Group Work - Week 9

1 The data file "bears.csv" on D2L contains measurements of a random sample of bears from a national park. Harsh winters can be hard on a bear population, especially older bears. Park officials want to know if the mean bear age is greater than the usual mean of 55 months.

(a) What are the null and alternative hypotheses for a test on this claim? Is this a one-sided or two-sided test? Are the requirements of a t-test satisfied?

$H_0 : \mu = 55$
$H_a : \mu > 55$
One-sided test
All the requirements are satisfied (sample size is > 30).

(b) Using the data set, conduct a test at the $\alpha = 0.05$ level of significance of the claim that the bear population has a mean age greater than 55 months. Be sure to state your conclusion in the context of the question.

$t = -2.502$, $p = 0.0155 < \alpha = 0.05$. Reject H_0.
There is evidence that the bear population has a different mean age than 55 months.

2 A manufacturer of flash drives wants to know if there is a difference in the reliability of their drives used in extreme conditions. A sample of 15 drives used in cold conditions (< 32°F) had a mean lifespan of 41.9 months with a standard deviation of 6.3. A sample of 17 drives used in hot conditions (> 99°F) had a mean lifespan of 38.4 months with a standard deviation of 5.9. Assume lifespans of flash drive are normally distributed.

(a) What are the null and alternative hypotheses for a test on this claim? Is this a one-sided or two-sided test? Are these independent or dependent samples? Are the requirements for a hypothesis test satisfied?

$H_0 : \mu_c = \mu_h$ or $\mu_c - \mu_h = 0$
$H_a : \mu_c \neq \mu_h$ or $\mu_c - \mu_h \neq 0$
Two-sided test, independent samples
All the requirements are satisfied (populations are normally distributed).

(b) Conduct an hypothesis test at the $\alpha = 0.05$ level of significance. Be sure to state your conclusion in the context of the question.

$t = 1.616$, $p = 0.1171 > \alpha = 0.05$. Fail to reject H_0.
There is not evidence the drives in extreme cold and extreme heat have different lifespans.

(c) Calculate the appropriate confidence interval. Does the inference from the confidence interval match the results of the hypothesis test?

Two-sided test: confidence level $= (1 - \alpha)\% = 95\%$
95% CI $= (-0.932, 7.932)$
Zero is in the confidence interval, thus there is not evidence that the means differ.

3 Researchers are interested in whether meditation can lower blood pressure in people that have high blood pressure. They conduct a study on 45 patients with high blood pressure (systolic blood pressure > 20), measuring their systolic blood pressure at baseline and after 30 minutes of meditation. The file "meditation_bp.csv" on D2L contains the data.

(a) What are the null and alternative hypotheses for a test on this claim? Is this a one-sided or two-sided test? Are these independent or dependent samples? Are the requirements for a hypothesis test satisfied?

$H_0 : \mu_d = 0$
$H_a : \mu_d > 0$, (if BP is lowered, then baseline - after = positive)
One-sided test, dependent or paired samples
All the requirements are satisfied (sample size is > 30).

(b) Conduct an hypothesis test at the $\alpha = 0.01$ level of significance. Be sure to state your conclusion in the context of the question.

$t = -6.339$, $p < 0.0001 < \alpha = 0.01$. Reject H_0.
There is evidence that systolic blood pressure is lower after 30 minutes of meditation.

(c) Calculate the appropriate confidence interval. Does the inference from the confidence interval match the results of the hypothesis test?

One-sided test: confidence level $= (1 - 2\alpha)\% = 98\%$
98% CI = (1.472, 3.283)
Zero is not in the confidence interval and both limits are positive, thus there is evidence that the mean difference is positive, or that blood pressure dropped from baseline to after meditation.