This problem comes from MATH 1342 Statistics – David Katz

Killing a fly with a sledge hammer, or when hypothesis testing is not really necessary

---

Hypothesis testing allows students to decide if experimental data differs from previous data sets in a scientifically significant way. How to make this decision is especially important when experimental data is close, but not the same as previous data.

Consider this fictitious case of smart phone durability. A certain manufacturer claims that this year's models are more durable than previous years. In previous years, 90% of phones tested survived a six-foot drop. This year, in a random sample of 100 phones, 93 or 93% survived and were still workable after the drop test. A 93% survival rate is better than 90%, but still relatively close to the 90% rate. The hypothesis test procedure can help us decide is this improvement is statistically significant.

If, however, the experimental data totally contradicts the established claim, then there is no need to perform a hypothesis test. I have come across two homework problems from our Math Lab, which ask students to do a hypothesis when one is not really necessary. Unfortunately, such misleading problems do not promote a true understanding of hypothesis testing.

In the first misleading problem, the experimental data (again for our fictitious smart phone company) shows that only 89 or 89% of the 100 phone sample survived the drop test. Here, the experimental data gives a percent survival rate *less* than the previously established rate of 90%. This problem, nonetheless, is written to claim the rate is *greater* than 90%. If the experimental rate is opposite from the claimed rate, there is absolutely no way the hypothesis test can ever support the claim. Running a hypothesis test is completely unnecessary since we already know the result.

Consider the arithmetic when we claim the experimental rate > established rate $(\hat{p} > p_0)$, and we have a right-tailed test with this test statistic z:

$$z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} < 0 \text{ because in reality } \hat{p} < p_0$$

The critical region for a right-tailed test by definition must lie on the right, that is, beyond $z > 0$ on the number line. But the test statistic is always negative and on the left of the number line. Thus, no such claim can ever be supported.

In the second misleading problem, the claim (again for our fictitious smart phone company) is now made that the survival rate for smart phones *is equal to* 90% or better after the drop test. If the claim already agrees with the established or assumed survival rate of 90% (both rates can equal 90%), then there is absolutely no reason to do hypothesis testing to decide between competing claims.