

Psychology 405: Psychometric Theory

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Swift 315 (as if that were useful)

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1 Outline (to be added to frequently – keep checking)

This is the abbreviated form of the syllabus, The full syllabus is at <https://personality-project.org/courses/405/405.syllabus.pdf>

Current version of June 1, 2020

1.1 News of changes

April 8th Minor improvements to the notes from Monday, updated today's notes.

April 19th Update coming to problem set 3 soon

April 22 Updates to the regression notes

May 3 Added the reliability and IRT sections

May 12th Updated the reliability and validity homework sets. Updated the irt handout

May 18th Updated the validity pages, Added another week (scale construction)

May 20th Added the cfa discussion

May 27th Added sem for week 8

June 1st Added more sem readings (optional) as well as further topics in psychometrics and a final summary of the course. Added a note on the final project.

1.2 Assignments as a table

Week	Topic	Lecture Notes	Readings	Homework/ R help
1 a	Correlational and Experimental Psychology	Overview	Chapter 1: the role of measurement	Getting started with R
1b		Theory of Data	Chapter 2: Theory of Data	Appendix A: Using R Homework #1 with answers
2 a	Models of Measurement Variance and Covariance	Metric properties and the problems of scale	Chapter 3: The problems of scale	Using R for statistics and an even shorter guide to R
2b		Correlation and Regression (Part 1)	Chapter 4: Correlation Francis Galton & Charles Spearman	Simple Regression problems #2 More problems
3a	Variance and Covariance	Correlation and Regression (Part2)	Review of linear/matrix algebra (Appendix E)	
3b		Linear algebra More on correlations and regression and even more	Multiple Correlations (Chapter 5)	Applications of correlations Problem set 3
4a	Latent variable models	Factor Analysis	Constructs, Components, and Factors (Chapter 6)	Factor Analysis (How To)
4 b		Even more fa		Homework set 4
5a	Reliability	Reliability Theory	Reliability (Chapter 7) α to ω Supplement to α to ω	Omega Analysis (How To) Homework set 5
6 a	Item Response Theory	Item Response Theory	Item Response Theory (Chapter 8)	Factor approaches to IRT see section 7
6 b	Validity	Validity	Predicting the Persome That takes the BISCUIT	Homework set 6 Homework set 7
7	Scale Construction	scale construction	That takes the BISCUIT	scoring scales Homework set 7
	Confirmatory analysis	efa vs. cfa	more on validity	
8	Structural Equation Modeling	sem Goodness of fit	sem chapters 3, 4, 5, 6	Factor analysis and sem
9	Other approaches	Further topics Review of 405		Final Project

This table and the entire syllabus is being converted from HTML to L^AT_EX. The original version is [here](#)

1.3 R advice

The [R tutorial](#) gives a short introduction to the use of R.

- (Macs and PCs) For this, or any other package to work, you must activate it by either using the Package Manager or the “library” command:
 - type `library(psych)`
 - If loading the psych package works, function such as `describe` and `pairs.panels` should work (or at least give an error message that is NOT “could not find function”).
 - entering `?psych` will give a list of the functions available in the *psych* package.

References

- Jöreskog, K. G. and Sörbom, D. (1999). *LISREL 8: Structural equation modeling with the SIMPLIS command language*. Scientific Software International, Lincolnwood.
- Loehlin, J. C. and Beaujean, A. (2017). *Latent variable models: an introduction to factor, path, and structural equation analysis*. Routledge, Mahwah, N.J., 5th edition.
- R Core Team (2019). *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, Austria.
- Raykov, T. and Marcoulides, G. A. (2006). *A first course in structural equation modeling*. Lawrence Erlbaum Associates, Mahwah, N.J., 2nd edition.
- Revelle, W. (2020). *psych: Procedures for Personality and Psychological Research*. Northwestern University, Evanston, <https://CRAN.r-project.org/package=psych>. R package version 2.0.1.

Revelle, W. (in prep). *An introduction to psychometric theory with applications in R*. Springer.

Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software*, 48(2):1–36.