Chapter 9
Hypothesis Testing

1 Hypothesis Testing

Couple different ways to define hypothesis.

$$\begin{aligned} H_0 : \mu \leq (\text{or} =)\mu_0 \quad &\text{VS.} \quad H_a : \mu > \mu_0 \\ H_0 : \mu \geq (\text{or} =)\mu_0 \quad &\text{VS.} \quad H_a : \mu < \mu_0 \\ H_0 : \mu = \mu_0 \quad &\text{VS.} \quad H_a : \mu \neq \mu_0 \end{aligned}$$

2 Tests about Population Mean/Population Proportion

Idea: Use sample mean (or sample proportion) to test the value of population mean (or population proportion)

2.1 Distribution of Population Mean

Assumption: $\bar{x}$ has a normal distribution

Condition

- Original population distribution is normal or
- Sample sizes n is large (≥ 30) (Central Limit theorem)

Case	Test Statistics	Additional condition
σ is known	$z = \dfrac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$	
σ is unknown	$z = \dfrac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$	$n \geq 30$

2.2 Distribution of Population Proportion

Assumption: $\hat{p}$ has a normal distribution

Conditions

- $np \geq 5$ and $n(1-p) \geq 5$

Test statistics: $z = \dfrac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$

3 Two Difference Ways to Test Hypothesis

test statistic vs. critical value
p-value vs. the level of significance α