Hypothesis Testing Roadmap

Taught in Green Belt | Taught in Black Belt | Taught in ToolMaster

Tips to Remember

1. Proper sample size selection is required for tests to be effective.
2. H_A can be <, >, or ≠.
3. If $p > \alpha$, then fail to reject H_O.
4. If $p \leq \alpha$, then reject H_O.
5. An α-risk of 0.05 is typical.

Abbreviations
B.S. = Basic Statistics
CI = Confidence Interval

Building Models

Tests for Significance (All types of models)

For each model as a whole:
H_O: Model is not Significant
H_A: Model is Significant

For each factor in a model:
H_O: Model is not Significant
H_A: Model is Significant

Fitted Line Plot
Stat>Regression>Fitted Line Plot
Variable Y
One, Continuous X
Assumes Normality & Equal Variances

Binary Logistic Regression
Stat>Regression>Binary Logistic Regression
Binomial, Attribute Y
Multiple, Continuous or Discrete Xs

Multiple Regression
Stat>Regression>Regression
Variable Y
Multiple, Continuous Xs
Assumes Normality & Equal Variances

Ordinal Logistic Regression
Stat>Regression>Ordinal Logistic Regression
Multinomial, Attribute, Ordinal Y
Multiple, Continuous or Discrete Xs

ANOVA/DOE
Stat>ANOVA>General Linear Model
Variable Y
Multiple, Discrete Xs
Assumes Normality & Equal Variances

Nominal Logistic Regression
Stat>Regression>Nominal Logistic Regression
Multinomial, Attribute, Unordered Y
Multiple, Continuous or Discrete Xs

Start

Xs
- > 1
- One

Type of Y
- Attribute
- Variable

Normal?
- No
- Yes

Normality Test
H_O: Sample is from a Normal Population
H_A: Sample is Not from a Normal Population
Stat>B.S.>Graphical Summary

Attribute Data

Values for Y
- Two (Binomial)
- Two or More (Multinomial)

Chi-Square Analysis GOF
H_O: Distribution fits Assumption
H_A: Distribution does not fit
Stat>Tables>Chi Square Goodness of Fit Test (One Variable)

Chi-Square Analysis
H_O: Variables are Independent
H_A: Variables are NOT Independent
Stat>Tables>Chi Square Test (Two-Way Table in Worksheet)

Levels of X
- One (Group)
- Two (Groups)
- > Two (Groups)

1 Proportion Test
H_O: $P = P_{Tgt}$
H_A: $P \neq P_{Tgt}$
Stat>B.S.>1 Proportion Test

2 Proportion Test
H_O: $P_1 = P_2$
H_A: $P_1 \neq P_2$
Stat>B.S.> 2 Proportion Test

Analysis of Means (Binomial)
$H_{O_{1,2,...k}}$: $P_1, P_2, ...P_k = P_{Pooled}$
$H_{A_{1,2,...k}}$: $P_1, P_2, ...P_k \neq P_{Pooled}$
Stat>ANOVA>Analysis of Means

Variable Data - Non-Normal

Levels of X
- > Two (Groups)
- One (Group)
- Two (Groups)

Levene's Test
H_O: $\sigma_1^2 = \sigma_2^2 = \ldots = \sigma_k^2$
H_A: at least one is different
Stat>ANOVA>
Test for Equal Variances

σ^2 Equal?
- No → Proceed with caution
- Yes

Kruskal-Wallis or Mood's Median Test
H_O: $M_1 = M_2 = \ldots = M_k$
H_A: at least one is different
Stat>Nonparametrics>Kruskal-Wallis
Stat>Nonparametrics>Mood's Median Test

Levene's Test
H_O: $\sigma_1^2 = \sigma_2^2 = \ldots = \sigma_k^2$
H_A: at least one is different
Stat>ANOVA>
Test for Equal Variances

σ^2 Equal?
- Yes → Mann-Whitney Test
  H_O: $M_1 = M_2$
  H_A: $M_1 \neq M_2$
  Stat>Nonparametrics>Mann-Whitney
- No → Proceed with caution

Median or σ?
- M → 1 Sample Sign Test / 1 Sample Wilcoxon
  H_O: $M = M_{Tgt}$
  H_A: $M \neq M_{Tgt}$
  Stat>Nonparametrics>1 Sample Sign or Stat>Nonparametrics>1 Sample Wilcoxon
- σ → 1 Variance Test
  H_O: $\sigma = \sigma_{Tgt}$
  H_A: $\sigma \neq \sigma_{Tgt}$
  Stat>B.S.>1 Variance

Variable Data - Normal

Levels of X
- > Two (Groups)
- One (Group)
- Two (Groups)

Bartlett's Test
H_O: $\sigma_1^2 = \sigma_2^2 = \sigma_3^2 \ldots$
H_a: at least σ^2 is different
Stat>ANOVA>
Test for Equal Variances

σ^2 Equal?
- No → Proceed with caution
- Yes

ANOVA One-Way
H_O: $\mu_1 = \mu_2 = \ldots = \mu_k$
H_A: At least 1 is different
Stat>ANOVA>One-Way

F- Test
H_O: $\sigma_1^2 = \sigma_2^2$
H_A: $\sigma_1^2 \neq \sigma_2^2$
Stat>B.S.>2 Variances

2 Sample t Test
H_O: $\mu_1 = \mu_2$
H_A: $\mu_1 \neq \mu_2$
Stat>B.S.>2 Sample t

σ^2 Equal?
- Yes → ☑ Assume equal variances
- No → ☐ Assume equal variances

Paired Data?
- Yes → **Paired t Test**
  H_O: $\mu_{1-2} = 0$
  H_O: $\mu_{1-2} \neq 0$
  Stat>B.S.>1 Paired t
- No → μ or σ ?
  - μ → **1 Sample t Test**
    H_O: $\mu = \mu_{Tgt}$
    H_A: $\mu \neq \mu_{Tgt}$
    Stat>B.S.>1 Sample t
  - σ → **1 Variance Test**
    H_O: $\sigma = \sigma_{Tgt}$
    H_A: $\sigma \neq \sigma_{Tgt}$
    Stat>B.S.>1 Variance

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