

Problem 1. In the latest CNN/USA Today/Gallup Tracking Poll, 337 likely voters (51.6 percent) said they would vote for George W Bush and 316 (48.4 percent) said they would vote for J. Kerry. Verify that Bush's lead over Kerry is not statistically significant. Give the name of the test and the value of the statistic you calculate.

Solution. We are comparing the mean of two population, but we don't have the population variance, so we have to use the t -test. First, we are going to call X_i to the answer of the i -th person who replied the survey. We know that X_i can be 0 or 1, depending if the person is planning to vote for Kerry or Bush respectively. With these notations we have

$$\begin{aligned}\bar{X} &= \frac{1}{653} \sum_{i=1}^{653} X_i = 0.516 \\ \bar{S}^2 &= \frac{1}{652} \sum_{i=1}^{653} (X_i - \bar{X})^2 = \frac{1}{652} \left(\sum_{\text{Kerry}} (X_i - 0.516)^2 + \sum_{\text{Bush}} (X_i - 0.516)^2 \right) \\ &= \frac{1}{652} \left(\sum_{\text{Kerry}} (0.516)^2 + \sum_{\text{Bush}} (0.484)^2 \right) = \frac{1}{652} (316 \times 0.2663 + 337 \times 0.2343) = 0.25\end{aligned}$$

All these calculations mean that

$$\bar{S} = 0.5$$

Now, we are going to compute the value of the t statistic. The formula tells us

$$t = \frac{\bar{X} - \mu}{\bar{S}}$$

where μ is the population mean which we want to test. In this case, we want to check if the percentage of people voting for Bush is enough to beat Kerry, which means we set $\mu = 0.5$. So, our t is

$$t = \frac{0.516 - 0.5}{0.5} = 0.032$$

Now, we have to find t_α , the cut-off value for an specified α . Commonly, to test significance, we set $\alpha = 0.05$. With this value of α , we go to table for the t -distribution for $n = 652$ degrees of freedom, and we get

$$t_\alpha = 1.97$$

Since $t < t_\alpha$ we conclude that *Bush's advantage is not statistically significant*

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