quad ; x = 0,1,2,3 \text{----}$$

$\therefore \mu = np$

$\therefore e = 2.71828$

* Poisson Process:

$$P(X=x) = \frac{e^{-\lambda t}(\lambda t)^{x}}{x!}$$ Here $\mu = \lambda t$

M T W T F S DATE:

* $E(X) = \mu = Var(X)$
* poison can never be negtively skewed

* Distribution
$\mu = \frac{a+b}{2}$ and variance $= \sigma^2 = \frac{(b-a)^2}{12}$

*

M T W T F S Lecture #30 DATE:

* Normal distribution

$$y = f(x) = \frac{1}{\sigma(\sqrt{2\pi})} e^{-\frac{1}{2}\left[\frac{x-\mu}{\sigma}\right]^2} \quad ; -\infty < x < \infty$$

$\because \pi \approx 3.1416$

$\because e \approx 2.71828$

* Properties from handout

$\because \mu_4 = 3\mu_2^2 \qquad \because \mu_2 = \sigma^2$

* $\beta_2 > 3$ Lepto kurtic
* $\beta_2 < 3$ platy kurtic
* $\beta = 3$ meso kurtic

* $P(\mu - \sigma \le x \le \mu + \sigma) = 0.6828$

$\mu + 2\sigma = 95.44\%$

$\mu + 3\sigma = 99.73\%$

M T W T F S DATE:

Process of STANDARization:

$$Z = \frac{X - \mu}{\sigma}$$

$\because \bar{Z} = 0$, $S.D(Z) = 1$

M T W T F S lec # 31 DATE:

* Population = N
* Sample = n
* Number of samples with Replacement = N^n
* Number of samples without Replacement = ${}^{N}C_n$
* Verification with Replacement:-
  - $\mu_{\bar{x}} = \mu$
  - $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$
  - $\sigma^2_{\bar{x}} = \frac{\sigma^2}{n}$
  - $\sigma^2_{\bar{x}} = \frac{\sigma^2}{n}$
* Verification without Replacement:-
  - $\mu_{\bar{x}} = \mu$
  - $\sigma^2_{\bar{x}} = \frac{\sigma^2}{n} \cdot \left(\frac{N-n}{N-1}\right)$
  - $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} \sqrt{\frac{N-n}{N-1}}$

DATE:

$\mu_{\bar{x}} = E(\bar{x}) = \sum \bar{x} f(\bar{x})$

$\sigma^2_{\bar{x}} = var(\bar{x}) = E(\bar{x}^2) - [E(x)]^2$

$\sigma_{\bar{x}} = \sqrt{\sigma^2_{\bar{x}}}$

4

Lec#32 DATE:

* Pop. Size = N = 310
Pop. mean = Pop Average = μ = 24,000/
Pop SD = σ = 5000/
Sample size = n = 100
Sample mean = Sample Average = $\bar{x}$ = 245...

$P(\bar{x} \geq 245000) = ?$

$\mu_{\bar{x}} = \mu = 24000$

without Rep

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} \sqrt{\frac{N-n}{N-1}}$ $\because FPC = \frac{N-n}{N-1}$

$= \frac{5000}{\sqrt{100}} \sqrt{\frac{310-100}{310-1}}$

$\sigma_{\bar{x}} = 412.20/$

$P(\bar{x} \geq 245000)$

$= P\left(\frac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}} \geq \frac{24500 - 24000}{412.20}\right)$

$= P(Z \geq 1.21)$

$= 0.50 - P(0 < Z < 1.21)$

$= 0.50 - 0.3869 = 0.1131 = 11.3\%$

★ Population proportion $= p = \frac{X}{N}$

* Sample proportion $= \hat{p} = \frac{X}{n}$

Example

pop = 1, 3, 6, 8, 9, 12

$N = 6$, $n = 3$. WOR

$m = {}^{N}C_{n} = {}^{6}C_{3} = 20$

(9)

$\hat{p} = \frac{X}{n}$

Sample	$\hat{p}$	samples	$\hat{p}$
1, 3, 6	1/3	3, 6, 8	2/3
1, 3, 8	1/3	3, 6, 9	1/3
1, 3, 9	0/3	3, 6, 12	2/3
1, 3, 12	1/3	3, 8, 9	1/3
1, 6, 8	2/3	3, 8, 12	2/3
1, 6, 9	1/3	3, 9, 12	1/3
1, 6, 12	2/3	6, 8, 9	2/3
1, 8, 9	1/3	6, 8, 12	3/3
1, 8, 12	2/3	6, 9, 12	2/3
1, 9, 12	1/3	8, 9, 12	2/3

Sampling of $\hat{p}$

$\hat{p}$	f	$f(\hat{p})$	$\hat{p}f(\hat{p})$	$\hat{p}^2 f(\hat{p})$
0/3	1	1/20	0/60	0/180
1/3	9	9/20	9/60	9/180
2/3	9	9/20	18/60	36/180
3/3	1	1/20	3/60	9/180
	20		30/60	= 45/180

$\mu_{\hat{p}} = E(\hat{p}) = \sum \hat{p} f(\hat{p})$

$= 30/60 = 1/2 = 0.5$

$\sigma^2_{\hat{p}} = \cancel{E(\hat{p}^2)} = \sum \hat{p}^2 f(\hat{p}) - \left[\sum \hat{p} f(\hat{p})\right]^2$

$= \frac{45}{180} - \left(\frac{30}{60}\right)^2$

$= \frac{45}{180} - \frac{900}{3600} = 0.05$

$\cancel{\sigma^2_{\hat{p}} = E(\hat{p}^2)}$

$p = \frac{X}{N} = \frac{3}{6} = \frac{1}{2} = 0.5$

verifficatio

* $\mu_{\hat{p}} = p = 0.5$

* $\sigma^2_{\hat{p}} = \frac{pq}{n} \cdot \frac{N-n}{N-1} = \frac{0.25}{3} \cdot \frac{6-3}{6-1}$

$= \frac{0.25}{5} = 0.05 = Var(\hat{p})$

(10)

$\sigma_{\hat{p}} = \sqrt{\frac{pq}{n} \cdot \frac{N-n}{N-1}}$ withReplacmt

$\sigma_{\hat{p}} = \sqrt{\frac{pq}{n}}$ WOR

Ex# Lec# 33

A	B
$\mu_1 = 4.3$	$\mu_2 = 4.0$
$\sigma_1 = 0.6$	$\sigma_2 = 0.4$
$n_1 = 49$	$n_2 = 36$
$\bar{X}_1$	$\bar{X}_2$

$P(\bar{X}_1 - \bar{X}_2 \geq 0.5) = ?$

First

$$\mu_{\bar{X}_1 - \bar{X}_2} = \mu_1 - \mu_2 = 4.3 - 4.0 = 0.3$$

$$\sigma_{\bar{X}_1 - \bar{X}_2} = \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}} = 0.1086$$

$$P(\bar{X}_1 - \bar{X}_2 \geq 0.5)$$

$$= P\left(\frac{\bar{X}_1 - \bar{X}_2 - \mu_{\bar{X}_1 - \bar{X}_2}}{\sigma_{\bar{X}_1 - \bar{X}_2}} \geq \frac{0.5 - 0.3}{0.1086}\right)$$

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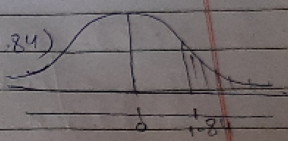
$$= P(Z \geq 1.84)$$

$$= 0.5 - P(0 < Z < 1.84)$$

$$= 0.5 - 0.4671$$

$$= 0.0329$$

$$= 3.29\%$$



$= \bar{X}_1 - \bar{X}_2 = d$

Example:-

A	B
$P_1 = 30\% = 0.30$	$P_2 = 20\% = 0.20$
$n_1 = 100$	$n_2 = 100$
$\hat{p}_1 = 0.34$	$\hat{p}_2 = 0.13$

$$\hat{p}_1 - \hat{p}_2 = 0.34 - 0.13 = 0.21$$

$$P(\hat{p}_1 - \hat{p}_2 \geq 0.21) = ?$$

$$\mu_{\hat{p}_1-\hat{p}_2} = P_1 - P_2 = 0.30 - 0.20$$
$$= 0.10$$

$$\sigma_{\hat{p}_1-\hat{p}_2} = \sqrt{\frac{P_1 q_1}{n_1} + \frac{P_2 q_2}{n_2}}$$

$$= \sqrt{\frac{(0.30)(0.70)}{100} + \frac{(0.20)(0.80)}{100}}$$

$\because P_1 = 0.30$

$\because q_1 = 1 - P_1$

$\because q_1 = 0.70$

$\because P_2 = 0.20$

$\because q_2 = 0.80$

$$= 0.0037$$

Now!

$$P(\hat{P}_1 - \hat{P}_2 \geq 0.21)$$

$$P\left(\frac{(\hat{P}_1 - \hat{P}_2) - \mu_{\hat{p}_1-\hat{p}_2}}{\sigma_{\hat{p}_1-\hat{p}_2}} \geq \frac{0.21 - 0.10}{0.0037}\right)$$

$$P(Z \geq 1.83)$$

(12)

$$= 0.50 - P(0 < Z \leq 1.83)$$
$$= 0.50 - 0.4664$$
$$= 0.0336$$
$$= 3.36\%$$

Point Estimation:-

pop. parameter (constant val)

$\theta = \mu, \sigma^2, \sigma, p$, etc

sample statistic / (random variable)

$\hat{\theta} = \bar{X}, s^2/S^2, s/S, \hat{P}$ etc

$$\bar{X} = \frac{\sum X}{n}$$

$$\bar{X} = T = \hat{\theta} = f(X)$$

lec#34

DATE:

Eficiency:-

* $E(\bar{X}) = \mu$ $E(\tilde{X}) = \mu$

$var(\bar{X}) = ?$ $var(\tilde{X}) = ?$

* $var(\bar{X}) = E(\bar{X}^2) - [E(\bar{X})]^2$
* $var(\tilde{X}) = E(\tilde{X}^2) - [E(\tilde{X})]^2$

* $var(\bar{X}) < var(\tilde{X})$

$\bar{X}$ is more effecient estimator ~~than~~ than $\tilde{X}$ for population mean-

OR

* $E_f = \frac{var(\tilde{X})}{var(\bar{X})} = \frac{3}{2} = 1.5 > 1$

* $E_f = \frac{var(\bar{X})}{var(\tilde{X})} = \frac{2}{3} = 0.67 < 1$

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DATE:

* Point estimation:- Ex#

$N = 1000$, μ = pop. mean weight = ?

$n = 100$, $\bar{X} = \frac{\sum x}{n} = \frac{6500}{100} = 65kg$

on the average students have weight 65 kg.

methods of Estimation:-

* methods of Moments:-

$m_1' = \frac{\sum x'}{n} = \bar{X}$ = sample moment about origin

population moment about origin $= \mu_1' = \int_{-\infty}^{\infty} x . f(x) dx$

$= \int_0^{\theta} x . \frac{1}{\theta} dx$

$$= \frac{1}{\theta}\left[\frac{x^2}{2}\right]_0^{\theta}$$

$$= \frac{1}{\theta}\left(\frac{\theta^2}{2} - \frac{0^2}{2}\right)$$

$$\mu_1' = \frac{1}{\theta} \cdot \frac{\theta^2}{2} = \frac{\theta}{2}$$

Equaling $m_1' = \mu_1'$

$$\frac{\Sigma x}{n} = \frac{\theta}{2}$$

$$\bar{x} = \frac{\theta}{2}$$

$$2\bar{x} = \theta$$

put hat

$$\boxed{\hat{\theta} = 2\bar{x}}$$

$$m_r' = \frac{\Sigma x^r}{n}$$

$$\boxed{m_1' = \frac{\Sigma x'}{n} = \bar{x}}$$

$$\boxed{m_2' = \frac{\Sigma x^2}{n}}$$

$$\mu_r' = \int_{-\infty}^{+\infty} x^r f(x)\,dx$$

μ_1', μ_2'

As

$$\boxed{\mu_1' = \mu}$$

$$\mu_2 = \mu_2' - \mu_1'^2$$

$$\sigma^2 = \mu_2' + (\mu)^2$$

$$\boxed{\sigma^2 + \mu^2 = \mu_2'}$$

Equaling

$$\mu_1' = m_1'$$

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

$$\hat{\mu} = \bar{x}$$

also

$$\mu_2' = m_2'$$

$$\sigma^2 + \mu^2 = \frac{\Sigma x^2}{n} \Rightarrow$$

$$\sigma^2 + (\bar{x})^2 = \frac{\Sigma x^2}{n}$$

$$\sigma^2 = \frac{\Sigma x^2}{n} - (\bar{x})^2$$

$$\sigma^2 = \frac{\Sigma x^2}{n} - \left(\frac{\Sigma x}{n}\right)^2$$

$$\sigma^2 = s^2$$

method of least square

$X = a + bx$

method of maximum likelihood

posion distribution $MLE = \bar{X}$

$G.D = \frac{1}{\bar{X}}$

$B.D = \bar{X}$

lec #35

Interval Estimation:-

* $X \sim N(\mu, \sigma^2) =$
* $\bar{X} \sim N(\mu_{\bar{X}}, \sigma^2_{\bar{X}}) = N(\mu, \frac{\sigma^2}{n})$
* $\hat{p} \sim N(\mu_{\hat{p}}, \sigma^2_{\hat{p}}) = (p, \frac{pq}{n})$
* $(\bar{X}_1 - \bar{X}_2) \sim N(\mu_{\bar{X}_1 - \bar{X}_2}, \sigma^2_{\bar{X}_1 - \bar{X}_2})$
* $(\hat{p}_1 - \hat{p}_2) \sim N(\mu_{\hat{p}_1 - \hat{p}_2}, \sigma^2_{\hat{p}_1 - \hat{p}_2})$

$(\bar{X}_1 - \bar{X}_2) \sim N(\mu_{\bar{X}_1 - \bar{X}_2}, \sigma^2_{\bar{X}_1 - \bar{X}_2}) = (\mu_1 - \mu_2, \frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}$

M T W T F S DATE:

* $Z = \frac{X-\mu}{\sigma}$

* $Z = \frac{\bar{X}-\mu_{\bar{x}}}{\sigma_{\bar{x}}} = \frac{\bar{X}-\mu}{\frac{\sigma}{\sqrt{n}}}$

* $Z \sim N(0, 1)$

$\mu_Z = \bar{Z} = 0, \quad \sigma_Z^2 = 1$

* $P(-1.96 < Z < 1.96) = 0.95$
* $P\left(-1.96 < \frac{\bar{X}-\mu}{\frac{\sigma}{\sqrt{2}}} < 1.96\right) = 0.95$

* C.I for mean (pop) (μ)

$\bar{X} \pm Z_{\alpha/2} \frac{S}{\sqrt{n}}$

$\therefore n = \Sigma f$

M T W T F S DATE:

* Confidence interval difference Between the means of Two populations:-

$(\bar{X}_1 - \bar{X}_2) \pm Z_{\alpha/2}\sqrt{\frac{S_1^2}{n_1}+\frac{S_2^2}{n_2}}$

when $n_1 \geq 30, n_2 \geq 30$

Lec #36

$\hat{p} \pm z_{\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

$\because \hat{p} = \frac{x}{n}$

confidence interval for P1-P2

$(\hat{p}_1 - \hat{p}_2) \pm z_{\alpha/2}\sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$

$\because \hat{q}_1 = 1-\hat{p}_1$

sample size for Estimating population mean

$n = \left(\frac{z_{\alpha/2}\,\sigma}{e}\right)^2 \quad \because e = |\bar{x} - \mu|$

$\because z_{\alpha/2} = 1.96$

Sample size for estimating population proportion

$n = \frac{(z_{\alpha/2})^2 \hat{p}\hat{q}}{e^2}$

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Hypothesis ~~test~~ : Also read Book Handout

. Null Hypothesis

. Alternative Hypothesis

Type-I and Type II ERROR

α = P(TYPE-I Error)

= P(Reject H_0 | H_0 is True)

β = P(TYPE II Error)

= P(Accept H_0 | H_0 is false)

M T W T F S Lect #37 DATE:

Pop. size	Sample-size
Parameter $N = 1000$ ⇒ Population	$n = 100$ Statistics
$\mu = \frac{\Sigma X}{N}$ Pop. mean	$\bar{x} = \frac{\Sigma x}{n}$ statistics ⇓ Random Variable

Next from Handout
and also ; click apk in whtp-

16

M T W T F S Lect#38 DATE:

S^2 is unbiased estimator of σ^2
~~σ^2 is unbiased~~
S^2 is biased estimator.

~~mean~~ $E(S^2) \neq \sigma^2$

$E(s^2) = \sigma^2$

when
* $n < 30$ use s^2 & t-distribution
* $n \geq 30$ use s^2 or S^2, Z-distribution

* $\mu_1 - \mu_2 = 0$ Insignificant difference
* $\mu - \mu_2 \neq 0$ Significant difference

* $Z = \frac{X \pm \frac{1}{2} - nP_0}{\sqrt{nP_0(1-P_0)}}$

lec#39 DATE:

$$Z = \frac{(\hat{P}_1 - \hat{P}_2) - \mu_{\hat{P}_1 - \hat{P}_2}}{\sigma_{\hat{P}_1 - \hat{P}_2}}$$

$$= \frac{(\hat{P}_1 - \hat{P}_2) - (\hat{P}_1 - \hat{P}_2)}{\sqrt{\frac{P_1 q_1}{n_1} + \frac{P_2 q_2}{n_2}}}$$

Example

$$= \frac{(\hat{P}_1 - \hat{P}_2) - 0}{\sqrt{\hat{P}_c \hat{q}_c \left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$\therefore$ $$P_c = \frac{X_1 + X_2}{n_1 + n_2}$$

$$\hat{P}_c = \frac{n_1 \hat{P}_1 + n_2 \hat{P}_2}{n_1 + n_2}$$

lec#39 DATE:

T-Distribution.

formula:-

$$y = f(x) = \frac{1}{\sqrt{v}\,\beta\left(\frac{1}{2}, \frac{v}{2}\right)} \left(1 + \frac{x^2}{v}\right)^{-(v+1)/2}$$

$-\infty < x < \infty$

It has only one parameter v, which is known as degree of freedom $v = n-1$

$v \geq 2$

variance of t-distribution:

$$\sigma^2 = \frac{v}{v-2} \quad \text{for } v > 2$$

Sumarization of formulas

DATE:

Confidence Interval for μ (population mean)

	σ^2 known	σ^2 unknown
$n \geq 30$	$\bar{x} \pm Z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$	$\bar{x} \pm Z_{\alpha/2} \frac{s}{\sqrt{n}}$
$n < 30$	$\bar{x} \pm Z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$	$\bar{x} \pm t_{\alpha/2, v} \frac{s}{\sqrt{n}}$

Confidence Interval for $(\mu_1 - \mu_2)$ (Diff B/w pop. mean)

σ_1^2, σ_2^2 known	σ_1^2, σ_2^2 unknown
$(\bar{x}_1 - \bar{x}_2) \pm Z_{\alpha/2} \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$	$(\bar{x}_1 - \bar{x}_2) \pm Z_{\alpha/2} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$
$(\bar{x}_1 - \bar{x}_2) \pm Z_{\alpha/2} \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$	$(\bar{x}_1 - \bar{x}_2) \pm t_{\alpha/2, v} \cdot S_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$

DATE:

C.I for Proportion (p)

$$\hat{p} \pm Z_{\alpha/2} \sqrt{\frac{\hat{p}\hat{q}}{n}} \quad \because \hat{q} = 1 - \hat{p}$$

C.I for diff B/w Pop. proportion

$$(\hat{p}_1 - \hat{p}_2) \pm Z_{\alpha/2} \sqrt{\frac{\hat{p}_1\hat{q}_1}{n_1} + \frac{\hat{p}_2\hat{q}_2}{n_2}}$$

Lec#40

* σ unknown & $n<30$

$$t = \frac{\bar{X} - \mu_0}{S/\sqrt{n}} \quad \because v = n-1$$

* $$S_p = \sqrt{\frac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{n_1+n_2-2}}$$

* $$(\bar{X}_1 - \bar{X}_2) \pm t_{(\alpha/2, v)} \cdot S_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

Lec#41

Example:-

1. $\mu_d = \mu_1 - \mu_2 = 0 \qquad \mu_1 = \mu_2$

   $\mu_d = \mu_1 - \mu_2 \neq 0 \qquad \mu_1 \neq \mu_2$

1. $H_0 : \mu_d = 0$

   $H_1 : \mu_d \neq 0$

2. $\alpha = 0.05$

3. $t = \frac{\bar{d} - \mu_d}{S_d/\sqrt{n}}$, $t = 2.09$

5. $t_{\alpha/2, v} = t_{(0.025, 0)}$

6. H_0 Accepted

   $H_0 : \mu_d = 0$