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 May 31, 2022

1.1 News of changes

April 6th Added the short form of the syllabus as a table.

April 25th Updated the reliability slides, Updated the week 4 and week 5 homework assignments.

May 2nd Added a proposed Midterm for May 9th (to cover up to and including reliability). Does not require a computer, just a calculator.

May 16: Updated the scale construction slides

May 22: Updated the CFA slides.

May 25: Updated the CFA slides (again) and updated the goodness of fit slides.

Final exam is scheduled for Wednesday, June 8th at 5:30 (normal class time), papers are due Thursday, June 9th. There will be one more review session on Monday, June 6th.
## 1.2 Assignments as a table

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

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

## 2 Detailed Notes

### 2.1 Week 1

Introduction to latent variables (405 in a week).

Review of *Correlation and Regression* and classical reliability theory (Revelle and Condon, 2018a,b). See also Chapter 4 on Correlation and regression as well as Chapter 5 on multiple correlation and regression.

Review of linear/matrix algebra (Appendix E)

What is a latent variable? Some opposing viewpoints (Bartholomew et al., 2009; Loevinger, 1957; Markon and Jonas, 2016; Jonas and Markon, 2016)

### 2.2 Week 2

2.3 Week 3

Structural models and goodness of fit tests. Barrett (2007), Examples with simulated data.

How to simulate structural data. This has been revised with a correction for two factor simulations and with a more extensive analysis of the effects of sample size on estimating parameters in the two factor model.

Using basic sem programs to find structure and apply goodness of fit tests. Using the sem (Fox et al., 2013) and lavaan (Rosseel, 2012) packages.

2.4 Week 4

Perhaps the fundamental issue of latent variable analysis is why use latent variables. The classic development of latent variable analysis was (Spearman, 1904a) with the development of what has come to be called “Exploratory Factor Analysis”. While a useful descriptive technique to describe the “common” part of variables, EFA can be made a testable technique using “Confirmatory Factor Analysis” which is the root of most SEM packages. See EFA/CFA for an overview of PCA, EFA, and then the basics of CFA. EFA/CFA – psych, sem and lavaan.

Exploratory and confirmatory factor analysis, continued. The lecture notes for week 5 are here.

Considering issues of using items rather than continuous measures. items vs continuous measures. Unfortunately, items have serious problems with skew.

One of the most powerful applications of sem is the analysis of change.

2.5 Week 5

The problem of estimating reliability has been with us since at least Spearman (1904b). See the recent tutorial on reliability by Revelle and Condon (2019). By applying factor analytic tools, questions of reliability are easier to understand.

The problem of hierarchical representations of data. Many people claim a “general factor” of personality in analogy to the ‘g’ factor of ability. This has been disputed (Revelle and Wilt, 2013). See also A general factor of personality? talk given at an “Experts Meeting” on personality structure.

2.6 Week 6

Comparing three examples from the literature: a short example (Erdle et al., 2009) of how not to report factor analysis, a sem paper which which actually fails to identify the model correctly (Erdle et al., 2010) and another (Marsh et al., 2010) which systematically compares models. This last one includes a good discussion of how to do measurement invariance.

2.7 Week 7

Scale construction has some classic and new papers well worth reading. The basic problem of Validity versus reliability (Loevinger, 1957; Steger et al., 2022). The supposed threat of response styles was a confounding of content with response alternatives (Block, 1965; Rorer, 1965). Although perhaps extreme response style is a problem (Hamilton, 1968). The problem of bad responders and of wording effects are discussed in some recent papers (Arias et al., 2020) (Garcia-Pardina et al., 2022). Scale validity varies independently of scale internal consitency (Eagly and Revelle, 2022).
Validity studies range from selection (e.g., Gideon, OSS (OSS Assessment Staff, 1948), army Airforce (Dubois, 1947), Peace Corps. VA trainees (Kelly and Fiske, 1950)) as well as long term career success Benbow et al. (1996); Lubinski and Benbow (2000); Lubinski et al. (2001); Lubinski and Benbow (2006); Lubinski (2016), and mortality Deary et al. (2004); Deary and Batty (2007); Deary et al. (2007, 2013).

Any discussion of validity needs to include the classics of (Cronbach and Meehl, 1955; Campbell and Fiske, 1959; Loevinger, 1957).

lavaan uses many examples from the MPlus manual (http://www.statmodel.com/ugexcerpts.shtml. See in particular the example data sets at http://www.statmodel.com/usersguide/chapter5.shtml. The notes describing lavaan output for these examples are available here.

2.8 Week 8

Comparing sem in R and LISREL (Jöreskog and Sörbom, 1999). Consideration of goodness of fit tests (Barratt et al., 2007) (Click on Issue 5 in the left hand column). R and LISREL lecture notes

For a very good discussion of latent change estimation in R see Ghisletta and McArdle, (2014) (Ghisletta and McArdle, 2012). Also see the lecture notes from Yves Rosseel Modeling change with lavaan

For an example of modeling change in cognitive ability and depression to examine the temporal sequencing of the effects, look at Aichele et al. (2018).

An excellent set of lecture notes on testing for invariance comes from Tutorial on measurement invariance Kate Xu.

2.9 Week 10

Course review

2.10 Software


2.11 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


