

Group Work - Chapter 9

1 A coffee shop is interested in the proportion of decaf coffee drinkers on Sunday and Monday mornings. The manager thinks they have a lower proportion of decaf drinkers on Monday. They examine a random sample of coffee orders and find that on Sunday 52 out of 156 orders are for decaffeinated coffee and on Monday 43 out 174 are decaf orders.

- (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 for a hypothesis test satisfied?

$$H_0 : p_s = p_m \quad \text{or} \quad p_s - p_m = 0$$

$$H_a : p_s > p_m \quad \text{or} \quad p_s - p_m > 0$$

One-sided test

All the requirements are satisfied.

- (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.

$$z = 1.73, p = 0.0421 < \alpha = 0.05. \text{ Reject } H_0.$$

There is evidence that the proportion of decaf coffee orders is lower on Mondays.

- (c) Construct an appropriate confidence interval of the true difference of population proportions. What is your conclusion based on the confidence interval? Does it agree with the hypothesis test?

90% confidence interval: (0.004, 0.168)

Because both lower and upper limits are positive, we can conclude, with 95% certainty, that the true population difference in proportions is positive. Thus, this result agrees with the hypothesis test.

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 ($< 32^{\circ}\text{F}$) had a mean lifespan of 41.9 months with a standard deviation of 6.3. A sample of 15 drives used in hot conditions ($> 99^{\circ}\text{F}$) 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?

$$H_0 : \mu_c = \mu_h \quad \text{or} \quad \mu_c - \mu_h = 0$$

$$H_a : \mu_c \neq \mu_h \quad \text{or} \quad \mu_c - \mu_h \neq 0$$

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.

$$t = 1.57, p = 0.1276 > \alpha = 0.05. \text{ Fail to reject } H_0.$$

There is not evidence the drives in extreme cold and extreme heat have different lifespans.

- (c) Construct an appropriate confidence interval of the true difference of population means. What is your conclusion based on the confidence interval? Does it agree with the hypothesis test?

95% confidence interval: (-1.066, 8.066)

Because zero is contained in the interval, we cannot conclude that the true population difference in mean lifespans is different than zero. Thus, this result agrees with the hypothesis test.

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?

Let μ_d be the population mean difference in systolic blood pressure (SBP after 30 minutes of meditation - baseline SBP).

$$H_0 : \mu_d = 0$$

$$H_a : \mu_d < 0$$

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.

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

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

- (c) Construct an appropriate confidence interval of the true population mean of the differences. What is your conclusion based on the confidence interval? Does it agree with the hypothesis test?

98% confidence interval: (-3.283, -1.472)

Because both lower and upper limits are negative, we can conclude, with 99% certainty, that the true population mean of the change in systolic blood pressure between baseline and after 30 minutes of meditation (after meditation - baseline) is negative. Thus, this result agrees with the hypothesis test.