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LO2

Normal Approximation

• If the number of observations in the sample is larger than 10, the normal distribution can be used to approximate the binomial.

Binomial Test: $z = \frac{(X - np) \pm \sqrt{npq}}{npq}$

Normal Test: $z = \frac{(X - np) \pm \sqrt{npq}}{npq}$

EXAMPLE
The market research department of Cola, Inc. has been given the assignment of testing a new soft drink. Two versions of the drink are considered—either sweet drink and a somewhat bitter one. A preference test is to be conducted consisting of a sample of 64 consumers. Each consumer will taste both the sweet cola (labeled A) and the bitter one (labeled B) and indicate a preference. Conduct a test of hypothesis to determine if there is a difference in the preference for the sweet and bitter tastes. Use the .05 significance level.

Step 1: State the null hypothesis and the alternate hypothesis.
 $H_0: \mu = 50$ There is no preference
 $H_1: \mu \neq 50$ There is a preference

Step 2: Select the level of significance.
 $\alpha = 0.05$ as stated in the problem

Step 3: Select the test statistic.
Use Z-distribution where $\mu = 50$ and $\sigma = 50 \sqrt{.5}$

Step 4: Formulate the decision rule.
Referring to Appendix B.1. Areas under the Normal Curve for a two-tailed test (because states that $\mu \neq 50$), at the .05 significance level, the critical values are -1.96 and +1.96.

Step 5: Compute z, compare the computed value with the critical value, and make a decision regarding H_0 .
Preference for cola A was given a "+" sign and preference for B a "-" sign. Out of the 64 in the sample, 42 preferred the sweet taste, which is cola A. Therefore, there are 42 pluses. Since 42 is more than $42 - 50 = -8$, we use:

$$z = \frac{(42 - 50) \pm \sqrt{42(64 - 42)}}{50 \sqrt{.5}} = 2.18$$

The computed z of 2.18 is beyond the critical value of 1.96. Conclusion: The null hypothesis of no difference in consumer preference. There is evidence of a difference in consumer preference. That is, we conclude consumers prefer one cola over another.

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