Chapter 8. Testing Hypothesis

A statistical hypothesis is a claim about a population

Eg.
1. The average monthly balance of credit card holders is equal to $75
2. Manufacturer claims that the average weight of a box is 3.25 lbs.
3. Students suspect that the cost of textbooks is more than $300 per semester.

Test statistic components:

1. Null and alternative hypotheses.

   a. Null hypothesis (H_0) -- status quo or hypothesis of equality
      eg.: H_0: $\mu = 75$

   b. Alternative hypothesis (H_a or H_1) -- hypothesis that is accepted when H_0 is rejected.
      eg.: H_a: $\mu < 75$ (one-tailed test)
      H_a: $\mu > 75$ (one-tailed test)
      H_a: $\mu \neq 75$ (two-tailed test)

   c. Select a level of significance or α.
      eg.: $\alpha = 0.05$

2. Test statistic: the value used to determine the observed level of significance.

$$\text{test statistic} = \frac{\text{pointEstimate} - \text{H}_0\text{:value}}{\text{SE of estimate}}$$

3. *P*-value: the observed level of significance.
      eg.: *p*-value = 0.03

4. Conclusion:
      eg.: There is evidence that the average is different from 75.

1. Hypotheses

H_0: parameter ≤ hypothesizedValue vs. H1: parameter > hypothesizedValue
H_0: parameter ≥ hypothesizedValue vs. H1: parameter < hypothesizedValue
H_0: parameter = hypothesizedValue vs. H1: parameter ≠ hypothesizedValue

2. test statistic

$$\text{test statistic} = \text{testStat} = \frac{\text{pointEstimate} - H_0\text{:value}}{\text{SE of estimate}}$$

Estimate	**Parameter**	**SE of estimate**	**Critical value**	**TI-83**
$\bar{x}$	μ	$\frac{s}{\sqrt{n}}$	t_{n-1}	t-test
$\bar{x}_1 - \bar{x}_2$	$\mu_1 - \mu_2$	$\sqrt{(s_{pooled})^2((1/n_1) + (1/n_2))}$	$t_{n_1+n_2-2}$	2-sampTtest
$\hat{p}$	P	$\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$	z	1-propZtest
$\hat{p}_1 - \hat{p}_2$	$p_1 - p_2$	$\sqrt{(SE_1)^2 + (SE_2)^2}$	z	2-propZtest

3. *P-value*

Test	Mean	Proportion	Key words
lower-tailed	tcdf(-9999, testStat, df)	normalcdf(-9999, testStat)	Less than
upper-tailed	tcdf(testStat, 9999, df)	normalcdf(testStat, 9999)	More than
two-tailed	2*Tcdf(|testStat|, 9999, df)	2*Normalcdf(|testStat|, 9999)	Different

4. Conclusion

	p-value	critical value
z table	If *p*_value < α then reject H_0, there is evidence that ...; else do not reject H_0, there is no evidence that ...	If $\|z\| > z_\alpha$ then reject H_0, there is evidence that ...; else do not reject H_0, there is no evidence that ...
t table	If *p*_value < α then reject H_0, there is evidence that ...; else do not reject H_0, there is no evidence that ...	If $\|t\| > t_{n-1}$ then reject H_0, there is evidence that ...; else do not reject H_0, there is no evidence that ...