When testing the relationship between two variables, follow these steps:

(This is the short version – the other side of this page is the longer version…)

1) Identify the variables and state the research hypothesis H_1 (what is the relationship?) and the null hypothesis H_0 (in plain words and with a diagram $H_1 = \mu_1 \neq \mu_2$ & $H_0 = \mu_1 = \mu_2$)
2) Calculate the appropriate test statistic (see below for our different test statistics)
3) Identify the appropriate critical value of that test statistic (use the Tables in the Textbook's Appendix)
4) Compare the calculated test statistic and the critical value: which is larger?
   a) If the calculated test statistic is **larger** than the critical value, **reject** the Null hypothesis [H_0] and accept the research hypothesis (there *is* a difference or relationship between the variables)
   b) If the calculated test statistic is **smaller** than the critical value, **retain** the Null hypothesis[H_0] and reject the research hypothesis (there *is no* difference or relationship between the variables)
5) Interpret what you have found by looking back to the variables and identifying the pattern (using plain words so that anyone would understand what you learned about people or society).

Test Statistics & Critical Values:

For testing the difference between means for two independent groups: T-TEST (CH.7)

$t = \dfrac{\bar{X}_1 - \bar{X}_2}{s_{\bar{X}_1 - \bar{X}_2}}$ & refer to the Critical Values of t [CV(t)] table with $df = N_1 + N_2 - 2$ and $\alpha = .05$

SPSS/PASW: Analyze > Compare Means > Independent Samples Test

For testing the difference between means for three or more groups: ANALYSIS OF VARIANCE (CH. 8)

$F = \dfrac{MS_{between}}{MS_{within}}$ with $MS_{between} = \dfrac{SS_{between}}{df_{between}}$ and $MS_{within} = \dfrac{SS_{within}}{df_{within}}$ with $df_{between} = k - 1$ (k = # of groups) & $df_{within} = N_{total} - k$

& refer to the Critical Values of F [CV(F)] table with $df_{numerator} = df_{between\ groups}$ & $df_{denominator} = df_{within\ groups}$

SPSS/PASW: Analyze > Compare Means > Means > Options-ANOVA

For testing if interval variables are related to each other: PEARSON'S r (CH. 10/11)

Pearson's r & refer to the Critical Values of r [CV(r)] table with $df = N-2$ and $\alpha = .05$

SPSS/PASW: Analyze > Correlation > Bivariate > Options-means
Regression: Analyze > Regression > Linear > Statistics - Descriptives
Scatterplot: Graphs > Legacy Dialogs > Scatter/Dot > Simple Scatter

For testing if variables in a cross tabulation table are related to each other: CHI SQUARE (CH. 9/12)

Chi-Square [χ^2] & refer to the Critical Values of Chi-Square [CV(χ^2)] table
with $df = (\#\ rows - 1)(\#\ columns - 1)$ and $\alpha = .05$

SPSS/PASW: Analyze > Descriptive Stats > Crosstabs > Statistics-Chi-Square > Cells-Row/Col percents

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Note: "Sig." in SPSS printouts is related to the alpha level – it stands for "significance". If the number in the "Sig." box is less than our alpha (0.05), then the test is significant statistically and you must reject the Null Hypothesis H_0.

Does one variable affect another? Are the values of one variable (or more) affected by another?

Which test to use?

Is there a significant difference or relationship between:

- ☞ TWO GROUPS (OR TIME PERIODS) OF A NOMINAL OR ORDINAL VARIABLE AND THE MEANS (OR PROPORTIONS) OF AN INTERVAL VARIABLE? *t-test (t or z statistic)*
- ☞ THREE OR MORE GROUPS OF A NOMINAL OR ORDINAL VARIABLE AND THE MEANS OF AN INTERVAL VARIABLE? *ANOVA (F-ratio)*
- ☞ TWO (OR MORE) INTERVAL VARIABLES? *Correlation & Regression (Pearson's r)*
- ☞ TWO NOMINAL OR ORDINAL VARIABLES? *Chi Square (Pearson's χ^2)*

Procedure?

1) **IDENTIFY THE VARIABLES AND THEIR RELATIONSHIP** – this is the Research Hypothesis H_1 – also state the Null hypothesis H_0.
2) **CALCULATE TEST STATISTIC** [See above, "Which test to use" - t/z, F ratio, χ2, r]
3) **IDENTIFY APPROPRIATE**
   a) **LEVEL OF SIGNIFICANCE** for the test [α of .05 or .01]
   b) **DEGREES OF FREEDOM** [see formula sheet]
   c) **CRITICAL VALUE** for test statistic (See the relevant Table for the test statistic)
4) **DECISION TIME!**
   a) If the calculated test statistic is **larger** than the critical value for that test statistic, you must **reject** the Null hypothesis [H_0] and accept the research hypothesis (there *is* a difference or relationship between the variables)
   b) If the calculated test statistic is **smaller** than the critical value for that test statistic, you must **retain** the Null hypothesis[H_0] and reject the research hypothesis (there *is no* difference or relationship between the variables)
5) **INTERPRETATION!!** (Tell the story of the data…)
   a) DESCRIBE THE VARIABLES USED (what they are measuring, their means or proportions, sample size, etc...)
   b) DESCRIBE THE RESEARCH HYPOTHESIS ("*Variable 1* is related to *Variable 2*"), and THE NULL HYPOTHESIS ("There is no relationship between *Variable 1* and *Variable 2*") Name the variables – do not just say "Variable 1" or "Variable 2")
   c) MENTION THE TEST USED, THE VALUE OF THE TEST STATISTIC, THE LEVEL OF SIGNIFICANCE AND HOW IT COMPARES TO THE CRITICAL VALUE (If a.01 α is used, explain why—Type 1 vs Type 2 error)
   d) DESCRIBE THE DECISION (regarding the null hypothesis) you've made based on the test statistic and its relation to the critical value for that test statistic
      i) If you rejected the H_0, say that there IS a real or statistically significant relationship between your two variables.
      ii) If you accepted the H_0, say that there IS NOT a real or statistically significant relationship between your two variables –and that any apparent difference is simply due to chance or random occurrence.
   e) SUM UP BY DESCRIBING WHAT YOU FOUND OUT: (Use everyday words that anyone can understand)
      i) Are the variables related in a statistically significant way?
         (1) If so, how are they related? (compare means or %'s - which category of the variable is higher or lower and what does that mean?)…
         (2) If not, why not? (Was the sample not random? Too small an N? Error?)…