Formula Sheet for Statistics

	Confidence Interval	Hypothesis Testing
Single Mean (σ *known*	$\mu \in \bar{x} \pm z_{\alpha/2}\dfrac{\sigma}{\sqrt{n}}$	$Z = \dfrac{\bar{X}-\mu}{\sigma/\sqrt{n}}$
Single Mean (σ *unknown*)	$\mu \in \bar{x} \pm t_{\alpha/2}\dfrac{s}{\sqrt{n}}$	$T = \dfrac{\bar{X}-\mu}{s/\sqrt{n}}$ *with* $v = n-1$
Two means (σ *known*)	$\mu_1-\mu_2 \in (\bar{x}_1-\bar{x}_2) \pm z_{\alpha/2}\sqrt{\dfrac{\sigma_1^2}{n_1}+\dfrac{\sigma_2^2}{n_2}}$	$Z = \dfrac{\bar{x}_1-\bar{x}_2-(\mu_1-\mu_2)}{\sqrt{\sigma_1^2/n_1 + \sigma_2^2/n_2}}$
Two Means $\sigma_1^2=\sigma_2^2$ unknown	$\mu_1-\mu_2 \in (\bar{x}_1-\bar{x}_2) \pm t_{\alpha/2}s_p\sqrt{\dfrac{1}{n_1}+\dfrac{1}{n_2}}$	$T = \dfrac{\bar{x}_1-\bar{x}_2-(\mu_1-\mu_2)}{s_p\sqrt{\dfrac{1}{n_1}+\dfrac{1}{n_2}}}$
	$S_p^2 = \dfrac{(n_1-1)S_1^2+(n_2-1)S_2^2}{n_1+n_2-2}$	$v = n_1+n_2-2$
Two Means $\sigma_1^2\neq\sigma_2^2$ unknown	$\mu_1-\mu_2 \in (\bar{x}_1-\bar{x}_2) \pm t_{\alpha/2}\sqrt{\dfrac{s_1^2}{n_1}+\dfrac{s_2^2}{n_2}}$	$T = \dfrac{\bar{x}_1-\bar{x}_2-(\mu_1-\mu_2)}{\sqrt{s_1^2/n_1+s_2^2/n_2}}$
		$v = \dfrac{(s_1^2/n_1+s_2^2/n_2)^2}{\dfrac{(s_1^2/n_1)^2}{n_1-1}+\dfrac{(s_2^2/n_2)^2}{n_2-1}}$
Variance	$\dfrac{(n-1)s^2}{\chi^2_{\alpha/2}} < \sigma^2 < \dfrac{(n-1)s^2}{\chi^2_{1-\alpha/2}}$	$\chi^2 = \dfrac{(n-1)s^2}{\sigma^2}$ *with* $v = n-1$
Two Variances	$\dfrac{s_1^2}{s_2^2}\dfrac{1}{f_{\alpha/2}(v_1,v_2)} < \dfrac{\sigma_1^2}{\sigma_2^2} < \dfrac{s_1^2}{s_2^2}f_{\alpha/2}(v_1,v_2)$	$f(v_1=n_1-1, v_2=n_2-1) = \dfrac{\sigma_2^2 s_1^2}{\sigma_1^2 s_2^2}$
Proportion	$p \in \hat{p} \pm z_{\alpha/2}\sqrt{\hat{p}\hat{q}/n}$	$z = \dfrac{\hat{p}-p_0}{\sqrt{p_0q_0/n}}$
Two Proportions	$p_1-p_2 \in (\hat{p}_1-\hat{p}_2) \pm z_{\alpha/2}\sqrt{\dfrac{\hat{p}_1\hat{q}_1}{n_1}+\dfrac{\hat{p}_2\hat{q}_2}{n_2}}$	$\dfrac{\hat{p}_1-\hat{p}_2}{\sqrt{\hat{p}\hat{q}(1/n_1+1/n_2)}}$

Sample Size	$n = \left(\dfrac{z_{\alpha/2}\sigma}{e}\right)^2$ for mean, n = $\hat{p}(1-\hat{p})\left(\dfrac{z_{\alpha/2}}{e}\right)^2$ for proportion	
Prediction Intervals	$x_0 \in \bar{x} \pm z_{\alpha/2}\sigma\sqrt{1+1/n}$ (σ *known*)	$x_0 \in \bar{x} \pm t_{\alpha/2}s\sqrt{1+1/n}$ (σ unknown)
Test statistic (Goodness of Fit Tests)	$\chi^2 = \sum_i \dfrac{(o_i-e_i)^2}{e_i}$ *with* $(r-1)\times(c-1)$ *degrees of freedom*	

$\bar{X} = \sum_{i=1}^{n} X_i/n$	$S^2 = \sum_{i=1}^{n}\dfrac{(X_i-\bar{X})^2}{n-1}$	$Z = \frac{X-\mu}{\sigma}$ where X = $N(\mu,\sigma)$

Chi square RV with v=n-1:	$\chi^2(n-1) = \dfrac{(n-1)S^2}{\sigma^2}$	T RV with v=n-1	T= $\dfrac{\bar{X}-\mu}{s/\sqrt{n}}$
F RV with v_1=n_1-1 and v_2=n_2-1 d.o.f		$F = (\sigma_2^2S_1^2)/(\sigma_1^2S_2^2)$	

Regression

$S_{xy} = \sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})$	$S_{yy} = \sum_{i=1}^{n}(y_i-\bar{y})^2$	$S_{xx} = \sum_{i=1}^{n}(x_i-\bar{x})^2$	$b_0 = \bar{y}-b_1\bar{x}$	
SST = SSR + SSE	$SST = \sum_{i=1}^{n}(y_i-\bar{y})^2$	$SSR = \sum_{i=1}^{n}(\hat{y}_i-\bar{y})^2$	$b_1 = S_{xy}/S_{xx}$	
$SSE = S_{yy}-b_1S_{xy}$	$S^2 = \dfrac{SSE}{n-(k+1)}$	$R^2 = 1-\frac{SSE}{SST}$, $f = \frac{SSR}{s^2}$	$s_{b_1}^2 = \dfrac{s^2}{S_{xx}}$	$s_{b_0}^2 = \dfrac{s^2}{S_{xx}}\sum_i\dfrac{X_i^2}{n}$