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Psychology 313P
Correlation and Regression

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Course Description:

The purpose of this course is to develop an in-depth knowledge of bivariate and multiple regression/correlation techniques. This includes the theory underlying the methods (in particular, OLS, some WLS and logistic regression), computational procedures, and interpretation of results. The course will be an introduction to specific applications. These include: (1) the full range of correlation indices; (2) a range of regression strategies (e.g., reduced-form regression, path analysis, ordered and unordered step-wise inclusion); (3) statistical power; (4) regression diagnostics; (5) nonlinear regression and linearizing transformations; (6) testing interactions, and (7) conditions for causal analysis and analysis of change (primary focus is on manifest variables using OLS and logistic models).

Course Requirements and Grades:

There is one required texts:

Cohen, J. Cohen, P. West, S.G. and Aiken, L.S. *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences, 3rd Edition.* Mahwah, New Jersey: Lawrence Erlbaum Associates, 2003.

Problem Sets, Exams and Grading

The time in class will be mostly lecture, derivations, demonstrations, and interpretation. To assure that we are all making adequate progress through the material there will be: (1) 9 problem sets (graded problems, applications) and 3 exams. A composite index for the problem sets will be created. The problem sets (composite) and 3 exams will be equally weighted in determining your final grade. In the absence of anything better, I will use the standard A=90-100; B=80-89; and C=70-79 formulation. In the event I construct an abnormal exam, I'll adjust distribution to accommodate this scheme.

Honor Code:

I encourage you to work together on problem sets but you must prepare your own answers to each problem with the problem set. Your work on the exams must be your own, following the tenets of the VU Honor Code.

When you are allowed to use notes and other material, I will make this clear in the instructions for the exam.

Week	*Day*	*Date*	*Main Topics, Key Concepts, Events*	*Focal Topics*
1	Th	1/12	**Introductions, overview**	
2	Tu	1/17	**Bivariate Correlation and Regression** Cohen et al. Chap 2, pp.19-41	r, r^2, B_{yx} and B_0 (standardized and raw-score formulations) plus phi, rank, point biserial, standard errors
	Th	1/19		
	F	1/20	Due: Problem Set # 1	
3	Tu	1/24	**Assumptions, hypothesis testing, confidence intervals, statistical power** Cohen et al. Chap 2, pp. 41-63	r_{xy} B_{xy} B_0 Plus $r_{xy1} - r_{xy2}$, $B_{xy1} - B_{xy2}$ and $\rho_{xy} \neq 0$, Fisher r to Z_r transformation; factors affecting the magnitude of the correlation.
	Th	1/26		
	F	1/27	Due: Problem Set # 2	
4	Tu	1/31	**SAS presentation and Multiple regression (k =2 or more)** Cohen et al. Chap. 3, pp. 64-100	Multiple R, R^2, increment R^2 , shrunken R^2 , partial correlation and pr^2, semi-partial correlations and sr^2, redundancy, suppression, spurious effects, direct and indirect effects, partial regression coefficients, standard errors and CI for B and *B,* CI for R; statistical tests for R, B, *B*, pr, sr; precision and statistical power for R and B's.
	Th	2/2		
	F	2/3	Due: Problem Set # 3	
5	Tu	2/7	**Displays and assumptions** Cohen et al. Chapt 4, pp. 101-124	Focal topics: variations in univariate and bivariate plots, lowess lines/curves, regression interactive graphics procedures; notably, SAS/INSIGHT; specification of the form; regression planes; model specification, measurement reliability, homoscedasticity, independence of residuals, normality of residuals, BLUE, autocorrelation.
	Th	2/9	**Detecting Violations of Assumptions and Some Fixes** Cohen et al. Chap pp. 124-150	Linear-nonlinear form, omitted variables, unreliability, non-constant variance, abnormality of residuals, auto-correlated data.
	F	2/10	Due: Problem Set #4	
6	Tu	2/14	**EXAM 1**	
	Th	2/16	**Regression Models, Analytic strategies, Statistical Tests, Power** Cohen et al. Chapter 5, pp. sections 5.1- 5.4	Focal topics: simultaneous solutions; hierarchical sequence of variables.
7	Tu	2/21	**Review EXAM 1 Regression models with sets of variables** Cohen et al. Chap. 5 Sections 5.5-5.8	Sets of variables; stepwise solutions; semi-partial R^2, partial R^2 , Model 1 and Model 2 error, statistical power of R^2 and semi-partial R^2; selecting variables and power.
	Th	2/23	**Regression Disagnostics: Outliers and multicollinearity** Cohen et al. Chap 10, sec. 10.1-10.7	Leverage, discrepancy, studentized residuals, DFFITS, DFBETAS, tolerance, respecification
	F	2/24	Due: Problem Set # 5	
8	Tu	2/28	No class	

	Th	3/2	**Nonlinear relations, transformations** Cohen et al. Chap 6, Sections 6.1,6.2, 6.4.1-6.4.4	Focal topics: power polynomials, centering predictors, log and exponential transformations; reciprocal and square root transformation.
9	Tu	3/7	**Spring Break**	
	Tr	3/9		
	F	3/10		
10	Tu	3/14	**Linearizing Transformation** Cohen at al. Chapt 6, Sec. 6.4.5- 6.4.8, 6.4.13;	Ladder of reexpression, bulging rule;
	Th	3/16	**Interactions** Cohen et al. Chap 7, Sec. 7.1-7.3	First-order, higher-order effects, centering, plotting interactions, "simple" regression equations, moderator variables, ordinal and disordinal interactions.
	F	3/17	Due: Problem Set # 6	
11	Tu	3/21	**EXAM 2**	
	Th	3/23	**Dummy, contrast and effects coding and interactions** Cohen et al. Chap 8, Sec. 8.1, 8.2, 8.3,8.4, 8.5, 8.7	Focal topics: binary coding, reference group, intercorrelations among dummy-coded variables; sets of dummy variables, statistical tests and CIs. unweighted and weighted effects coding; contrast coding; statistical significance and CIs; interpretation of coefficients r^2_{yi} B_0 B_i sr^2_i pr^2_i; choosing contrasts, and adjusted means.
12	Tu	3/28	**Review Exam 2** **Interactions with Categorical Variables** Cohen et al. Chap 9, Sec. 9.1,9.2	Ordinal, disordinal interactions, selecting coding method.
	Th	3/30	**Missing Data** Cohen et al. Chap 11, Sec. 11.1-11.4	Reducing missingness, types of missingness, methods of imputation, multiple imputation methods.
	F	3/31	Due : Problem Set #7	
13	Tu	4/4	**Causal models and Analysis of Change** Cohen et al. Chapter 12, Sec. 12.1-12.2, 12.4 ; Chap. 15 Sec. 15.1 -15.3	Focal topics: models involving mediating, confounding, moderator and suppressor variables; endogenous and exogenous variables, residuals, direct, indirect and spurious relations, path coefficients, tracing rules, reduced-form regression equations or partial causal models, residual change
	Th	4/6		
	F	4/7	Due: Problem Set # 8	
14	Tu	4/11	**Logistic regression** Cohen et al. Chapter 13, Sec. 13.1-13.2.12 (pp. 479-504)	Focal topics: regression coefficients, logit, odds, predicted probability, odds ratio, exp(**B**), partial regression coefficients, CIs for regression coefficients and OR deviance, likelihood ratio, Wald test, classification of cases.
	Th	4/13		
	F	4/14	Due: Problem Set # 9	
15	Tu	4/18	**Introduction to Random Coefficient Regression and Multi-level Models**	Clustering, intraclass correlation, level 1 and level 2 equations, mixed model, variance
	Th	4/20		

			Cohen et al. Chap 14 pp. 536-567	components, several examples
16	Tu	4/25	**Review**	
	Th	5/4	**EXAM 3 (9 :00 AM)**	