$\mu = (\sum x)/N = \sum XiYi/N \quad med = X\frac{n+1}{2} = L1 + \frac{\frac{n+1}{2} - Fj - 1}{Nj} \quad MD = \sum\frac{|Xi-\mu|}{N} \quad Range = Xmax - Xmin \quad \sigma^2 = \frac{\sum Xi^2 - (\sum Xi)^2/N}{N} = \frac{\sum NiXi^2 - (\sum NiXi)^2/N}{N}$ تغييرات ضريب $CV = \sigma/\mu \times 100$

اگر دو گروه را روي هم بريزيم $\mu = N1\mu1 + N2\mu2/N \quad \sigma^2 = \frac{N1\sigma1^2 + N2\sigma2^2}{N1+N2} + \frac{N1N2(\mu1-\mu2)^2}{(N1+N2)^2}$

$\binom{N}{X} = NCx = N!/x!\,(N-x)! \qquad \mu_x = np \quad \sigma_x^2 = npq$

$P(A\ or\ B) = P(A \cup B) = P(A) + P(B) - P(A \cap B) \quad P(A\ and\ B) = P(A \cap B) = P(A) \times P(B) \quad P(A|B) = P(A \cap B)/P(B)$

اي جمله دو توزيع $P_N(x) = NCx \times P^x \times q^{N-x}$

پواسون $\tilde{P} = x/n = \bar{x} \quad \frac{x}{n} \xrightarrow{n\ \text{بزرگ}} N(P, \sqrt{\frac{pq}{n}}) \quad np, nq > 5, Z = \frac{\bar{P} - P}{\sqrt{\frac{pq}{n}}} \quad , \quad CI(p_{(1-\alpha)100}) = \tilde{P} \pm Z_{1-\frac{\alpha}{2}}\sqrt{\frac{\tilde{p}\tilde{q}}{n}} \quad p \to 0, n \to +\infty \quad \mu_x = np = \lambda \quad P_n(x) = e^{-\lambda} \times \lambda^x/x!$

$z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}} \quad CI = \bar{X} \pm Z_{1-\frac{\alpha}{2}}\frac{\sigma}{\sqrt{n}} \quad t = \frac{\bar{X} - \mu}{s/\sqrt{n}} \quad CI = \bar{X} \pm t_{1-\frac{\alpha}{2},df}\frac{s}{\sqrt{n}} \quad S^2 = \frac{\sum Xi^2 - (\sum Xi)^2/N}{N-1}$

α	1-α/2	Z
.01	.995	2.575
.05	.975	1.96
.1	.95	1.64

	%	Z
1σ	68	.3413
2σ	95	.4772
3σ	97	.4987

اطمينان فاصله از نيمي $\sim 2\sigma$ دقت $d = Z_{1-\frac{\alpha}{2}}\frac{\sigma}{\sqrt{n}}$ نمونه تعداد $n = Z_{1-\frac{\alpha}{2}}^2\sigma^2/d^2$

نسبت $n = Z_{1-\frac{\alpha}{2}}^2 pq/d^2$ اگر $.21 < pq < .25$ نداشتيم شيوع

آزمون فرضيه يك نسبت در جامعه

$\mu_{\tilde{p}} = P \quad \sigma^2_{\tilde{p}} = \frac{pq}{n} \quad Z = \frac{\tilde{P} - P_0}{\sqrt{\frac{p_0 q_0}{n}}} \quad np, nq > 5$

آزمون فرضيه تفاوت دو نسبت H0: P1=P2

$\tilde{P}_1 - \tilde{P}_2 \sim N\left(P_1 - P_2, \sqrt{\frac{p_1q_1}{n_1} + \frac{p_2q_2}{n_2}}\right) \quad Z = \frac{(\tilde{P}_1 - \tilde{P}_2) - (P_1 - P_2)}{\sqrt{\frac{\bar{p}\bar{q}}{n_1} + \frac{\bar{p}\bar{q}}{n_2}}} \quad CI_{(1-\alpha)100} = (\tilde{P}_1 - \tilde{P}_2) \pm Z_{1-\frac{\alpha}{2}}\sqrt{\frac{p_1q_1}{n_1} + \frac{p_2q_2}{n_2}} \quad \bar{P} = \frac{X_1 + X_2}{N_1 + N_2}$

Mcnemar (ordinal/nominal)اسمي
(A:بوده - شده+) (D: شده + بوده-)
$X^2 = \frac{[(A-D)-1]}{A+D} \quad df = (r-1)(c-1) \quad A + D > 10\ valid$

آزمون فرضيه تفاوت دو ميانگين $\mu_1 - \mu_2 = 0$ اگر σ نامعلوم باشد ولي n بزرگ باشد بجاي آن s ميگذاريم
$Z_c = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$

آزمون فرضيه تفاوت دو ميانگين با توزيع نا معلوم وحجم

$t = \frac{(X_1 - X_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}}} \quad \bar{X} = \frac{n_1X_1 + n_2X_2}{n_1 + n_2} \quad S_p^2 = \frac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{n_1 + n_2 - 2} \quad CI_{(1-\alpha)100}(\mu_1 - \mu_2) = (\bar{X}_1 - \bar{X}_2) \pm t_{1-\frac{\alpha}{2},df}\sqrt{\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}} \quad \mu_1 - \mu_2 = 0$

pair t test (non:wilcoxon)(Mcnemar اسمي)(befor/after) $(H_0 = \mu_d \geq 0)$
2 گروه داده كمي وابسته اگر واريانس معلوم باشد استفاده از z

$t = \frac{\bar{d} - \mu_d}{S_d/\sqrt{n}} \quad df = n - 1 \quad S_d = \frac{\sum d^2 - (\sum d)^2/n}{n-1}$

Student t test (Mann whitney رتبه اي) 2 گروه داده كمي برحسب متغير كيفي
معنا دار بودن آماري تفاوت ميانگين ها

$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \quad df = n_1 + n_2 - 2 \quad S_p$

Chi square ((non: fisher exact test 2*2 nominal/ordinal)
داده كيفي-كيفي حجم نمونه بيشتر از 40 يا 20% خانه ها بيشتر از 5

$X^2 = \sum\frac{(O_i - E_i)^2}{E_i} \quad df = (r-1)(c-1) \quad 2*2\ X^2 = \frac{n(ad-bc)^2}{(a+c)(b+d)(a+b)(d+b)}$

Correlation (pearson) (Kendaull غير نرمال) رابطه 2 گروه داده

كمي $S_w^2 = \frac{1}{n-3} \quad t = r\sqrt{\frac{n-2}{1-r^2}} = \frac{w}{1/\sqrt{n-3}} \quad w = \mu_w = \frac{1}{2}ln\frac{1+r}{1-r}$

$r = \frac{S_{xy}}{S_x.S_y} = \frac{\sum(X_i - Y_i)^2}{\sum(X_i - \bar{X})^2.\sum(Y_i - \bar{Y})^2} = \frac{n\sum XY - \sum X.\sum Y}{\sqrt{n[\sum X^2 - (\sum X)^2]n[\sum Y^2 - (\sum Y)^2]}}$

Regression $b = \frac{S_{xy}}{Ss_x} = \frac{\sum XY - \frac{\sum X.\sum Y}{n}}{\sum X^2 - \frac{(\sum X)^2}{n}} \quad a = \bar{y} - b\bar{x} \quad r^2 = \frac{b^2[\sum X_i^2 - \frac{(\sum X_i)^2}{n}]}{\sum Y_i^2 - \frac{(\sum Y_i)^2}{n}} = SS_{explaned}/SS_{total} \quad S_{y|x}^2 = \frac{\sum(Y_i - Y_c)^2}{n-2} \quad x$ براي $\mathbf{y} CI_{y_c} = y_c \pm t_{\left(1-\frac{\alpha}{2}\right)(n-2)}S_{y|x}\sqrt{1 + \frac{1}{n} + \frac{(X_p - \bar{X})^2}{\sum(X_i - \bar{X})^2}}$

ميانگين براورد $CI_y = y \pm t_{\left(1-\frac{\alpha}{2}\right)(n-2)}S_{y|x}\sqrt{\frac{1}{n} + \frac{(X_p - \bar{X})^2}{\sum(X_i - \bar{X})^2}} \quad t = \frac{b-0}{S_{y|x}/\sqrt{Ss_x}} \quad CI_b = b \pm t_{(1-\alpha/2)(n-2)}.S_{y|x}/\sqrt{Ss_x} \quad t =$

$\frac{a-0}{S_{y|x}/\sqrt{\frac{1}{n} + \frac{\bar{X}^2}{Ss_x}}} \quad CI_a = a \pm t_{\left(1-\frac{\alpha}{2}\right)(n-2)}S_{y|x}/\sqrt{\frac{1}{n} + \frac{\bar{X}^2}{Ss_x}}$

One way Anova (non: kruskal wallis) کمي –کيفي بيش از 2 گروه

		SS	df	Ms	
Between	B	$\sum n_k(\bar{X}_k - \bar{\bar{X}})^2$	k-1	SSB/k-1	F=MSB/MSW
Within	W	SST-SSB	n-k	SSW/n-k	
Total	T	$\sum (X_{nk} - \bar{\bar{X}})^2$	n-1		SST=$\sum({X_{nk}}^2) - \frac{T^2}{N}$

Errore: random(chance)

Systematic (Bios)

Informative ,Selection, Confound

Bios: Differential Nondiffrential

PICO: participants, Interventions, Comparisons, Outcome

Two variables of classification (non: friedman) کمي –کيفي بيش از 2 گروه

		SS	df	Ms		
Row	c	$\sum {\bar{X}_k}^2 - CF$	k-1	SSc/k-1	F=MSc/MSE F= MSr/MSE F(1- α)	H0=$\mu_{10}=\mu_{20}=\ldots=\mu_{k0}$
Column	r	$\sum {\bar{X}_n}^2 - CF$	n-1	SSr/n-1		
Residual (error)	E	SSE=SST-SSc-SSr	(c-1)(r-1)	SSE/df		H0=$\mu_{01}=\mu_{02}=\ldots=\mu_{0n}$
Total	t	$\sum {X_{nk}}^2 - CF$	Kn-1	$CF = \sum \frac{{X_{nk}}^2}{cr} = \frac{T^2}{cr}$		

کيفي-کيفي Chi square (fisher exact test) (spearman رتبه اي)

کمي-کمي
- **Correaltion pearson (Kendal No NL)**
- **Regression**

کمي-کيفي :
- **2**
  - **جور pair t test (wilcoxon)**
  - **مستقل student t test (mann withney)**
- **>2**
  - **one Anova (kruskal wallis)**
  - **Two way: repeated**

تفاوت
- **2 group**
  - **مستقل : (کمي :Two t test) (اسمي: chi sq ارتباط) (رتبه اي: mann withney)**
  - **وابسته : (کمي: pair test (wilcoxon)) (اسمي:Mc nemar)**
- **>2 group**
  - **يك فاكتور : one way Anova(kruskal wallis) (مربوط به هم –درون موردي Cochran)**
  - **بيش از يك فاكتور : Two way Anova (friedman)**

رابطه
- **کمي : Pearson (correlation)**
- **رتبه اي : spearman**
- **اسمي : (2: Chi sq)(>2: Log analysis)**

توضيع:
- **کمي : one sample kolmogrov simrnov**
- **کيفي : chi sq - binominal test**