Stat13 Homework 8

http://www.stat.ucla.edu/~dinov/courses_students.html

Suggested Solutions

Question 8.2:

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.

Question 8.3:

Part (a) :

The explanatory variable is whether or not a woman has had breast implants.

Part (b):

The response variable is illness (whether or not one is ill).

Part (c):

The observational units are individual women.

Question 8.8:

It appears that the digestive problems were caused by the placebo effect. People feared that fluoridation of their drinking water would cause health problems and this fear lead to digestive problems when, in fact, fluoride was not yet being added to the water.

Question 8.19:

This is a bad proposal because treatment differences would be confounded with differences between the litters. If two treatments appeared to be different, we would not know whether this was due to a true treatment effect or due to differences in the litters.

Question 8.28:

This is a non-sampling error, because it would occur even with a census of the entire database.

Question 9.2:

Part (a) :

The standard deviation of the nine sample differences is given as 59.3. The standard error is:

$$SE_{\bar{d}} = \frac{s_d}{\sqrt{n_d}} = \frac{59.3}{\sqrt{9}} = 19.77$$

Part (b):

H_0: The mean weight gains on the two diets are the same $(\mu_1 = \mu_2)$.

H_A: The mean weight gains on the two diets are different $(\mu_1 \neq \mu_2)$.

$$t_S = \frac{22.9}{19.77} = 1.158$$

With df = 8, Table 4 gives $t_{0.20} = 0.889$ and $t_{0.10} = 1.397$. Thus, $0.20 < P < 0.40$ and we do not reject H_0. There is insufficient evidence ($0.20<P<0.40$) to conclude that the man weight gains on the two diets are different.

Part (c):

$$CI = 22.9 \pm (1.860)(19.77) = (-13.90, 59.70)$$

Part (d):

We are 90% confident that the average steer gains somewhere between 59.7 pounds more and 13.9 pounds less when on Diet 1 than when on Diet 2 (in a 140-day period).

Question 9.22:

Let p denote the probability that the Northern member of a pair will dominate in more episodes than the Carolina.

H_0: Dominance is balanced between the subspecies $(p = 0.5)$.

H_A: One of the subspecies tends to dominate the other $(p \neq 0.5)$.

$N_+ = 8$, $N_- = 0$, $B_S = 8$. Looking under $n_d = 8$ in Table 7, we see that the rightmost column with a critical value less than or equal to 8 is the column headed 0.01 (for a nondirectional alternative), and the next column is headed 0.002. Therefore, $0.002<p<0.01$. There is sufficient evidence ($0.002<p<0.01$) to conclude the Carolina subspecies tends to dominate the Northern.

Question 9.23:

$$p = 2(0.5^8) = 0.0078125$$

Question 9.33:

H_0: Alcoholism has no effect on brain density.

H_A: Alcoholism reduces brain density.

The differences tend to be negative, which is consistent with H_A.

The absolute values of the differences are 1.2, 1.7, 0.5, 4.7, 3.3, 0.4, 2.7, 1.8, 0.1, 0.3 and 1.4.

The ranks of the absolute differences are 5, 7, 4, 11, 10, 3, 9, 8, 1, 2 and 6.

The signed ranks are -5, -7, -4, -11, -10, 3, -9, -8, -1, 2 and -6.

Thus, $W_+ = 3 + 2 = 5$ and $W_- = 5 + 7 + 4 + 11 + 10 + 9 + 8 + 1 + 6 = 61$.

$W_S = 61$ and $n_d = 11$; reading Table 8 we find $0.001 <$ p-value < 0.005 and H_0 is rejected. There is strong evidence ($0.001<$p-value<0.005) to conclude that alcoholism is associated with reduced brain density. This was an observational study, so drawing a cause-effect inference is risky. We should stop short of saying that alcoholism reduces brain density.

Question 9.44:

It must be reasonable to regard the differences as a random sample from a normal population. We must trust the researchers that their sampling method was random. The normality condition can be verified with a normal probability plot. The plot below is fair linear (although the plateaus show that there are several differences that have the same value) which supports the normality condition.