Stat 50 – Worksheet #26: Statistical Significance and Large Sample Test for Difference Between Two Means

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1. Suppose a hypothesis test of $H_0 : \mu \leq 10$ vs $H_1 : \mu > 10$ is conducted and the data result in a P-value of 0.04.

   (a) True or False: The test is statistically significant at the 5% significance level.

   (b) True or False: The test is statistically significant at the 1% significance level.

   (c) True or False: The null hypothesis is rejected at the 5% significance level.

   (d) True or False: The null hypothesis is rejected at the 1% significance level.

   (e) True or False: Testing the two-tailed version ($H_0 : \mu = 10$ vs $H_1 : \mu \neq 10$) with the same data would result in rejection of the null hypothesis at the 5% signficance level.

2. A study is conducted to determine if there is a difference in the mean amount of caffeine consumed in a day by mathematicians and engineers. A random sample of 50 mathematicians gives an average of 250mg of caffeine per day with a standard deviation of 40 mg while a sample of 35 engineers gives a mean of 270 mg of caffeine in a day with a standard deviation of 45 mg.

   (a) The null hypothesis is: $H_0 : \mu_{math} = \mu_{eng}$. What is the alternative hypothesis?

   (b) Calculate the P-value of the data.

   (c) Based on the P-value would you reject the null at the 5% level of significance? at the 1% significance level?

   (d) Would you conclude there is a difference in the mean caffeine consumption per day between mathematicians and engineers? Why or why not?

3. A hypothesis test is conducted to determine if the mean score on a certain test is lower for brown-eyed people compared to green-eyed people. Thus, a test of $H_0 : \mu_B = \mu_G$ vs $H_1 : \mu_B < \mu_G$ is conducted. A summary of the data are $\bar{X}_B = 70, n_B = 100, s_B = 20$ and $\bar{X}_G = 80, n_G = 105, s_G = 30$.

   (a) Calculate the P-value for these data.

   (b) Can you conclude that the mean score is lower for people with brown eyes compared to people with blue eyes? Why or why not?

   (c) What would the P-value be if the two-tailed version of this test ($H_1 : \mu_B \neq \mu_G$) were conducted with the same data?

4. Why is the test statistic $\dfrac{\bar{X} - \bar{Y}}{\sqrt{\frac{\sigma_x^2}{n_x} + \frac{\sigma_y^2}{n_y}}}$ inappropriate for testing the difference between means with these sample data: $\bar{X} = 50, n_x = 8, s_x = 9$ and $\bar{Y} = 60, n_y = 5, s_y = 10$?