# FORMULA SHEET FOR STATISTICAL INFERENCE

## Critical Regions and P-Values for Z-test and T-test

| | CR for $z-$test | CR for $t-$test | $P-$values for $z-$test | $P-$values for $t-$test |
|---|---|---|---|---|
| If $H_1$ contains $\neq$ sign | $\lvert z\rvert \geq z_{\frac{\alpha}{2}}$ | $\lvert t\rvert \geq t_{\frac{\alpha}{2}(d.f)}$ | $P = 2[1-\Phi(\lvert z_0\rvert)]$ | $P = 2[\Phi(\lvert t_0\rvert)]$ |
| If $H_1$ contains $<$ sign | $z < -z_{\alpha}$ | $t < -t_{\alpha(d.f)}$ | $P = \Phi(z_0)$ | $P = 1-\Phi(\lvert t_0\rvert)$ |
| If $H_1$ contains $>$ sign | $z > z_{\alpha}$ | $t > t_{\alpha(d.f)}$ | $P = 1-\Phi(z_0)$ | $P = \Phi(\lvert t_0\rvert)$ |

## Test Statistics for Mean

*Test Statistic* $z = \dfrac{\bar{x}-\mu}{\sigma/\sqrt{n}}$ *and* $t = \dfrac{\bar{x}-\mu}{s/\sqrt{n}}$ *with* $d.f = n-1$

| | Confidence Intervals for $z-$test | Confidence Intervals for $t-$test |
|---|---|---|
| If $H_1$ contains $\neq$ sign | $\bar{x} - Z_{\frac{\alpha}{2}}.\dfrac{\sigma}{\sqrt{n}} \leq \mu \leq \bar{x} + Z_{\frac{\alpha}{2}}.\dfrac{\sigma}{\sqrt{n}}$ | $\bar{x} - t_{\frac{\alpha}{2}(d.f)}.\dfrac{S}{\sqrt{n}} \leq \mu \leq \bar{x} + t_{\frac{\alpha}{2}(d.f)}.\dfrac{S}{\sqrt{n}}$ |
| If $H_1$ contains $<$ sign | $\mu \leq \bar{x} + Z_{\alpha}.\dfrac{\sigma}{\sqrt{n}}$ | $\mu \leq \bar{x} + t_{\alpha(d.f)}.\dfrac{S}{\sqrt{n}}$ |
| If $H_1$ contains $>$ sign | $\mu \geq \bar{x} - Z_{\alpha}.\dfrac{\sigma}{\sqrt{n}}$ | $\mu \geq \bar{x} - t_{\alpha(d.f)}.\dfrac{S}{\sqrt{n}}$ |

## Test Statistics for Difference of Means

*Test Statistic* $Z = \dfrac{(\bar{x}_1-\bar{x}_2)-(\mu_1-\mu_2)}{\sqrt{\dfrac{\sigma_1^2}{n_1}+\dfrac{\sigma_2^2}{n_2}}}$ *and* $t = \dfrac{(\bar{x}_1-\bar{x}_2)-(\mu_1-\mu_2)}{\sqrt{\dfrac{s_1^2}{n_1}+\dfrac{s_2^2}{n_2}}}$ *with* $d.f = \dfrac{\left(s_1^2/n_1+s_2^2/n_2\right)^2}{\left(s_1^2/n_1\right)^2/(n_1-1)+\left(s_2^2/n_2\right)^2/(n_2-1)}$

*Confidence Intervals for $z-$test*

If $H_1$ contains $\neq$ sign: $(\bar{x}_1-\bar{x}_2) - Z_{\frac{\alpha}{2}}.\sqrt{\dfrac{\sigma_1^2}{n_1}+\dfrac{\sigma_2^2}{n_2}} \leq \mu_1-\mu_2 \leq (\bar{x}_1-\bar{x}_2) - Z_{\frac{\alpha}{2}}.\sqrt{\dfrac{\sigma_1^2}{n_1}+\dfrac{\sigma_2^2}{n_2}}$

If $H_1$ contains $<$ sign: $\mu_1-\mu_2 \leq (\bar{x}_1-\bar{x}_2) + Z_{\alpha}.\sqrt{\dfrac{\sigma_1^2}{n_1}+\dfrac{\sigma_2^2}{n_2}}$

If $H_1$ contains $>$ sign: $\mu_1-\mu_2 \geq (\bar{x}_1-\bar{x}_2) - Z_{\alpha}.\sqrt{\dfrac{\sigma_1^2}{n_1}+\dfrac{\sigma_2^2}{n_2}}$

*Confidence Intervals for $t-$test*

If $H_1$ contains $\neq$ sign: $(\bar{x}_1-\bar{x}_2) - t_{\frac{\alpha}{2}(d.f)}\sqrt{\dfrac{s_1^2}{n_1}+\dfrac{s_2^2}{n_2}} \leq \mu_1-\mu_2 \leq (\bar{x}_1-\bar{x}_2) + t_{\frac{\alpha}{2}(d.f)}\sqrt{\dfrac{s_1^2}{n_1}+\dfrac{s_2^2}{n_2}}$

If $H_1$ contains $<$ sign: $\mu_1-\mu_2 \leq (\bar{x}_1-\bar{x}_2) + t_{\alpha(d.f)}\sqrt{\dfrac{s_1^2}{n_1}+\dfrac{s_2^2}{n_2}}$

If $H_1$ contains $>$ sign: $\mu_1-\mu_2 \geq (\bar{x}_1-\bar{x}_2) - t_{\alpha(d.f)}\sqrt{\dfrac{s_1^2}{n_1}+\dfrac{s_2^2}{n_2}}$