

ch 6

* for estimation:

σ_v : Z distribution $\rightarrow Z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$

Sample mean \bar{x} , Population mean μ , population std σ , sample size n

σ_x :

 $n > 30$: Z $\rightarrow Z = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$

 $n < 30$: t_{n-1} $\rightarrow t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$

sample std s

Binomial: if $n\hat{p}\hat{q} \geq 5 \Rightarrow Z \rightarrow Z = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}}$

sample proportion \hat{p} , population proportion p , $q \rightarrow (1-p)$

Hypothesis testing:

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* one sample inference

σ_v : Z distribution $\rightarrow Z = \frac{\bar{x} - \mu_0}{\frac{\sigma}{\sqrt{n}}}$

σ_x :

 $n > 30$: Z $\rightarrow Z = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}}$

 $n < 30$: t_{n-1} $\rightarrow t = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}}$

For Binomial: if $n\hat{p}_0\hat{q}_0 \geq 5 \Rightarrow Z \rightarrow Z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0q_0}{n}}}$, $Z_{crit} = \frac{1/2 - p_0}{\sqrt{\frac{p_0q_0}{n}}}$

* Two samples inference

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Test statistic and P-value $\rightarrow \alpha \times$

Paired samples $\rightarrow t = \frac{\bar{d} - \Delta \overset{\text{always } = 0}{\rightarrow}}{\frac{s}{\sqrt{n}}} = \frac{\bar{d}}{\frac{s}{\sqrt{n}}}$

t_{n-1} distribution

independent samples $\rightarrow t = \frac{\bar{x}_1 - \bar{x}_2}{S \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$

$t_{n_1+n_2-2}$ distribution

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

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Binomial proportions: 2 methods

* Normal theory method

Z is Normal distribution

$$\text{if } n_1 \hat{p}_1 \hat{q}_1 \geq 5 \text{ and } n_2 \hat{p}_2 \hat{q}_2 \geq 5$$

$$\hat{p} = \frac{x_1 + x_2}{n_1 + n_2}$$

$$\Rightarrow Z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}\hat{q}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}, \quad Z_{\text{crit}} = \frac{|\hat{p}_1 - \hat{p}_2| - \left(\frac{1}{2n_1} + \frac{1}{2n_2}\right)}{\sqrt{\hat{p}\hat{q}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

* Contingency-table

Goodness-of-fit

$$\chi^2 = \sum_{g,k=1}^{d \times d} \frac{(O_{gk} - E_{gk})^2}{E_{gk}}$$

estimated diagonals

$$\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

2x2

$$\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

(chi-square)

$$\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

OR

$$\chi^2 = \sum \frac{(|O_{ij} - E_{ij}| - 0.5)^2}{E_{ij}}$$

RxC

$$\chi^2 = \sum_{R \times C} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

Columns

$$\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

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* Correlation coefficient

when $H_0: \rho = 0 \rightarrow t$ distribution $\rightarrow t = \frac{r \sqrt{n-2}}{\sqrt{1-r^2}}$

when $H_0: \rho = \rho_0$ Normal distribution $\rightarrow \lambda = \frac{Z - Z_0}{\frac{1}{\sqrt{n-3}}}$

Z transformation

$$Z_0 = \frac{1}{2} \ln \left(\frac{1+\rho}{1-\rho} \right)$$

OR
 $\tanh^{-1}(\rho)$

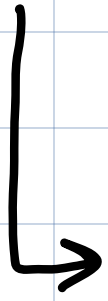
$$Z = \frac{1}{2} \ln \left(\frac{1+r}{1-r} \right)$$

OR
 $\tanh^{-1}(r)$

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* One way Anova

~ we use it to compare the means for different groups



$F_{(k-1)(n-k)}$ distribution
total number of groups: $k-1$
total number of observations: $n-k$

$$F = \frac{\text{between MS}}{\text{within MS}}$$



H_0 is rejected!

we have to know which groups differ from each other.

\mathcal{N} ✓

Normal distribution

$$Z = \frac{\bar{y}_j - \bar{y}_c}{\sqrt{\sigma^2 \left(\frac{1}{n} + \frac{1}{n_c} \right)}}$$

\mathcal{X}

t_{n-k} distribution
total observations: $n-k$
total number of groups: k

group (j) mean

$$t = \frac{\bar{y}_j - \bar{y}_c}{\sqrt{s^2 \left(\frac{1}{n} + \frac{1}{n_c} \right)}}$$

within MS (pooled S)