STA 2101/442 Formulas

$Z_1 = \frac{\sqrt{n}(\overline{Y}_n - \pi_0)}{\sqrt{\pi_0(1-\pi_0)}}$ $\quad Z_2 = \frac{\sqrt{n}(\overline{Y}_n - \pi_0)}{\sqrt{\overline{Y}_n(1-\overline{Y}_n)}}$ $\quad \overline{Y}_n \pm z_{\alpha/2}\sqrt{\frac{\overline{Y}_n(1-\overline{Y}_n)}{n}}$

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> qnorm(0.975)
[1] 1.959964
> qnorm(0.995)
[1] 2.575829
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If $E(\mathbf{X}) = \boldsymbol{\mu}$, then $V(\mathbf{X})$ is defined by $V(\mathbf{X}) = E\left\{(\mathbf{X}-\boldsymbol{\mu})(\mathbf{X}-\boldsymbol{\mu})'\right\}$.

If $\mathbf{X} \sim N(\boldsymbol{\mu}, \boldsymbol{\Sigma})$, then $\mathbf{AX} \sim N(\mathbf{A}\boldsymbol{\mu}, \mathbf{A\Sigma A}')$.

If $\lim_{n\rightarrow\infty} E(T_n) = \theta$ and $\lim_{n\rightarrow\infty} Var(T_n) = 0$, then $T_n \stackrel{P}{\rightarrow} \theta$

$\mathbf{Y}_n = \sqrt{n}(\overline{\mathbf{X}}_n - \boldsymbol{\mu}) \stackrel{d}{\rightarrow} \mathbf{Y} \sim N(\mathbf{0}, \boldsymbol{\Sigma})$

$\sqrt{n}(g(\mathbf{T}_n) - g(\boldsymbol{\theta})) \stackrel{d}{\rightarrow} \dot{\mathrm{g}}(\boldsymbol{\theta})\mathbf{T}, \quad \dot{\mathrm{g}}(\mathbf{x}) = \left[\frac{\partial g_i}{\partial x_j}\right]_{k\times d}$

$P(n_1,\ldots,n_c) = \binom{n}{n_1 \cdots n_c}\pi_1^{n_1}\cdots\pi_c^{n_c}$

$L(\boldsymbol{\pi}) = \prod_{i=1}^n \pi_1^{y_{i,1}}\pi_2^{y_{i,2}}\cdots\pi_c^{y_{i,c}} = \pi_1^{n_1}\pi_2^{n_2}\cdots\pi_c^{n_c}$

$G^2 = -2\log\left(\frac{\max_{\theta\in\Theta_0} L(\theta)}{\max_{\theta\in\Theta} L(\theta)}\right)$

$W_n = (\mathbf{L}\widehat{\boldsymbol{\theta}}_n - \mathbf{h})'\left(\mathbf{L}\widehat{\mathbf{V}}_n\mathbf{L}'\right)^{-1}(\mathbf{L}\widehat{\boldsymbol{\theta}}_n - \mathbf{h})$

If $X \sim N(\mu, \sigma^2)$, then $\frac{X^2}{\sigma^2} \sim \chi^2(1,\lambda)$, with $\lambda = \frac{\mu^2}{\sigma^2}$

$\widehat{\boldsymbol{\beta}} = (\mathbf{X}'\mathbf{X})^{-1}\mathbf{X}'\mathbf{Y} \sim N_p\left(\boldsymbol{\beta}, \sigma^2(\mathbf{X}'\mathbf{X})^{-1}\right)$

$SSE/\sigma^2 \sim \chi^2(n-p)$

$F = \frac{(\mathbf{L}\widehat{\boldsymbol{\beta}}-\mathbf{h})'(\mathbf{L}(\mathbf{X}'\mathbf{X})^{-1}\mathbf{L}')^{-1}(\mathbf{L}\widehat{\boldsymbol{\beta}}-\mathbf{h})}{r\,MSE_F} = \frac{(SSR_F - SSR_R)/r}{MSE_F} = \left(\frac{n-p}{r}\right)\left(\frac{a}{1-a}\right)$, where $a = \frac{R_F^2 - R_R^2}{1-R_R^2} = \frac{rF}{n-p+rF}$

$\phi = \frac{(\mathbf{L}\boldsymbol{\beta}-\mathbf{h})'(\mathbf{L}(\mathbf{X}'\mathbf{X})^{-1}\mathbf{L}')^{-1}(\mathbf{L}\boldsymbol{\beta}-\mathbf{h})}{\sigma^2}$

$f(y|\theta,\phi) = \exp\left\{\frac{y\theta - b(\theta)}{\phi} + c(y,\phi)\right\}$

$\theta = g(\mu) = \eta = \mathbf{x}'\boldsymbol{\beta}$

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> df = 1:8
> CriticalValue = qchisq(0.95,df)
> round(rbind(df,CriticalValue),3)
               [,1]  [,2]  [,3]  [,4]  [,5]   [,6]   [,7]   [,8]
df            1.000 2.000 3.000 4.000  5.00  6.000  7.000  8.000
CriticalValue 3.841 5.991 7.815 9.488 11.07 12.592 14.067 15.507
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