Read Chapter 20 : Testing Hypotheses About Proportions

Particular attention will be given to:
- Null and alternative Hypotheses pg. 509.
- SD(pHAT) calculated at a point p0 pg. 509.
- Test Statistic ∼ z = (pHAT - p0) / SD(pHAT) pg.509.
- p-Value pg. 511 (not the usual p as used for population fraction).
- z-Test pg. 513.
- Other hypotheses pg. 515 (see "Alternative Alternatives).
- Summary beginning pg. 519.

**Lecture 12-2-09 will go over the following:**

1. In a typical season one particular menu item accounts for around 17 percent of red meat orders, but a promotion has possibly increased that. A random sampling of 200 red meat orders from 16,000 orders during one week finds 46 for the item (rather more than the 34 expected if p0 = 0.17 applies). It is desired to test the hypothesis H0: p = 0.17 versus the alternative hypothesis H_A: p > 0.17.

   a. Determine pHAT from this data.

   b. Is this test one-sided or two-sided?

   c. Determine SD(p0).

   d. Determine the value of the test statistic z.
e. Determine the p-value \( P(Z > z) \) test statistic value \( z \) from (d)) using the z-table.

f. A statistical test of the hypothesis \( H_0: p = 0.17 \) versus the alternative hypothesis \( H_A: p > 0.17 \) will take the action of "rejecting the null hypothesis \( H_0: p = 0.17 \)" if the p-value (e) is less than \( \alpha = 0.01 \). Using p-value (e) it this action taken? If not we say the test has failed to reject \( H_0: p = 0.17 \).

The value \( \alpha \) called the "significance level of the test" is chosen by the experimenter. Its practical meaning is the probability of "error of the first kind" which is in turn equal to the probability that \( H_0: p = 0.17 \) will be falsely rejected when indeed \( p = 0.17 \) (the value \( p_0 \)). This would be a "false rejection."

g. Sketch the power curve of this test. Include \( \alpha \), \( p_0 \), in the sketch and also identify the roll of \( \sqrt{n} \) (this is not in the readings, we will do it in class).

2. In a typical season one particular menu item accounts for around 17 percent of red meat orders, but a promotion has possibly changed that. A random sampling of 200 red meat orders from 16,000 orders during one week finds 46 for the item (rather different from the 34 expected if \( p = 0.17 \) applies). It is desired to test the hypothesis \( H_0: p = 0.17 \) versus the alternative hypothesis \( H_A: p \neq 0.17 \).

a. Determine \( \hat{p} \) from this data.

b. Is this test one-sided or two-sided?

c. Determine SD(\( p_0 \)).
d. Determine the value of the test statistic $z$.

e. Determine the p-value $P( | Z | > | \text{test statistic value} \ z \ from \ (d) | )$ using the $z$-table.

f. A statistical test of the hypothesis $H_0: \ p = 0.17$ versus the alternative hypothesis $H_A: \ p \neq 0.17$ will take the action of "rejecting the null hypothesis $H_0: \ p = 0.17"$ if the p-value (e) is less than $\alpha = 0.05$. Using p-value (e) it this action taken? If not we say the test has failed to reject $H_0: \ p = 0.17$.

g. Sketch the power curve of this test. Include $\alpha$, $p_0$, in the sketch and also identify the roll of $\sqrt{n}$ (this is not in the readings, we will do it in class).