Worked-Out HT and CI from Chapter 11 Class
revised 24 November 2011

[Also check the Guide to Chapter 11 on the Web page.]
[Square brackets enclose things you think but don't write.]

Hypothesis test, page 511 Example 2 (*Case 3, paired data*)

(1) d = Dom – Non-dom
H0: $\mu_d = 0$, no difference in reaction time
H1: $\mu_d < 0$, dominant hand reaction time is less than non-dominant hand reaction time

(2) $\alpha = 0.05$

(RC) [Put the d's into L1 by subtracting the original data *in order*.]
n < 30. MATH200A/2 no outliers; MATH200A/5 straight line (r=.978); therefore sampling distribution is ND [or, therefore OK]

(3-4) T-Test, $\mu_0=0$, List:L1, $\mu<\mu_0$
outputs: t = –2.78, p = .0090, $\bar{x}$ [really d-bar] = –.0132, s = .0164, n = 12

(5) pval<α, reject H_0 and accept H_1

(6) At the 0.05 significance level, dominant hand reaction time is less than non-dominant hand reaction time in the average person.

Confidence interval

[No need for requirements check, since we already did it for the preceding HT. But when doing CI on its own, check requirements.]

T-Interval: List L1, C-Level .95
Outputs (-.0236, -.0027) [This is a CI on the mean d in the population.]
[First draft: Dominant minus non-dominant is between -0.0236 and -0.0027, therefore dominant reaction time is less by 0.0027 to 0.0236 second.]

For publication: I'm 95% confident that, on average, the dominant hand has reaction time 0.0027 to 0.0236 second less than the non-dominant hand.

[Remember, confidence interval with these cases needs **size and direction**.]

[Remark. The HT was one-tailed with α = 0.05. The two-tailed α would be 0.10, and the corresponding CI would be 90%. But there's nothing wrong with doing a 95% interval.]

Hypothesis test, page 523 (*Case 4*)

(1) Pop. 1 = Space rats; Pop. 2 = Earthbound rats
H_0: $\mu_1 = \mu_2$, no difference between space rats' and Earthbound rats' mean red blood cell mass
H_1: $\mu_1 \neq \mu_2$, mean red blood cell mass different for space rats and Earthbound rats

(2) $\alpha = 0.05$

(RC) Flight sample: normality check r = .9838, no outliers, OK
Control group: normality check r = .9732, no outliers, OK

(3-4) 2-SampTTest, List1:L2, List2:L3, $\mu_1 \neq \mu_2$, Pooled:No
Outputs: t = –1.44, p = .1627, df = 25.996, $\bar{x}1$ = 7.881, $\bar{x}2$ = 8.43, s1 = 1.017, s2 = 1.005, n1 = 14, n2 = 14

(5) $p > \alpha$. Fail to reject H_0

(6) At the 0.05 significance level, [the difference between the sample means could be explained away by sample variability, so] we can't tell whether there is a difference in average red blood cell mass between space rats and earthbound rats or not.

Confidence interval

[No need for requirements check, since we already did it for the preceding HT. But when doing CI on its own, check requirements.]

2-SampTInt, C-Level: .95
Outputs: (-1.335, .23655) [= space average minus Earthboound average]

[First draft: space minus earthbound is between -1.335 and +.237]
For publication: I'm 95% confident that the average space rat has between 1.335 ml lower RBC mass and 0.237 ml higher RBC mass than the average Earthbound rat.

[Notice that 0 (no difference) is inside the confidence interval when $p > \alpha$, and we can't tell whether there is a difference or not. This 95% confidence interval is exactly the flip side of the 0.05 hypothesis test we just did.]

Hypothesis test, Physicians' Health Study (*Case 5*)

Data: Aspirin group, 104 had heart attacks, 10,933 did not
Placebo group, 189 had heart attacks, 10,845 did not

(1) Pop. 1: aspirin takers, pop.2: non-aspirin takers
H_0: $p_1 = p_2$, taking aspirin makes no difference in likelihood of heart attack
H_1: $p_1 \neq p_2$, taking aspirin makes a difference to the likelihood of heart attack
[Population 2 is non-aspirin takers, not "placebo". The *sample* takes a placebo, but the *population* that you're interested in would take nothing.]

(2) $\alpha = 0.001$

(3-4) 2-PropZTest, x1 = 104, n1 = 11037, x2 = 189, n2 = 11034, $p_1 \neq p_2$
Outputs: z = -5.00, pval = 5.7009E-7, $\hat{p}_1 = .0094$, $\hat{p}_2 = .0171$, $\hat{p} = .0133$

(RC) [For HT, use $\hat{p}$, the blended probability of the two samples]
$n * \hat{p} * (1-\hat{p}) = (11037+11034)*.0133*(1-.0133)=289.64 > 10$, OK
$20n_1$, $20n_2$ both < population? $20n_1$ = about $20n_2$ = about 220,000, less than US male population, OK

(5) $p < \alpha$. Reject H_0 and accept H_1

(6) At the 0.001 level of significance, taking aspirin does change the likelihood of a heart attack. In fact, taking aspirin reduces the likelihood of a heart attack.

Confidence interval

[No need for requirements check, since we already did it for the preceding HT. But if doing the CI without HT, check requirements for each sample separately, using $\hat{p}_1$ and $\hat{p}_2$.]

2-PropZInt, C-Level = .999

Outputs: (-.0128, -.0026) [= likelihood with aspirin – likelihood w/o aspirin]

We're 99.9% confident that taking aspirin reduces the likelihood of a heart attack by .26% to 1.28%.