Identifying the Proper Confidence Interval or Test

When creating a confidence interval (CI) or running a test for a mean, proportion, or difference in means or proportions, there is some *estimate* of the mean, proportion, or difference from the data. There is also the standard error (SE), which is a measure of the uncertainty of this *estimate*. The general form for a $100 * (1 - \alpha)\%$ confidence interval is

$$estimate \pm [Z_{\text{from table}} \text{ or } t_{\text{from table}}] * SE$$

$Z_{\text{from table}}$ and $t_{\text{from table}}$ are found using the appropriate table. ($\alpha = 0.05$ for a 95% confidence interval.) The general form for a hypothesis test statistic is

$$T \text{ or } Z = \frac{estimate - expected}{SE}$$

where *expected* is the expected value of the estimate under H_0 (if $H_0 : \mu = 7.3$, then $expected = 7.3$).

To identify the *estimate* and SE, begin by asking

How many samples are there?	1	2
Are proportions or means of interest?	proportion	mean
Is this for a confidence interval or a hypothesis test?	CI	test

Using these answers, identify the proper CI or test in the table. Additional instructions and special circumstances for using the table below:

- If the data is for proportions or the standard deviation is known, use Z (ie, the normal dist.). If it is for means and the standard deviation is unknown, use t (ie, the t-dist.).
- If you chose (2, proportion, test) from above, only use the pooled test if H_0 is $p_1 - p_2 = 0$ (or $p_1 = p_2$). For the pooled test, $\hat{p}_c = \frac{x_1+x_2}{n_1+n_2} = \frac{n_1\hat{p}_1+n_2\hat{p}_2}{n_1+n_2}$.
- If you chose (2, mean, either CI or test) and the data is paired, work only with the differences. n_{diff} = # of differences (ie, 2 samples each of size 10 implies there are 10 differences, $n_{\text{diff}} = 10$).
- To avoid any confusion: s, s_1, s_2, and s_{diff} are standard deviations of the samples.

Circumstance	value to estimate	estimate	SE
1-prop (CI)	p	$\hat{p}$	$\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$
1-prop (test, $p_0 = expected$)	p	$\hat{p}$	$\sqrt{\frac{p_0(1-p_0)}{n}}$
2-prop (unpooled, test or CI)	$p_1 - p_2$	$\hat{p}_1 - \hat{p}_2$	$\sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$
2-prop (pooled, test only)	$p_1 - p_2$	$\hat{p}_1 - \hat{p}_2$	$\sqrt{\frac{\hat{p}_c(1-\hat{p}_c)}{n_1} + \frac{\hat{p}_c(1-\hat{p}_c)}{n_2}}$
1-samp (t-test or CI)	μ	$\bar{x}$	$s/\sqrt{n}$
2-samp (unpaired, t-test or CI)	$\mu_1 - \mu_2$	$\bar{x}_1 - \bar{x}_2$	$\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$
2-samp (paired, t-test or CI)	$\mu_{\text{diff}} = \mu_1 - \mu_2$	$\bar{x}_{\text{diff}}$	$s_{\text{diff}}/\sqrt{n_{\text{diff}}}$