**Question 1**

A football coach is frustrated with his team’s lack of speed. He measure’s each player’s 30-yard dash speed and then sends all of them to a speed and agility camp. He then measures their times then after. The data is below. Is there sufficient evidence to say that the camp helped the players speed? Run a test.

|  |  |
| --- | --- |
| **Before** | **After** |
| 5.88 | 5.76 |
| 5.89 | 5.21 |
| 3.41 | 3.35 |
| 5.79 | 5.89 |
| 4.92 | 4.78 |
| 4.96 | 4.54 |
| 4.95 | 4.79 |
| 4.66 | 4.88 |
| 5.56 | 5.08 |
| 5.73 | 5.65 |
| 5.05 | 5.1 |
| 4.44 | 4.79 |
| 4.27 | 4.78 |
| 4.87 | 4.95 |
| 5.55 | 4.98 |

Is there evidence that the mean gets significantly better performance after camp? Use a 0.05 level of significance and a test.

1. **Write an appropriate hypothesis test for this situation and state the appropriate testing procedure.**

H₀: The mean 30-yard dash speed of the players before the camp is equal to the mean 30-yard dash speed of the players after the camp.

H₁: The mean 30-yard dash speed of the players before the camp is less than the mean 30-yard dash speed of the players after the camp

The appropriate testing procedure is a one tailed paired sample t test where we need to conduct an upper tailed test.

The formula for the test is;

1. **Compute the necessary summary statistics for the test in part (a)**

Degree of freedom is 15-1 = 14

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Before** | **After** | D | |  | | --- | |  | |
| 5.88 | 5.76 | 0.12 | 0.0144 |
| 5.89 | 5.21 | 0.68 | 0.4624 |
| 3.41 | 3.35 | 0.06 | 0.0036 |
| 5.79 | 5.89 | -0.1 | 0.01 |
| 4.92 | 4.78 | 0.14 | 0.0196 |
| 4.96 | 4.54 | 0.42 | 0.1764 |
| 4.95 | 4.79 | 0.16 | 0.0256 |
| 4.66 | 4.88 | -0.22 | 0.0484 |
| 5.56 | 5.08 | 0.48 | 0.2304 |
| 5.73 | 5.65 | 0.08 | 0.0064 |
| 5.05 | 5.1 | -0.05 | 0.0025 |
| 4.44 | 4.79 | -0.35 | 0.1225 |
| 4.27 | 4.78 | -0.51 | 0.2601 |
| 4.87 | 4.95 | -0.08 | 0.0064 |
| 5.55 | 4.98 | 0.57 | 0.3249 |
|  | Total | 1.4 | 1.7136 |

T = 1.075

Critical value 1.761310136

1. **Perform the test and report the p-value**

|  |  |  |
| --- | --- | --- |
| t-Test: Paired Two Sample for Means |  |  |
|  |  |  |
|  | *Before* | *After* |
| Mean | 5.062 | 4.968666667 |
| Variance | 0.48586 | 0.355312381 |
| Observations | 15 | 15 |
| Pearson Correlation | 0.876200911 |  |
| Hypothesized Mean Difference | 0 |  |
| df | 14 |  |
| t Stat | 1.075016454 |  |
| P(T<=t) one-tail | 0.150273019 |  |
| t Critical one-tail | 1.761310136 |  |
| P(T<=t) two-tail | 0.300546038 |  |
| t Critical two-tail | 2.144786688 |  |

The p value for the paired t test is 0.150273019

**Interpret your results and conclusion**

The test statistics for the paired t test is 1.075 while the critical value is 1.761310136. The test statistics falls in the rejection region at 5% significance level. Additionally, the p value of the test is 0.150273019. The p-value is not statistically significant at 5% significance level. Therefore, we fail reject the null hypothesis that the mean 30-yard dash speed of the players before the camp is equal to the mean 30-yard dash speed of the players after the camp.

**Question 2**

The distribution of scores for students taking the LSATs is claimed to have a mean of 463. Sample 15 incoming Harvard law school freshman LSAT scores and find a mean of 543 and a standard deviation of 35. Since Harvard is an ivy league school, they think their freshmen are smarter than average law students. Test this theory by applying a suitable hypothesis test (that Harvard students score higher than the average on the LSATs) at 0.05 significance level.

Null hypothesis (H₀): The mean LSAT score of Harvard law school freshmen is equal to the claimed mean LSAT score of 463.

Alternative hypothesis (H₁): The mean LSAT score of Harvard law school freshmen is not equal to the claimed mean LSAT score of 463.

The t statistics is 8 .85253336

To determine the t critical value, we need to look for it at the t tables where the significance level is 5% and the degrees of freedom are 14. Therefore, the t critical value is 1.76131014.

|  |  |
| --- | --- |
| **Population Mean** | 463 |
| **Sample Mean** | 543 |
| **Sample standard deviation** | 35 |
| **Sample size** | 15 |
| **Degrees of freedom** |  |
| **α** | 0.05 |
| **t statistic** | 8.85253336 |
|  |  |
| **Critical value for left side** | -1.7613101 |
| **Critical value for right side** | 1.76131014 |
| **P-value** | 2.0669E-07 |

**Interpretation**

The table above shows the t test results. The t statistics value is 8.85253336 while the Critical value is 1.76131014. The t statistics lies in the rejection region. Additionally, the p-value for this test is 2.0669E-07. The p-value is significant at 5% significance level; therefore, we reject the null hypothesis that the mean LSAT score of Harvard law school freshmen is equal to the claimed mean score of 463 in favor of the alternative hypothesis.