MATH1001 Homework Solution

Chapter 7

7.1.1

The randomization test does not provide compelling evidence for a difference in pulse rates between the genders. 120 of 252 or about 48% of the randomizations yielded differences in means that were larger than the difference observed in our samples of five men and women. Thus, our observed difference is quite consistent with the types of differences one might see do to randomness alone.

7.2.4

(a) Because $P > \alpha$, we do not reject H_0.

(b) Because $P < \alpha$, we reject H_0.

(c) $t_{5,0.04} = 2.191$ and $t_{5,0.03} = 2.422$, so $0.06 < P < 0.08$. Because $P < \alpha$, we reject H_0.

(d) $t_{16,0.04} = 1.869$ and $t_{16,0.03} = 2.024$, so $0.06 < P < 0.08$. Because $P > \alpha$, we do not reject H_0.

7.2.5

(a) $t_s = 1.07$

(b) H_0: Hereford and Brown Swiss/Hereford cows gain the same amount of weight during a 78-period, on average. H_A: The mean 78-day weight gain of Hereford and Brown Swiss/Hereford cows differs across the breeds.

(c) We retain H_0 because the P-value is larger than 0.10. We have insufficient evidence to say that HH and SH have different mean weight gains.

7.3.5

A type II error may have been made.

7.3.7

Yes; because zero is outside of the confidence interval, we know that the P-value is less than 0.05, so the P-value is less than .10. Thus, we reject the hypothesis that $\mu_1 - \mu_2 = 0$.

7.4.2

In this observational study, the effect of implants on illness is confounded with the effects on illness of smoking, drinking heavily, using hair dye, and having an abortion.

7.5.2

(a) $t_s = \frac{3.24 - 3.00}{0.61} = 0.39$.

With df = 17, Table 4 gives $t_{0.20} = 0.863$. Thus, P-value > 0.20.

(b) $t_s = \frac{560 - 500}{45} = 1.33$.

With df = 8, Table 4 gives $t_{0.20} = 0.889$ and $t_{0.10} = 1.397$. Thus, 0.10 < P-value < 0.20.

(c) $t_s = \frac{73 - 79}{2.8} = -2.14$.

Because $\bar{y}_1 < \bar{y}_2$, the data do <u>not</u> deviate from H_0 in the direction specified by H_A. Thus, P > 0.50.

7.5.4

(a) No. With df = 23, Table 4 gives $t_{0.10} = 1.319$ and $t_{0.05} = 1.714$. Thus, 0.05 < P-value < 0.10. Since $P > \alpha$, we do not reject H_0.
(b) Yes. With df = 5, Table 4 gives $t_{0.04} = 2.191$ and $t_{0.03} = 2.422$. Thus, 0.03 < P-value < 0.04. Since $P < \alpha$, we reject H_0.
(c) No. Because $t_s > 0$, the data do <u>not</u> deviate from H_0 in the direction specified by H_A. Thus, P > .50 and we do not reject H_0.
(d) Yes. With df = 27, Table 4 gives $t_{0.005} = 2.771$ and $t_{0.0005} = 3.690$. Thus, 0.0005 < P-value < 0.005. Since $P < \alpha$, we reject H_0.

7.6.3

Let 1 denote male and 2 denote female.

$$SE_{(\bar{Y}_1 - \bar{Y}_2)} = \sqrt{0.62^2 + 0.53^2} = 0.8157.$$

(137.21 - 137.18) ± (1.977)(0.8157) (using df = 140)

$(-1.6, 1.6)$ or $-1.6 < \mu_1 - \mu_2 < 1.6$ beats per minute.

We can be 95% confident that the mean difference does not exceed 1.6 beats per minute, which is small and unimportant (in comparison with, for example, ordinary fluctuations in heart rate from one minute to the next.)

7.6.6

Using the larger SD the sample effect size is computed as

$$\frac{55.3 - 53.3}{6.1} = 0.3279 .$$

7.8.1

(a) Because of the small sample sizes, we require that the data comes from a normal population for our t-test to be valid (Condition 2). Unfortunately, the presence of outliers in each group suggest that the sperm concentrations are not from a normal population.

(b) With large samples (n_1 and $n_2 > 20$), a t-test would be valid even if the data is not from a normal population (Condition 2).

(c) These small Shapiro-Wilk test P-values support our visual assessment of normality: there is significant evidence that the data does not come from a normal population.

(d) A log transformation could make the data appear more normal and thus permit us to use a test that requires normality, such as the t-test.

7.9.1

(a) False; the P-value is the probability of data as unusual as those obtained *if* H_0 is true.
(b) True; reject H_0 since the P-value is less than α.
(c) False. We should reject H_0, but don't know the chance that we would reject H_0 in repeated experiments – we do not know if H_0 is true.
(d) True; this is the interpretation of a P-value.