Hypothesis testing for proportion.

Question: What is a hypothesis testing? How to perform it?

Want to test whether a hypothesis for **population parameter** is correct.

Background

Consider only proportion case in this note.

i.e. For population, $X \sim Ber(p), \mu = p, sd = \sigma = \sqrt{p(1-p)}$. p is proportion.

Then draw a sample of sample size n. Point estimation for mean is the sample mean, $\bar{X}$, with sd as $\sigma_{\bar{X}} = \sigma/\sqrt{n}$.

Five steps to solve

1. Assumptions

   Is sample size large enough? Have at least 15 successes and 15 failures.

2. Null/Alternative hypothesis

   $H_0 : p = \theta_0$ v.s.

$H_a : p \neq \theta_0$ (Two-sided) or $H_a : p \leq \theta_0$ (One-sided) or $H_a : p \geq \theta_0$ (One-sided)

3. Test statistic

   $T = \frac{\bar{X} - \theta_0}{\sigma_{\bar{X}}}$

   (Reasoning behind: Assume H_0 is true, then T will follow a standard normal distribution. So if hull hypothesis is true, T is less likely a large number. Therefore, when T is large enough, we are going to reject H_0, otherwise retain it. And we use p-value to evaluate whether T is large enough)

4. p-value

   - Two-sided

     $p - value = 2 * P(T > |t|) = 2(1 - pnorm(|t|))$, where t is the test statistic calculated from our sample.

   - One-sided

     $p - value = P(T > |t|) = 1 - pnorm(|t|)$

5. Conclusion & interpretation

   If $p < \alpha$, we reject H_0, otherwise retain it.
   $\alpha = 1 - \text{confidence level}$