Stat 22000 Summer 2020 Homework 10

All page, section, and exercise numbers below refer to the course text (*OpenIntro Statistics*, **3rd edition**, by Diez, Barr, and Cetinkaya-Rundel.).

Reading: Section 4.3, 5.1
Problems for Self-Study : (Do Not Turn In)

- Exercise 4.17, 4.19, 4,21, 4.25, 4.31 on p.209-213 and Exercise 5.1, 5.3, 5.7, 5.11 on p.257-259. The answers can be found on p.413-416 the book.

Problems to Turn In: due **midnight of Sunday, July 19, on Canvas**.

1. (Similar to Exercise 5.3 on p.257) An random sample is selected from an approximately normal population with an unknown standard deviation. For each the given set of hypotheses, sample size and the T-statistic, find the p-value using the `pt()` function in R.

   (a) $H_A : \mu > 0.5$, $n = 26$, $T = 2.6$

   (b) $H_A : \mu \neq 0.5$, $n = 26$, $T = 2.6$

   (c) $H_A : \mu < 3$, $n = 18$, $T = -2.2$

   (d) $H_A : \mu < 3$, $n = 18$, $T = 2.2$

2. A study compared different psychological therapies for teenage girls suffering from anorexia, an eating disorder that causes them to become dangerously underweight.

   Each girl's weight was measured before and after a period of therapy. The variable of interest was the weight change, defined as weight at the end of the study minus weight at the beginning of the study.

   Two therapies were designed to aid weight gain, one of which is the cognitive behavioral therapy. This form of psychotherapy stresses identifying the thinking that causes the undesirable behavior and replacing it with thoughts designed to help improve this behavior. The changes of 29 teenage girls receiving the cognitive behavioral therapy in weight (in lbs) during the study were

   ```
   1.7, 11.7, -1.4, 0.7, 6.1, -0.8, -0.1, 1.1, 2.4, -0.7, -4.0, 12.6, -3.5, 20.9,
   1.9, 14.9, -9.3, 3.9, 3.5, 2.1, 0.1, 17.1, 1.4, 15.4, -7.6, -0.3, -0.7,1.6, -3.7
   ```

   The weight change was positive if the girl gained weight (which is desired) and negative if she lost weight. We want to test whether the cognitive behavioral therapy is effective to aid weight gain.

   (a) Using a calculator or R, find the sample mean and the standard deviation of the weight changes.

   (b) Formulate the null and alternative hypotheses for testing whether teenage girls receiving the cognitive behavioral therapy have a positive mean weight gain.

   (c) Calculate the t-statistic and report the degrees of freedom.

   (d) Find the p-value and make a conclusion use a significance level of 0.01.

   (e) What are the Type 1 error and Type 2 error respectively for the hypothesis test done in part (b-d)?

   (f) Repeat part (b)(c)(d) but for testing whether the population mean weight gain is not 0, rather than higher than 0.

   (g) Find the 95% t-confidence interval for μ, where μ is the population mean weight gain of girls receiving the cognitive behavioral therapy. Based on the constructed interval, explain why it suggests that the true mean change in weight is positive, but possibly quite small.

   (h) Verify your computations in part (c)(d)(f)(g) with the R commend `t.test`.

```
cognitive = c(1.7,11.7,-1.4,0.7,6.1,-0.8,-0.1,1.1,2.4,-0.7,-4.0,12.6,-3.5,20.9,
              1.9,14.9,-9.3,3.9,3.5,2.1,0.1,17.1,1.4,15.4,-7.6,-0.3,-0.7,1.6,-3.7)
t.test(cognitive, alternative = "greater")
t.test(cognitive, alternative = "two.sided")
```

3. Determine if the following statements are true or false, and explain your reasoning. If false, state how it could be corrected.

   (a) Decreasing the significance level (α) will increase the probability of making a Type 1 Error.

   (b) If a given value is within a 90% confidence interval for a parameter, it will also be within a 95% confidence interval.

   (c) Suppose the null hypothesis is $\mu = 5$ and we fail to reject H_0. Under this scenario, the true population mean is 5.