Answer on Question #60620 – Math – Statistics and Probability

Question

Grade 11 students enrolled in schools in the LSB jurisdiction have had an average score of 63% on the exam with a standard deviation of 11%. Using the data from a clustered random sample of students from amongst the school board (see table below), determine if this year's performance (2012) on the math exam was significantly lower than the historical average. Conduct a complete hypothesis test using a confidence level of 95%.

A complete hypothesis test includes:

a) The null and alternative hypotheses, Ho and Ha.

b) The critical value (confidence coefficient).

c) The test statistic [2] (including sample mean and standard deviation.

d) The p-value.

Student scores:

72, 52, 85, 60, 41, 39, 50, 48, 89, 70, 75, 61, 62, 40, 64, 79

Solution

Since the sample is small and the type of distribution is unknown, one should use

t-distribution.

a) The null hypothesis: this year's performance is equal to the historical average; $\mu = 63$

The alternative hypothesis: this year's performance is lower than the historical average; $\mu < 63$ (represents the claim, left-tailed test).

b) The critical *t*-value, associated with the given significance level, can be either obtained from the *t*-table, or calculated using the technology (T.INV() function of MS Excel).

For the left-tailed test with $df = n - 1 = 15$, and $\alpha = 1 - c$ =1-0.95= 0.05, the critical

t-value is $t_c = -2.6025$.

c) The standardized test statistic:

$$t = \frac{\overline{x} - \mu}{s/\sqrt{n}}.$$

Sample mean and sample SD are calculated using MS Excel functions AVERAGE() and STDEV.S() respectively:

$\overline{x} = 61.6875$; $s = 15.8775$.

Then

$$t = \frac{61.6875 - 63}{15.8775/\sqrt{16}} = -0.3307 .$$

d) The *p*-value, associated with the obtained test statistic, can be either obtained from the *t*-table, or calculated using the technology (T.DIST() function of MS Excel).
For the left-tailed test with $df = 15$ and $t = -0.3307$, $p = 0.3727$.

Conclusion:

I. since the test statistic is in the non-rejection region, fail to reject the null;
II. since the obtained *p*-value is greater than the significance level, fail to reject the null.

Interpretation:

At 0.05 significance level, the sample does not provide enough evidence to support the claim that this year's performance is lower than the historical average.