**Course Description**

Social science research relies on quantitative methods as an aid in interpreting research findings. For this reason, it is important that students develop a thorough understanding of these methods. SW 961 provides an overview of many statistical procedures commonly used in the social sciences and is intended to serve as a foundation for more advanced study. The course is designed to review and introduce parametric and nonparametric approaches to analyzing univariate and bivariate data. Students who have had little exposure to statistics coursework will be helped to move quickly to an intermediate level, in preparation for more advanced coursework. This course, or satisfactory completion of its equivalent or demonstration of equivalency, is required of all students in the social work doctoral program.

This one-semester graduate level course is divided into two parts: a 3 credit lecture section and a 1 credit computing lab. Lectures will cover concepts, formulas, hand calculations and applications; as well as provide practice in the interpretation of the various statistics. Lab time will be used to show how the analyses are conducted in the SAS and SPSS statistical software packages and how to interpret the output. Students should be simultaneously enrolled in the lecture and lab sections.

**Prerequisites**

Graduate standing or the written consent of the instructor.

**Course Objectives**

On completion of this course, the students will be able to:

1. Choose appropriate statistical procedures to address research questions.
2. Critically assess the application of statistical techniques reported in published research.
3. Perform statistical analyses by hand calculation and using computer software.
4. Properly interpret statistical software output.

**Required Texts / Readings**

Lecture texts:


OR

The Siegel (& Castellan) text, a classic in the field, is very readable. However, only used copies are available and may be hard to find (and pricey).

Lecture notes:

- Copies of the lecture notes and other class materials will be available on the D2L system and can be printed out prior to lecture to facilitate note taking.

**Course Policies**

Campus policy information regarding participation by students with disabilities, accommodations for religious observances, academic conduct/misconduct, incomplete grading policies, complaint procedures, grade appeal procedures, sexual harassment and safety policies, final exam date requirements, and other standing policies/procedures is available on-line at: http://www.uwm.edu/Dept/SecU/SyllabusLinks.pdf.

**Academic Misconduct:** Academic misconduct is an act in which a student seeks to claim credit for the work or efforts of another without authorization or citation, uses unauthorized materials or fabricated data in any academic exercise, forges or falsifies academic documents or records, intentionally impedes or damages the academic work of others, engages in conduct aimed at making false representation of a student's academic performance, or assists other students in any of these acts.

Prohibited conduct includes cheating on an examination; collaborating with others in work to be presented, contrary to the stated rules of the course; submitting a paper or assignment as one's own work when a part or all of the paper or assignment is the work of another; submitting a paper or assignment that contains ideas or research of others without appropriately identifying the sources of those ideas; stealing examinations or course materials; submitting, if contrary to the rules of a course, work previously presented in another course; tampering with the laboratory experiment or computer program of another student; knowingly and intentionally assisting another student in any of the above, including assistance in an arrangement whereby any work, classroom performance, examination or other activity is submitted or performed by a person other than the student under whose name the work is submitted or performed.

Students' work must be in their own words except where appropriately cited. Excerpts from other authors may be used judiciously, but direct quotes involving even a few words must include the source, date, and page number(s) and must be indented or enclosed in quotations. Failure to comply with these requirements constitutes plagiarism and is grounds for a failing grade.

**Re-purposing assignments:** Anyone caught repurposing an assignment for this course (i.e., turning in an assignment used for credit in another course) even if the assignment is modified will receive zero points for the assignment. Note that many now consider this to be a form of plagiarism.

**Late assignments and make-up policy:** Students are expected to be present for examinations and to turn in assignments on or before the due date unless they contact the instructor in advance of the exam or due date. If an extension is given for a particular assignment, the grade may be reduced at the discretion of the instructor by 1/2 of a letter grade for each day late. Alternatives such as make-up exams or substitute assignments may then be made available at the instructor’s discretion, but these will only be offered as a result of circumstances beyond the student’s control.

**Attendance and class participation:** Because the material will be covered at a rapid pace, attendance is mandatory for all lectures and labs unless prior arrangements have been made with the instructor. Students with unexcused absences will receive a one-third reduction in their final grade for each unexcused absence (e.g., a final grade of A will be reduced to an A- following one absence).

**Participation by Students with Disabilities:** If you need special accommodations in order to meet any of the requirements of this course, please contact me and the Student Accessibility Center as soon as possible to make the necessary arrangements.
Accommodation for Religious Observances: Students will be allowed to complete examinations or other requirements in advance of a religious observance.

Assignments/Grading

Weekly assignments: Students will be assigned weekly homework problems for the lecture portion of the course. Each assignment will be worth 20 points and together will count for 30% of your total grade.

Exams: Three (3) exams covering the lecture material will be given over the course of the semester. Each exam will count 20% toward your final grade for a total of 60%.

Project: Each student is expected to complete a final project which will include a written summary to be handed in at the final class meeting and an oral presentation of their projects to be given during the final day of class. Students are expected to work with a faculty member in their program to identify a data set and hypotheses to test of the faculty member's choosing. Analytic methods learned in the course are to be applied and summarized in the report and presentation. More information regarding the project will be given in class at the beginning of the semester. The project will count for 10% of your final grade.

Determination of Student Grade

Letter grades will not be assigned on individual assignments or exams. Rather, each assignment and exam will be allotted a specific number of points. Points earned will be summed into a final point total and letter grades assigned based on these final point totals by the percents listed below.

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Topics

Week 1: Introduction and overview, begin basic stats review

Readings: Relevant chapters in any undergraduate level statistics text.

1. Introduction and overview of course. Review syllabus.
2. Overview of basic concepts, hypotheses vs. theories, superpopulations, populations and samples, sampling and assignment rules (random, nonrandom, adaptive, and others), levels of measurement, matching vs. random assignment, cross-level inferencing, unit of analysis, etc.
3. Derivation of computational formulas from definitional formulas.
4. Frequency distributions
5. The normal distribution; z-scores; the unit normal table; finding percentile ranks, estimating proportions, finding scores from percentiles, deviations from normality skew and kurtosis, methods for evaluating skew and kurtosis (normal probability and other plots, numerical indices, etc.).
7. Measures of dispersion or variability: sum-of-squares, variance, standard deviation (sample and population estimates, rationale for using N-1), range, interquartile and semi-interquartile range, coefficient of variation.
8. Graphing: bar charts, histograms, line graphs, box plots, stem and leaf plots, scatter plots, etc.
Week 2: Correlation.

Readings: Relevant chapters in any undergraduate level statistics text.

1. Overview of correlation concepts and the general formula for Pearson's r, linear vs. nonlinear relationships, visualizing association with scatterplots, correlation vs. causation.
2. Interpretation of and understanding the meaning of the correlation coefficient (z-score and discrepancy score formulas), direction and magnitude.
3. Members of the Pearson family of correlation coefficients, their application, and extensions: biserial, point-biserial, tetrachoric, polychoric, polyserial, Spearman's rho (issue of tied ranks, correction for ties, use with small samples, etc.), phi, autocorrelation coefficient.
4. Other indices of association: Kendall’s Tau a,b,c; Goodman-Kruskal Gamma, etc.
5. Coefficients of determination and alienation.
6. Factors that attenuate or inflate r.

Week 3: Basics of Inferential Statistics

Readings: Relevant chapters in any undergraduate level statistics text.

1. Probability
2. Overview of hypothesis testing:
   a. Population, sample, and sampling distributions
   b. Constructing an empirical sampling distribution - resampling methods
   c. Central limit theorem
   d. 4-step procedure for hypothesis testing
3. Introduction to the concept of power and effect sizes, statistical vs. clinical or practical significance.
4. One sample z-test.

Week 4: Inferential Statistics cont.

Readings: Relevant chapters in any undergraduate level statistics text.

1. One sample t-test, t-table.
2. Independent and related samples t-tests.
3. Robust significance testing using Winsorized and trimmed means.
   a. Fisher's z-transformation and testing the difference between two correlation coefficients, significance tests for other correlation coefficients.
4. Methods for calculating power, effect sizes, and sample sizes for the t-test and correlation coefficients; corrected standard error for correlations with small samples.
5. Confidence intervals - rationale, methods of construction and interpretation

Exam I

Weeks 5-9: Analysis of Variance

Readings: Chapters 1,2,3,4 Kirk

1. ANOVA Introduction and overview, assumptions of the ANOVA model
2. Completely Randomized Design (One-way Analysis of Variance; ANOVA)
   Design model
   Expected Mean Squares
   Fixed vs. random effects
   F-tests
   Type I error rates
Normalizing transformations
Preplanned vs. post hoc tests
Multiple comparison tests controlling the Type I error rate or the false discovery rate
Trend analysis
eta-squared, partial and general formulas for rho and omega²
Power and sample size estimation
Estimable functions, Type I, II, and III sums-of-squares
Trend analysis using orthogonal polynomial coefficients

3. Readings: Chapters 8 and 9 in Kirk

2-way Completely Randomized Factorial Design
Design model
Expected Mean Squares
F-tests
Multiple comparison tests
Understanding interactions
  Simple main effects and simple-simple main effects
  Contrast x contrast interaction effects
  Graphing interactions
eta-squared, partial and general formulas for rho and omega²
Power and sample size estimation

4. Reading: Chapter 6 in Kirk

Randomized blocks design (One-way repeated measures ANOVA)
Design model
Expected Mean Squares
Additivity and Tukey’s test
F-tests
Multiple comparison tests
Understanding interactions
  Simple main effects
  Contrast x contrast interaction effects
  Graphing interactions
eta-squared, partial and general formulas for rho and omega²
Power and sample size estimation
General Randomized blocks design

5. Reading: Chapter 11 in Kirk and handouts TBA

Split-plot Design
Design model
General tables for deriving expected mean square formulas
Circularity and compound symmetry
Central and non-central F distributions
Quasi-F statistics, Cochran and Satterthwaite adjusted degrees of freedom
Estimating deviations from circularity and adjustments to degrees of freedom, Greenhouse-Geiser, Huynh-Feldt, etc.
Multivariate versus univariate approach to repeated measures analysis
eta-squared, partial and general formulas for rho and omega²
Power and sample size estimation
6. Analysis of longitudinal data and the mixed model approach to ANOVA.

   Overview of types of longitudinal analyses, e.g., end-point analysis, time-series designs, etc.
   The split-plot design and its assumptions revisited.
   Univariate vs. multivariate approach to repeated measures analysis
   GLMs, GLMMs and the mixed model approach to repeated measures analysis
   The mixed model in matrix form
   Covariance structures, random vs. fixed effects, and maximum likelihood estimation (FML, REML)
   Significance testing – likelihood ratio test, Type III SS, Wald test

Exam II

Weeks 10-13: Nonparametric Statistics (readings in Hollander & Wolfe unless specified otherwise)

1. Overview of nonparametric statistics: Chap 1

2. Goodness-of-fit tests
   Binomial test: pp 20-28
   Chi-Square Goodness-of-Fit test: Handout
   Kolmogorov-Smirnov One- and Two-sample tests: pp 178-185

3. Tests for related samples:
   McNemar: pp 468-473
   Sign test: Handout
   Wilcoxon Signed Ranks Test: pp 36-51, 79-81
   Friedman's test: Handout

4. Tests for independent samples
   Fisher Exact Test: 473-475
   Chi-square tests for equiprobability and for independence models: pp 461-471
   Kruskal-Wallis: pp 189-199
   Wilcoxon-Mann-Whitney test: pp 106-123, 132-134

5. Stratification tests
   Cochran, Mantel, Haenszel: pp 484-492
   Odds and odds ratios

6. Randomization tests (Permutation tests): Handout

7. Note on power-efficiency of nonparametric tests: Notes

Week 14: Missing Data and Preparing Data for Analysis

Readings: Handouts on D2L

1. Overview of missing data mechanisms and techniques for handling missing data
   MCAR, MAR, NMAR/OAR
   Hot-deck imputation
   Cold-deck imputation
   Mean imputation
   Regression-based methods
   Multiple imputation
   The EM algorithm
Week 15: Power Analysis

Readings: Handouts on D2L

Exam 3

Some Web-based resources:

- SAS: www.sas.com
- SPSS: www.spss.com
- An excellent site with information on SPSS: www.spsstools.net
- UCLA Statistical computing site: http://www.ats.ucla.edu/stat/
- Karl Wuensch's Web page with information on SAS and SPSS: http://core.ecu.edu/psyc/wuensch/SAS.htm
- Practical Stats -- http://www.psych.ku.edu/preacher/
Term: Fall, 2012 (9/4/10 - 12/11/12)
Instructor: Michael J. Brondino
Office: 1167 Enderis Hall
Phone: (414) 229-2778
E-mail: brondimj@uwm.edu
Office Hours: TBA
Time and location: Thursdays, 2-3pm, Enderis Hall, Rm 1024

Course Overview
This laboratory section is designed to introduce students to statistical computing using SAS and SPSS. The class will concentrate on techniques needed to read and write data, create and transform variables, restructure data, and run and interpret analyses run using the statistical techniques covered in the lecture portion of the course. All homework assignments are expected to be completed using SAS and SPSS unless otherwise specified.

Prerequisites
Graduate standing and enrollment in SW 961 Sec 401.

Course Objectives
On completion of this course, the students will be able to:
- Perform statistical analyses using SAS and SPSS.
- Correctly interpret output from SAS and SPSS.

Texts / Readings
Lab text: A lab manual will be available on the D2L system for use in this class. It is extensive, nearly 300 pages, covering the basics of SAS and SPSS. You can view it online or print sections as needed.

There are a number of excellent introductory level texts available that you also may find helpful.

Examples of these are:


These texts and others can be purchased online at Amazon and there are now many electronic versions of these texts.

** Note that there are no exams in the lab section of the course only weekly homework assignments.
**Computer Labs**

All students enrolled in social work courses have access to the Enderis computer lab located on the 10th floor Enderis Hall and computer labs located throughout campus. For specific locations/hours go to: www3.uwm.edu/IMT/services/campus/ccls. Not all of the other labs have SAS on the computers but SPSS is available across campus.

**Course Policies**

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Prohibited conduct includes cheating on an examination; collaborating with others in work to be presented, contrary to the stated rules of the course; submitting a paper or assignment as one's own work when a part or all of the paper or assignment is the work of another; submitting a paper or assignment that contains ideas or research of others without appropriately identifying the sources of those ideas; stealing examinations or course materials; submitting, if contrary to the rules of a course, work previously presented in another course; tampering with the laboratory experiment or computer program of another student; knowingly and intentionally assisting another student in any of the above, including assistance in an arrangement whereby any work, classroom performance, examination or other activity is submitted or performed by a person other than the student under whose name the work is submitted or performed.

Students' work must be in their own words except where appropriately cited. Excerpts from other authors may be used judiciously, but direct quotes involving even a few words must include the source, date, and page number(s) and must be indented or enclosed in quotations. Failure to comply with these requirements constitutes plagiarism and is grounds for a failing grade.

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**Attendance and class participation:** Because the material will be covered at a rapid pace, attendance is mandatory for all labs unless prior arrangements have been made with the instructor. Students with unexcused absences will receive a one-third reduction in their final grade for each unexcused absence (e.g., a final grade of A will be reduced to a A- following one absence).

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**Accommodation for Religious Observances:** Students will be allowed to complete examinations or other requirements in advance of a religious observance.
Assignments/Grading

Weekly assignments: Students will be assigned weekly computer-based assignments. These assignments will count for 100% of your total score.

Determination of Student Grade

Letter grades will not be assigned on individual assignments or exams. Rather, each assignment and exam will be allotted a specific number of points. Points earned will be summed into a final point total and letter grades assigned based on these final point totals by the percents listed below.

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Topics

Note: We may not cover each topic in the week it is listed, but will cover the topics in the order they are listed.

Week 1: Introduction and overview: SAS and SPSS

- General program structure (interface) of SAS and SPSS
- Configuring the software
- Batch processing
  - Fixed, list and Free input formats
  - Assigning data formats at input
  - Reading data inline in SAS editor and SPSS syntax window

Week 2: Reading and writing data cont., Variable and Value labels, Merging data

- External data sources
  - SPSS Get and Write statements
  - SAS Filename, Libname, Data, and Set statements - two-level names. etc.
  - SAS Import and Export procedures
  - Portable file formats and reading SAS datasets into SPSS and SPSS datasets into SAS.

- Data formats
  - Variable labels, value labels, and comments - documenting programs

- Horizontal concatenation (Merge files SPSS and SAS)
  - One to one merge
  - Match merge

- Vertical concatenation (Add files SPSS, Set statement SAS)

Week 3: Comments, assignment, missing value, recode and conditional statements

- Assignment statements
  - Creating and transforming values
  - Arithmetic operators, order of precedence, using parentheses
  - Issues surrounding missing values, coding of missing values and propagating missing values
Recoding data and transforming variables
   SPSS Recode statement
   SAS Conditional statements
   Reflexing variables

Conditional statements
   If, then, else keywords
   Logical operators
   Simple and complex statements
   Do if, end if constructions

Week 4: Subsetting cases, by group processing, renaming variables and functions

Subsetting "if" statements
   SPSS select if, temporary statement, delete vs. filter
   SAS if (argument), if (argument) then delete;

By group processing
   SPSS split file
   SAS by statement

Renaming variables
   SPSS Rename Variables command
   SAS Rename command

Functions
   Arithmetic
   Statistical
   Date and Time
   String
   Random number

Week 5-6. Descriptive procedures and Graphing

SPSS - descriptives, frequencies, list
SAS - univariate, means, and freq

Bar charts, histograms, stem and leaf, box plots, scatterplots, etc.

Independent and related samples t-test
Bivariate correlations
   Pearson r, phi, rho, point-biserial, tetrachoric
   Dealing with tied ranks and small sample sizes
Obtaining confidence intervals

Weeks 7-11: ANOVA

1. Completely randomized design (One-way ANOVA)
   GLM approach to ANOVA
   Type I, II, and III sums of squares
   Testing model assumptions
   Normalizing transformations
Box-Cox using proc Transreg
User defined contrasts
Post hoc tests
Line graphs
Effect size - eta, intraclass corr, Power

2. Completely randomized factorial design (2-way and beyond)
3. Simple repeated measures ANOVA
   Test for additivity
4. Split-plot design
   Multivariate and univariate formats, stringing and unstringing data
5. Mixed-model approach to analyzing repeated measures data and data from split-plot designs

**Weeks 12-13: Nonparametric analyses**

Goodness of fit tests
   Binomial test
   Chi-Square Goodness-of-Fit test
   Kolmogorov-Smirnov One- and Two-sample tests

Tests for related samples:
   McNemar
   Sign test
   Wilcoxon Signed Ranks Test
   Friedman's test

Tests for independent samples
   Fisher Exact Test
   Chi-square test for equiprobability and for independence
   Kruskal-Wallis
   Wilcoxon-Mann-Whitney test

Stratification tests
   Cochran, Mantel, Haenszel - Odds and odds ratios

**Week 14: Missing data**

Approaches to imputation
   Hot deck, cold deck, simple mean, multiple imputation
   Multiple imputation vs. FML
   Specialized software for MI
   Combining Results in MI
   SAS proc mi
   SAS proc mianalyze