L09: Homework Answer Key

Instructions: You are encouraged to collaborate with other students on the homework, but it is important that you do your own work. Before working with someone else on the assignment, you should attempt each problem on your own.

1. In your own words, explain what a P-value is.
   It is the probability that you get a result as extreme, or more extreme, than the one you saw in your sample, if the null hypothesis is really true.

2. When a hypothesis test is conducted, which hypothesis is assumed to be true?
   The null hypothesis (H_o)

Wikipedia asserts that the mean height of males in the United States is 69.5 inches. Based on your experience, you suspect that the true mean height of males exceeds this value. Use this information to answer questions 3 through 5.

3. State the null and alternative hypotheses that you would use to test your claim.
   H_o: $\mu = 69.5$ inches
   H_a: $\mu > 69.5$ inches

4. Is this a one-sided (i.e. one-tailed) test or a two-sided (i.e. two-tailed) test? Explain your answer.
   One-sided test

5. Suppose the sample data you collected had a mean height greater than the null hypothesis and indicates that the null hypothesis should be rejected when in fact the null hypothesis should not be rejected. Was a Type I or Type II error committed? Why?
   Type I error

According the Statistical Abstract of the United States, the mean consumption of fruits per person in 2003 was 98.4 pounds. A dietician believes people are becoming more health conscious and that fruit consumption has increased since then. Use this information to answer questions 6 through 10.

6. Determine the null and alternative hypotheses
   H_o: $\mu = 98.4$ pounds
   H_a: $\mu > 98.4$ pounds

7. Is this a one-sided (i.e. one-tailed) test or a two-sided (i.e. two-tailed) test? Explain your answer.
   One-sided test

8. What would be considered a Type II error in this example?
   A Type II error would be failing to reject the null hypothesis when it isn't true. In this example that would be concluding that fruit consumption hasn't increased when, in reality, it has.

9. If we tested this hypothesis at $\alpha = 0.01$ level, what is the probability of committing a Type I Error? Explain your answer.
   The probability of committing a Type I Error is $\alpha = 0.01$

10. If we wanted to decrease the probability of making a Type I error, would we need to increase or decrease the level of significance? Explain your answer.
    Decrease the level of significance

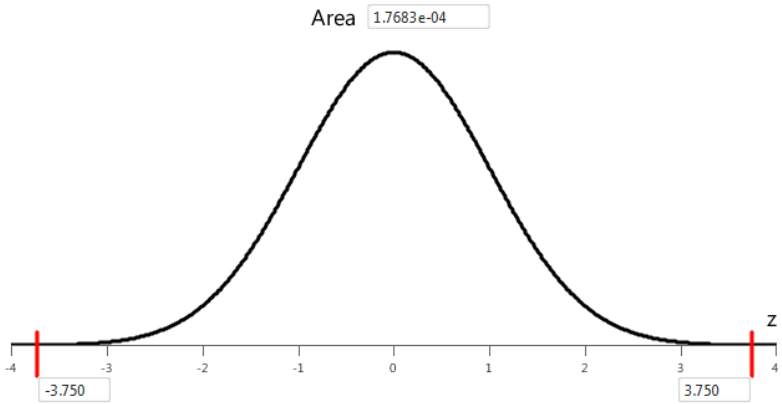
A simple random sample of 100 two-month-old babies is obtained, and the mean head circumference is found to be 39.4 cm. Assuming that the population standard deviation is known to be 1.6 cm, use $\alpha = 0.05$ level of significance to test the claim that the mean head circumference of all two-month-old babies is different than 40.0 cm. Use this information to answer questions 11 through 16.

11. State the null and alternative hypotheses.
    H_o: $\mu = 40.0$ cm
    H_a: $\mu \neq 40.0$ cm

12. Compute the test statistic for this analysis.
    $z = -3.750$

13. Determine the P-value based on the test statistic.
    P-value = 1.768E-4

14. Label the sample test statistic and shade the P-value on a sampling distribution curve.
    Note: You can either sketch the distribution curve and scan in your document or use the snipping tool to paste a picture of the distribution curve here. Click here for instructions on how to use the snipping tool.



15. What decision do you make based on the P-value and the level of significance (α)?
    Reject the null hypothesis

16. State your conclusion in an English sentence.

There is sufficient evidence to conclude that the mean head circumference of all two-month-old babies is different than 40.0 cm.

Because of the increased demand for corn for food, animal feed and ethanol, The USDA is trying to determine if corn production is keeping up with demand. They have determined that a yield of at least 135 bushels per acre will be necessary to meet the demands for the coming year. If the yield is less than 135 bushels per acre, then the USDA will need to recommend an approach to ration corn for the next year.

The mean yield of corn in the United States is about 135 bushels per acre. A survey of 50 farmers this year gives a sample mean yield of 133.1 bushels per acre. We want to know whether this is good evidence that the national mean this year is less than 135 bushels per acre. Assume that the farmers surveyed are an SRS from the population of all commercial corn growers and that the standard deviation of the yield in this population is σ = 10 bushels per acre. Test this claim at $\alpha = 0.05$ level of significance. Use this information to answer questions 17 through 23.

17. State the null and alternative hypothesis

H_o: μ = 135 bushels per acre

H_a: μ < 135 bushels per acre

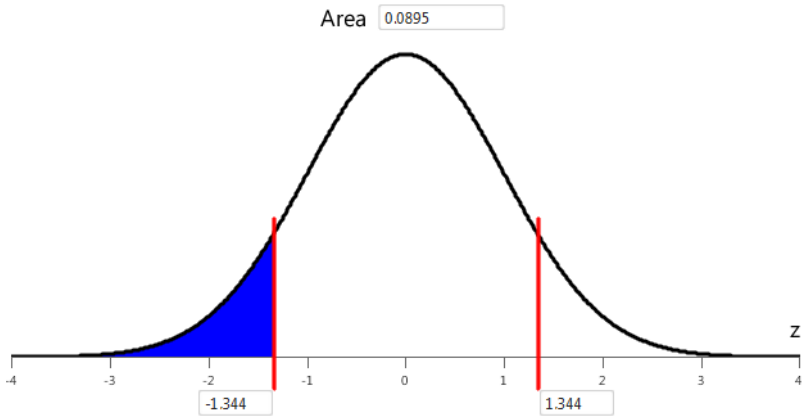
18. Compute the test statistic for this analysis

z = -1.344

19. Determine the P-value based on the test statistic.

P-value = 0.090

20. Label the sample test statistic and shade the P-value on a sampling distribution curve



21. What decision do you make based on the P-value and the level of significance (α)?

Fail to reject the null hypothesis

22. State your conclusion in an English sentence.

There is insufficient evidence to conclude that the mean yield of corn is less than 135 bushels per acre.

23. If you were overseeing this study for the USDA, what action would you recommend based on these results?

The evidence does not indicate that the production is less than 135 bushels per acre. However, it is worth keeping a close eye on the production over the next few years.