8.3.1: Exercises

1. What conditions are required to utilize the Student's T-distribution to approximate probabilities when we compare two population means?

2. Suppose you are interested in the difference in average life span between white and black people. You randomly survey death records of 120 white people, the mean life span was 77.6 years with a standard deviation of 12.1 years. Of the 87 black people, the mean life span was 71.8 years with a standard deviation of 16.3 years. Estimate the average difference in lifespan for white and black people using a 90% confidence level and 205 degrees of freedom. Show all five steps of the confidence interval process.

3. You are interested in finding out if mothers and fathers spend different amounts of time on childcare. You randomly survey 32 mothers and find that they spend an average of 14.0 hours per week on childcare with a sample standard deviation of 4.6 hours per week. You randomly survey 31 fathers and find that they spend an average of 10.8 hours per week on childcare with a sample standard deviation of 4.1 hours per week. Test the claim at a 5% level of significance using 61 degrees of freedom. Show all four steps of the hypothesis testing process.

4. Below is a solution that Zed wrote for the following problem: The mean batting average for a sample of eight Rattlers is 0.21 with a sample standard deviation of 0.05, and the mean batting average for a sample of nine Vikings is 0.26 with a sample standard deviation of 0.06. Assume batting averages are normally distributed. Are the batting averages of the Rattlers significantly lower than the Vikings, at a 1% level of significance? Use 15 degrees of freedom.

   Spot any errors in the solutions, and explain to Zed how to correct the error.

   Step 1: Let μ_1 represent the Rattlers and let μ_2 represent the Vikings.

   $H_0 : \mu = 0$

   $H_a : \mu < 0$

   Step 2: There are at least 10 observed successes and failures in the samples so it's normal. $n_1 = 8, \bar{x}_1 = 0.21, s_1 = 0.05, n_2 = 9, \bar{x}_2 = 0.26, s_2 = 0.06$

   Step 3: $T = \frac{0.21-0.26}{\sqrt{\frac{0.05}{8}+\frac{0.06}{9}}} = -0.44$ in desmos: tdist(15) with -0.44 as the min. P-value is 0.667.

   Step 4: The P-value is larger than the level of significance so we accept the null hypothesis and reject the alternative hypothesis. Therefore the batting average for the two teams are the same.

5. The mean batting average for a sample of eight Rattlers is 0.21 with a sample standard deviation of 0.05, and the mean batting average for a sample of nine Vikings is 0.26 with a sample standard deviation of 0.06. Assume batting averages are normally distributed. Are the batting averages of the Rattlers significantly lower than the Vikings, at a 1% level of significance? Use 15 degrees of freedom.

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