Review for Exam 3

Chapter 7 Unpaired continuous data
Chapter 8 Paired continuous data
Chapter 9 Categorical data: proportions confidence intervals
Chapter 10 Categorical data: test statistic and P-value

Tables 6 – 8: Discrete (e.g. a whole number) test statistics
Tables 4, 9: Continuous-valued (e.g. can be any value) test statistics

P-values in every table: If H_0 were true, then P is the likelihood of getting samples *this different* from what was expected/predicted, as described in H_0, *or even more different*.

For Tables 6 – 9, the P-values given are for the non-directional case. For the directional case, divide the given P-value by 2 to get the directional P-value.

The effects of doubling sample size on test statistics, and the resulting P-values.

Test Table	Change in test statistic	Example
t_s Table 4	New $t_s = \sqrt{2}$ Old t_s	Example 7.2.2 Old $t_s = 2.34, df \approx 8 \Rightarrow .04 < P < .05$ New $t_s = \frac{(540.8-444.2)-0}{\sqrt{\frac{66.1^2}{12}+\frac{69.6^2}{10}}} \approx 3.31, df \approx 19 \Rightarrow .001 < P < .01$
WMW Table 6	New $U_s = 4$ Old U_s	Table 7.10.2 Old $n = 8, n' = 7, U_s = 49.5 \Rightarrow .010 < P < .021$ New $n = 16, n' = 14, U_s = 198 \Rightarrow P \ll .0045$
Sign Table 7	New $B_s = 2$ Old B_s	Example 8.4.1 Old $n = 11, B_s = 9 \Rightarrow P = .065$ New $n = 22, B_s = 18 \Rightarrow P = .004$
Signed Rank Table 8	New $W_s \approx 4$ Old W_s	Example 8.5.1, Table 8.5.3 Old $n = 9$ $\left(\text{note: } 1+2+3+\cdots+9 = \frac{9\cdot 10}{2} = 45\right)$ $W_- = 1+2+3 = 6, W_+ = 4+\cdots+9 = 39,$ $W_s = 39 \Rightarrow .0390 < P < .0980$ New $n = 18$ $\left(1+2+3+\cdots+18 = \frac{18\cdot 19}{2} = 171\right)$ $W_- = 1+\cdots+6 = 21, W_+ = 7+\cdots+18 = 150,$ $W_s = 150 \Rightarrow .0100 < P < .0019$
Chi-square Table 9	New $\chi_s^2 = 2$ Old χ_s^2	Table 10.5.3 Old $\chi_s^2 = 14.09, df = 4 \Rightarrow .001 < P < .01$ New $\chi_s^2 = 28.18, df = 4 \Rightarrow P < .0001$

Confidence intervals shrink/decrease in width as sample size increases.

Example 7.2.2 (from previous page):

Suppose $\alpha = .01$ (so 99% confidence). From previous page:

Original	
t_s	P
2.34	$.04 < P < .05$
Don't reject H_0	

New (with doubled n)	
t_s	P
3.31	$.001 < P < .01$
Reject H_0	

Confidence intervals:

Original: $df \approx 8$, so $t = 3.355$, so

$$\mu_1 - \mu_2 = 540.8 - 444.2 \pm 3.555\sqrt{\frac{66.1^2}{6} + \frac{69.6^2}{5}}$$

$$= 96.6 \pm 3.355(41.195) = 96.6 \pm 138.21$$

i.e.

$$-41.61 < \mu_1 - \mu_2 < 234.81$$

which includes 0, so we do not conclude that $\mu_1 - \mu_2 \neq 0$.

New (with doubled n): $df \approx 16$, so $t = 2.921$, so

$$\mu_1 - \mu_2 = 540.8 - 444.2 \pm 2.921\sqrt{\frac{66.1^2}{12} + \frac{69.6^2}{10}}$$

$$= 96.6 \pm 2.921(29.129) = 96.6 \pm 85.06$$

$$\uparrow\approx 41.195/\sqrt{2} \qquad \uparrow\approx 138.21/\sqrt{2}$$

i.e.

$$11.54 < \mu_1 - \mu_2 < 181.66$$

which does not include 0, so we do conclude that $\mu_1 - \mu_2 \neq 0$.