Formulas and t-Table for Unit 2 Exam

μ = POPULATION MEAN

X = measurement in sample

Situation	Confidence Intervals: Estimate	C.V.	$SE_{estimate}$	Hypothesis Testing: Hypothesis	Test-statistic (df)	Notes
1 SAMPLE	$\bar{x}$ Sample mean	± z*	$SE_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$	$H_0: \mu_x = \mu_0$ $H_a: \mu_x [\neq><] \mu_0$	$z = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}}$	Use if you know the population SD or when sample is very large
		± t*	$SE_{\bar{x}} = \frac{s}{\sqrt{n}}$		$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$ $df = n - 1$	Use with a small sample or using the sample's SD instead of the population's $d = \bar{X}/SE_{\bar{x}}$
MATCHED PAIRS ($n = \#\ of\ pairs$)	$D = x_1 - x_2$	± t*	$SE_{\bar{D}} = \frac{s_D}{\sqrt{n}}$	$H_0: \mu_D = \mu_0$ $H_a: \mu_D [\neq><] \mu_0$ ---or— $H_0: \mu_1 - \mu_2 = 0$ $H_a: \mu_1 - \mu_2 [\neq><]\ 0$	$t = \frac{\bar{D} - \mu_0}{s_D/\sqrt{n}}$ $df = n - 1$	**"Direct-Differences Method"** First must subtract all pairs to create a new variable D and then find s_D which is the SD of D's
	$\bar{D} = \overline{x_1} - \overline{x_2}$	± t*	$SE_{\bar{D}} = \sqrt{\frac{s_1^2 + s_2^2}{n} - \frac{2rs_1s_2}{n}}$		$t = \frac{\bar{D} - \mu_0}{\sqrt{\frac{s_1^2 + s_2^2}{n} - \frac{2rs_1s_2}{n}}}$ $df = n - 1$	**"Correlation Method"** Instead of subtracting all pairs, find each variables' M & SD, as well as the r between the variables in the sample
2 INDEPENDENT SAMPLES (not paired)	$\bar{D} = \overline{x_1} - \overline{x_2}$ Difference in 2 sample means	± z*	$SE_{\bar{D}} = \sqrt{\frac{{\sigma_1}^2}{n_1} + \frac{{\sigma_2}^2}{n_2}}$	$H_0: \mu_1 - \mu_2 = 0$ $H_a: \mu_1 - \mu_2 [\neq><]\ 0$	$z = \frac{\bar{D}}{\sqrt{\frac{{\sigma_1}^2}{n_1} + \frac{{\sigma_2}^2}{n_2}}}$	Know both populations SD or when samples are large
		± t*	$SE_{\bar{D}} = \sqrt{\frac{{s_1}^2}{n_1} + \frac{{s_2}^2}{n_2}}$		$t = \frac{\bar{D}}{\sqrt{\frac{{s_1}^2}{n_1} + \frac{{s_2}^2}{n_2}}}$ $\min(n's) - 1 < df_{SV} < n_1 + n_2 - 2$	**"Separate Variances t-test"** Use with equal n's –or- if violated HOV (var.equal = FALSE). Also use with equal n's if the larger sample as the smaller SD $d = \bar{D}/SE_{\bar{D}}$
			$SE_{\bar{D}} = \sqrt{s_p^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$	$s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$ $s_p^2 \xRightarrow{n_1 = n_2,} \frac{s_1^2 + s_2^2}{2}$	$t = \frac{\bar{D}}{\sqrt{s_p^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$ $df_{pooled} = n_1 + n_2 - 2$	**"Pooled Variance t-test"** Assumes the populations have equal SD's (test HOV w/Levene's Test, var.equal = TRUE). Also use then the n's are not equal and the larger sample has the larger SD $d = \bar{D}/s_p$

$\delta =$ "expected t or z" ($\boldsymbol{population}$ $parameters$)

$$1\ group\colon\ \delta = \frac{\mu}{\sigma}\sqrt{n} \xrightarrow{d=\frac{\mu}{\sigma}} \delta = d\sqrt{n}$$

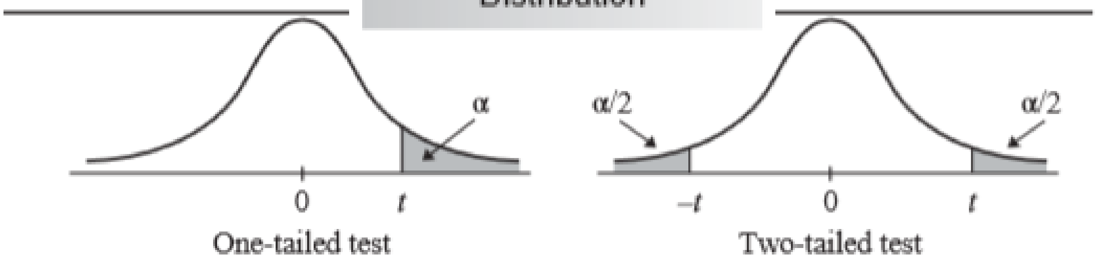
$$2\ groups\colon\ \delta \overset{n_1=n_2,}{\Longrightarrow} \frac{\mu_1-\mu_2}{\sigma}\sqrt{\frac{n}{2}} \xrightarrow{d=\frac{\mu_1-\mu_2}{\sigma}} \delta = d\sqrt{\frac{n}{2}}$$

$$\overset{est.\ \boldsymbol{d}=g\left(1-\frac{3}{4\,df-1}\right)}{\Longleftrightarrow}$$

$g =$ "$effect\ size$" ($\boldsymbol{sample}$ $statistics$)

$$g = \frac{\bar{X}_1-\bar{X}_2}{s_p} = \begin{cases} \overset{n_1=n_2,}{\Longrightarrow} t\sqrt{\frac{2}{n}} \\ \overset{n_1\neq n_2,}{\Longrightarrow} t\sqrt{\frac{n_1+n_2}{n_1 n_2}} \end{cases}$$

Table A.2
Critical Values of the t Distribution



	Level of Significance for One-Tailed Test					
	.10	.05	.025	.01	.005	.0005
	Level of Significance for Two-Tailed Test					
df	.20	.10	.05	.02	.01	.001
1	3.078	6.314	12.706	31.821	63.657	636.620
2	1.886	2.920	4.303	6.965	9.925	31.599
3	1.638	2.353	3.182	4.541	5.841	12.924
4	1.533	2.132	2.776	3.747	4.604	8.610
5	1.476	2.015	2.571	3.365	4.032	6.869
6	1.440	1.943	2.447	3.143	3.707	5.959
7	1.415	1.895	2.365	2.998	3.499	5.408
8	1.397	1.860	2.306	2.896	3.355	5.041
9	1.383	1.833	2.262	2.821	3.250	4.781
10	1.372	1.812	2.228	2.764	3.169	4.587
11	1.363	1.796	2.201	2.718	3.106	4.437
12	1.356	1.782	2.179	2.681	3.055	4.318
13	1.350	1.771	2.160	2.650	3.012	4.221
14	1.345	1.761	2.145	2.624	2.977	4.140
15	1.341	1.753	2.131	2.602	2.947	4.073
16	1.337	1.746	2.120	2.583	2.921	4.015
17	1.333	1.740	2.110	2.567	2.898	3.965
18	1.330	1.734	2.101	2.552	2.878	3.922
19	1.328	1.729	2.093	2.539	2.861	3.883
20	1.325	1.725	2.086	2.528	2.845	3.850
21	1.323	1.721	2.080	2.518	2.831	3.819
22	1.321	1.717	2.074	2.508	2.819	3.792
23	1.319	1.714	2.069	2.500	2.807	3.768
24	1.318	1.711	2.064	2.492	2.797	3.745
25	1.316	1.708	2.060	2.485	2.787	3.725
26	1.315	1.706	2.056	2.479	2.779	3.707
27	1.314	1.703	2.052	2.473	2.771	3.690
28	1.313	1.701	2.048	2.467	2.763	3.674
29	1.311	1.699	2.045	2.462	2.756	3.659
30	1.310	1.697	2.042	2.457	2.750	3.646
40	1.303	1.684	2.021	2.423	2.704	3.551
60	1.296	1.671	2.000	2.390	2.660	3.460
120	1.289	1.658	1.980	2.358	2.617	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.291