## Biostat 623 Midterm Exam Formula Sheet

## One Sample

$$H_0 : \mu = \mu_0 \quad z = \frac{\bar{x} - \mu_0}{\sigma / \sqrt{n}}$$

$$n = \frac{(z_{\alpha/2} + z_\beta)^2 \sigma^2}{\Delta^2}$$

$$t = \frac{\bar{x} - \mu_0}{s / \sqrt{n}}$$

$$H_0 : p = p_0 \quad z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0 q_0}{n}}}$$

$$\boldsymbol{n = \left[ \frac{z_{\alpha/2}\sqrt{p_0 q_0} + z_\beta \sqrt{p_a q_a}}{\Delta} \right]^2}$$

## Two Samples

$$\mathbf{H_0 : \mu_1 - \mu_2 = \mu_0} \quad \boldsymbol{z = \frac{(\bar{x}_1 - \bar{x}_2) - \mu_0}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}}$$

$$\boldsymbol{t = \frac{(\bar{x}_1 - \bar{x}_2) - \mu_0}{\sqrt{\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}}}}$$

$$n = \frac{\left(z_{\alpha/2} + z_\beta\right)^2 \left(\sigma_1^2 + \sigma_2^2\right)}{\Delta^2}$$

$$\textbf{where } \boldsymbol{s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - \mu_0}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$$H_0 : \mu_d = \mu_{d_0} \qquad t = \frac{\bar{d} - \mu_{d_0}}{s_d / \sqrt{n}}$$

$$H_0 : p_1 - p_2 = 0 \qquad z = \frac{(\hat{p}_1 - \hat{p}_2) - 0}{\sqrt{\frac{\overline{p}\overline{q}}{n_1} + \frac{\overline{p}\overline{q}}{n_2}}}$$

$$n = \frac{\left[ z_{\alpha/2}\sqrt{2\overline{p}\overline{q}} + z_\beta \sqrt{p_1 q_1 + p_2 q_2} \right]^2}{\Delta^2}$$

 

| Z | Tail Probability 1-sided | 2-sided |
|---|---|---|
| 0.65 | 0.26 | 0.52 |
| 0.75 | 0.23 | 0.46 |
| 0.84 | 0.20 | 0.40 |
| 1.28 | 0.10 | 0.20 |
| 1.645 | 0.05 | 0.10 |
| 1.96 | 0.025 | 0.05 (same as $\chi^2$=3.84) |
| 2.58 | 0.005 | 0.010 |

**Linear Regression Model:** $E[\mathrm{Y}] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\beta_s X_s$

$\ln = \log = \log_e$

$$\ln\left(\frac{a}{b}\right) = \ln(a) - \ln(b) \qquad \frac{e^{a+b}}{e^a} = e^b$$

**Logistic Regression Model:** log odds = logit[Pr(Y = 1)] = $\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\beta_s X_s$

$$\Pr(Y = 1) = \frac{e^{\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\beta_s X_s}}{1 + e^{\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\beta_s X_s}} = \frac{\text{odds}}{1 + \text{odds}}$$

**Proportional Hazards Model:**

$$\log h(t;X) = \log h_0(t:X) + \beta_1 X_1 + \ldots\ldots + \beta_p X_p$$

$$h(t;X) = h_0(t;X)e^{\beta_1 X_1 + \ldots\ldots + \beta_p Xp}$$

$$S(t;X) = [S_0(t)]^{e^{X\beta}}$$

**LRT (Likelihood Ratio Test) = -2 ($LL_{Null}$ - $LL_{Extended}$)**

**where LL = log likelihood**

**AIC = - 2 LL + 2(model df)**

 