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 different 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? Is the claim represented by the null or alternative hypothesis?

$\boldsymbol{H_0 : \mu = 55}$

$\boldsymbol{H_a : \mu \neq 55}$

Two-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 different mean age of 55 months. Be sure to state your conclusion in the context of the question.

```
> t.test(bears$AGE, mu=55)

One Sample t-test

data:  bears$AGE
t = -2.5021, df = 53, p-value = 0.01547
alternative hypothesis: true mean is not equal to 55
95 percent confidence interval:
 34.31454 52.72249
sample estimates:
mean of x
 43.51852
```

$\boldsymbol{t = -2.5,\ p = 0.0155 < \alpha = 0.05.}$ **Reject** $\boldsymbol{H_0}$**.**

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 15 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?

$\boldsymbol{H_0 : \mu_c = \mu_h}$ **or** $\boldsymbol{\mu_c - \mu_h = 0}$
$\boldsymbol{H_a : \mu_c \neq \mu_h}$ **or** $\boldsymbol{\mu_c - \mu_h \neq 0}$
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.

$$\boldsymbol{t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{41.9 - 38.4}{\sqrt{\frac{6.3^2}{15} + \frac{5.9^2}{15}}} = 1.5705}$$

$\boldsymbol{p = 2 \times P(T > 1.57) = 2 \times 0.06936761 = 0.1387352}$

$\boldsymbol{p = 0.139 > \alpha = 0.05}$. **Fail to reject** $\boldsymbol{H_0}$.
There is not evidence the drives in extreme cold and extreme heat have different lifespans.

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?

$\boldsymbol{H_0 : \mu_d = 0}$

$\boldsymbol{H_a : \mu_d < 0}$

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.test(bp$baseline, bp$after, paired=T, alternative = "greater")

Paired t-test

data:  bp$baseline and bp$after
t = 6.3391, df = 44, p-value = 5.35e-08
alternative hypothesis: true difference in means is greater than 0
95 percent confidence interval:
 1.747533      Inf
sample estimates:
mean of the differences
               2.377778
```

$\boldsymbol{t = -6.34,\ p < 0.0001 < \alpha = 0.01.}$ **Reject $\boldsymbol{H_0}$.**

There is evidence that systolic blood pressure is lower after 30 minutes of meditation.