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One sample t test example problems with solutions pdf

The automaker says their Super Spiffy Sedan averages 31 mpg. Randomly select 8 Super Spiffies from local car sales and test their mileage under similar conditions. You get the following MPG score: MPG: 30 28 32 26 33 25 28 30 Does the actual gas mileage for these cars significantly vary from 31 (alpha = .05)? The objective of the analysis is to test the significant deviation between the mean sample and the proposed mean population. We test the mean of these data at 31.00 with t test with one sample: the formula reader is equal to your sample mean minus the value of the population with which you compare the sample (in our case it is 31). The denominator is equal to the standard error of the sample: standard deviation of the sample divided by square root n (number of points in the sample). If you would like to help calculate the mean and standard deviations, see the documentation for the review procedure. Calculate test statistics. Calculate the mean and standard deviations of the sample. You find that the average is equal to 29.00, and the standard deviation is equal to 2.78. Now calculate your t statistics: Perform a hypothesis test. The degree of freedom (df) for your test is equal to n-1.

In this study df = 8–1 = 7. Perform a non-directional (i.e. two-sex) test with alpha = 0,05. From the table of critical values t you will see that if the absolute value of your obtained t is greater than 2,365, you would conclude that the average number of kilometres of gas travelled by cars differs significantly from 31.00. Since your obtained absolute value of t (2.04) is lower than the critical value (2,365), you would conclude that the average number of kilometres of gas travelled in your sample did not differ significantly from 31.00. Return to one sample T Test Return to content hypothesis Testing > One sample T Test One sample t test compares the mean value of your sample data with a known value. For example, you may know how your sample compares to the middle population. You should run one sample t test when you do not know the standard deviation of the population or you have a small sample size. For a full run of the test to be used, see: T-score vs. Z-Score. Test prerequisites (your data should meet the following requirements for the test to be valid): One sample T Preview Preview: Your company wants to improve sales. Data from past sales indicate that the average sales were $100 per transaction. After training your sales strength, recent sales data (taken from a sample of 25 sellers) indicates an average sale of $130, with a standard deviation of $15. Did the training work? Test your hypothesis at the 5% alpha level. Step 1: Write a statement of the zero hypothesis (How to indicate a zero hypothesis). The accepted hypothesis is that there is no difference in sales, so: H0: μ = Step 2: Write an alternative hypothesis. This is the one you're testing. Do you think there is a difference (that average sales increased), so: H1: μ > $100. Step 3: Identify the following information that you will need to calculate the test statistics. The question would give you the following items: sample means (x). This is listed in question as $130. Average (average μ). Because like $100 (from past data). Sample standard deviation(s) = $15. Number of observations (n) = 25. Step 4: Insert the items from above into the t score formula. t = (130 – 100) / ((15 / √(25)) t = (30 / 3) = 10 This is your calculated value t. Step 5: Find the value of the t-table. You need two values to find this: Alpha level: given as 5% in question. Degrees of freedom, which is the number of items in the sample (n) minus 1:25-1 = 24. Look up to 24 degrees of freedom in the left column and 0.05 in the top row. The intersection is 1,711.This is your single-tracked critical value of t. This critical figure means that we would expect most values to fall below 1,711. If our calculated value of t (from step 4) falls within this range, the null hypothesis is probably true. Step 5: Compare step 4 with step 5. The value from step 4 does not belong to the range calculated in step 5, so we can reject the zero hypothesis. The value of 10 falls within the rejection area (left tail). In other words, it is highly likely that the average sales are larger. Sales training was probably a success. Want to check your work? Check out Daniel Soper's calculator. Just connect the data to get t-statistics and critical values. References Beyer, W.H. CRC Standard Mathematical Tables, 31. Agresti A. (1990) Categorical analysis of data. John Wiley and sons, New York. Friedman (2015). Basic clinical trials 5. Salkind, N. (2016). Statistics for People Who (I Think) Hate Statistics: Using Microsoft Excel 4th Edition. --Suchn't help with homework or a test question? With the Chegg Study, you can get step-by-step solutions to your questions from an expert in this field. Your first 30 minutes with a chegg teacher is free! Comments? Do you need to post a fix? Please post a comment on our Facebook page. One t-test of the sample requires that the sample data be numerical and continuous because they are based on normal layout. Continuous data can take on any value in the range (income, height, weight, etc.). The opposite of contiguous data is discrete data, which can have only a few values (low, medium, high, etc.). Sometimes discrete data can be used to approximate a contiguous scale, such as Likert scales. The independence of observations is usually not testable, but can reasonably be assumed if the the collection process was random without compensation. In our example, we would like to select laptops randomly, compared to using any systematic pattern. This will ensure a minimum risk of collecting an biased sample that would yield inaccurate results. Normality To test the assumption of normality, different methods are available, but the easiest way is to visually check the data using a histogram or Q-Q scatterplot. Real-world data is almost never entirely normal, so this assumption can be considered reasonably met if the shape looks approximately symmetrical and bell-shaped. The data in the example below is roughly commonly distributed. Figure 1. Histogram approximately a commonly distributed variable. Outliers Outlier is the value of data that is too extreme to belong to the interest distribution. Suppose in our example that the mounting machine ran out of a particular component, resulting in a laptop that was assembled at a much lower weight. This is a condition that is beyond our question of interest and therefore we can remove this observation before carrying out the analysis. However, just because the value is extreme doesn't mean it is an outlier. Suppose that our laptop assembly machine occasionally produces laptops that weigh significantly more or less than five pounds, our target value. In this case, these extreme values are absolutely necessary for the question we are asking and should not be removed. Box-plots are useful for visualizing variability in the sample as well as placing all outliers. The box fence on the left shows a sample with no outliers. The box fence on the right shows a sample with one outlier. Figure 2. Boxplots variable without extreme levels (left) and with remote (right). The procedure for the t-test of one sample can be summarized in four steps. Symbols to be used are defined below: \(Y\ =\ \)Random Sample \(y_i\ \\)Observing \(i^{th}\) in \(Y\) \(n\ \\)Sample Size \(m_0\ =\ \)Estimated Value \(\overline{y}\ =\ \)Medium Sample \(\) sigma}\ =\ \)Sample standard deviation \(T\=\)Critical t-distribution with (\(n\-\ 1\)) degrees of freedom \(t\=\\)T-statistics (t-test statistics) for a single sample t-test \(p\ =\ \)\value \(p\)-value (probability value) for t-statistics. The four steps are given below: 1. Calculate the sample mean. \(\overline{y}\ =\ \frac{y_1\ +\ y_2\ +\ \cdots\ +\ y_n}{n}\) 2. Calculate the sample standard deviation. \(\hat{\sigma}\ =\ \sqrt{\frac{(y_1\ -\ \overline{y})^2\ +\ (y_2\ -\ \overline{y})^2\ +\ \cdots\ +\ (y_n\ -\ \overline{y})^2}{n\ -\ 1}}\) 3. Calculate test statistics. \(t\ =\ \frac{\overline{y}\ -\ m_0}{\hat{\sigma}/\sqrt{n}}\) 4. Calculate the probability of compliance with test statistics below the zero hypothesis. This value is obtained by comparing t with t-distribution with (\(n\-\ degree of freedom. This can be done by finding values in a table, such as those found in many statistical textbooks, or with statistical software for more accurate results. \(p\ =\ 2\ \cdot\ Pr(T\ >\ |t|) \) (two-tailed) \(p\ =\ Pr(T\ >\ t)\) (upper-tailed) \(p\ =\ Pr(T\ <\ t)\) (lower-tailed) Once the assumptions have been verified and the calculations are complete, All that remains is to determine whether the results provide sufficient evidence to reject the null hypothesis in favor of the alternative hypothesis. There are two types of meaning to consider when interpreting the results of a single sample test t, statistical significance and practical significance. Statistical significance Statistical significance is determined by looking at the p value. The value p indicates the probability of observing the test results below the zero hypothesis. The lower the p-value, the lower the probability of obtaining a result than that observed if the zero hypothesis is true. The low p-value therefore indicates reduced support for the zero hypothesis. However, the possibility that the zero hypothesis is true and that we have simply obtained a very rare result can never be completely ruled out. The final value for determining statistical significance is decided by the investigator, but usually a value of 0.05 or less is chosen. This corresponds to a 5% (or less) chance of getting a result like the one that was observed if the null hypothesis was true. Practical importance Practical importance depends on the subject. In general, the result is practically significant if the magnitude of the effect is large enough (or small) to be relevant to the research issues examined. It is not uncommon, especially with large sample sizes, to observe a result that is statistically significant, but not practically significant. Returning to the example of laptop weights, the average difference of £0.002 can be statistically significant. However, this small difference is unlikely to be in the interest. In most cases, both practical and statistical significance is needed to draw meaningful conclusions. Statistical solutions can help you with quantitative analysis by helping you develop your chapters on methodology and results. Services we offer include: Data Analysis Plan Edit your research questions and null/alternative hypotheses Write your data analysis plan; specify specific statistics to address research questions, assumptions of statistics and justify why they are appropriate statistics; Provide references Justify sample size/performance analysis, provide references Explain your data analysis plan to be comfortable and confident Two hours of additional support with your statistics Quantitative Results Section (Descriptive Statistics, Bivariate and analysis, modeling structural equations, Path Analysis, HLM, Cluster Analysis) Clean and code dataset Perform descriptive statistics (i.e. mean, standard deviation, frequency and percentage, as needed) Perform analyses to examine each of your research questions Provide tables and numbers 6. , schedule using the calendar on your page, or email

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