Expensive Diet Pill

There are many past examples in which ineffective treatments were marketed for substantial profits. Capsules of "Fat Trapper" and "Exercise in a Bottle," manufactured by the Enforma Natural Products company, were advertised as being effective treatments for weight reduction. Advertisements claimed that after taking the capsules, fat would be blocked and calories would be burned, even without exercise. Because the Federal Trade Commission identified claims that appeared to be unsubstantiated, the company was fined $10 million for deceptive advertising.

The effectiveness of such treatments can be determined with experiments in which one group of randomly selected subjects is given the treatment, while another group of randomly selected subjects is given a placebo. The resulting weight losses can be compared using statistical methods, such as those described in this section.

Interpretation

There is sufficient evidence to support the claim that the red background group has a lower mean creativity score than the blue background group. This supports the conclusion that higher creativity scores were achieved by the subjects with the blue background, but the results do not justify the conclusion that the blue background is the *cause* of the higher creativity scores.

Example 3 **Confidence Interval for Creativity Scores**

Using the sample data given in Example 2, construct a 98% confidence interval estimate of the difference between the mean creativity score for those with a red background and the mean creativity score for those with a blue background.

Solution

Requirement check Because we are using the same data from Example 2, the same requirement check applies here, so the requirements are satisfied. ✔

We first find the value of the margin of error E. We use the same critical value of $t_{\alpha/2} = 2.441$ found in Example 2. (A more accurate critical value is 2.392.)

$$E = t_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} = 2.441\sqrt{\frac{0.97^2}{35} + \frac{0.63^2}{36}} = 0.475261$$

Using $E = 0.475261$, $\bar{x}_1 = 3.39$, and $\bar{x}_2 = 3.97$, we can now find the confidence interval as follows:

$$(\bar{x}_1 - \bar{x}_2) - E < (\mu_1 - \mu_2) < (\bar{x}_1 - \bar{x}_2) + E$$
$$-1.06 < (\mu_1 - \mu_2) < -0.10$$

If we use technology to obtain more accurate results, we get the confidence interval of $-1.05 < (\mu_1 - \mu_2) < -0.11$, so we can see that the confidence interval above is quite good, even though we used a simplified method for finding the number of degrees of freedom (instead of getting more accurate results by using Formula 9-1 to compute the number of degrees of freedom).

Interpretation

We are 98% confident that the limits of -1.05 and -0.11 actually do contain the difference between the two population means. Because those limits do not contain 0, this confidence interval suggests that there is a significant difference between the two means. (We used a 98% confidence level, so the one-sided hypothesis test has a corresponding significance level of 0.01.) Also, because the confidence interval consists entirely of negative values, there is sufficient evidence to support the claim that the red background group has a lower mean creativity score than the blue background group. This supports the claim that "blue enhances performance on a creative task" as claimed by the researchers, but we should be careful to avoid a statement that the blue background is the *cause* of the higher creativity scores.

Rationale for the Test Statistic and Confidence Interval

If the given assumptions are satisfied, the sampling distribution of $\bar{x}_1 - \bar{x}_2$ can be approximated by a t distribution with mean equal to $\mu_1 - \mu_2$ and standard deviation