PSYC 3201—Statistics & Psychometrics

Unit of Study Code: PSYC3201

Coordinator: Dr Joel Michell
Office: Room S472 Main Quad
Phone: 9351 3916
E-mail: joelm@psych.usyd.edu.au

Other Teaching Staff: Dr Margaret Charles
Office: Room 635 Mungo MacCallum
Phone: 9351 13354
E-mail: margretc@psych.usyd.edu.au

Associate Professor David Grayson
Office: Room 658 Mungo MacCallum
Phone: 9351 5175
E-mail: dgrayson@psych.usyd.edu.au

Format of Unit: 2 x 1 hour lectures/week x 13 weeks
1 x 1 hour tutorial/week x 12 weeks

Credit Point Value: 4 Credit Points

Qualifying: 12 credit points of Second Year Psychology including PSYC 2112

Assessment: Classwork:
5% Tutorial test (to be held in Tutorial 4, week 5, 7-11 August)
15% Assignment (1,000 words), Due Date: 5 September (week 9)

Examination:
30% short answer questions (Statistics)
50% short answer questions (Measurement & Psychometrics)

Evaluation of teaching and learning:
Date: week 13 of semester
Type: questionnaire

Unit of study general description:
The Statistics section of this course deals with the design and analysis of experiments in psychology for which some form of analysis of variance is appropriate. Tutorials will involve the use of statistical packages on computer as well as hand calculators. Students should purchase a computer disk and bring it, as well as a calculator, to all tutorials.

The Psychometrics section of the course deals with the statistical theory of psychological test scores and with the logic of quantification in psychology with applications to unidimensional scaling.
Teaching outcomes:

(1) Ability to calculate and interpret a one way analysis of variance, including tests of contrasts.
(2) Demonstrate an understanding of the problem of multiple comparisons and control of the Type I error rate.
(3) Ability to calculate, analyze and interpret data from factorial designs including ANOVA and contrasts.
(4) Understanding of issues involved in the treatment of data involving repeated measurements.
(5) Ability to carry out computer-based analyses for ANOVA and contrast testing, and to interpret the results appropriately.
(6) Understanding of Classical Test Theory and its applications to the reliability and validity of psychological test items and total test scores.
(7) Understanding of the concept of scientific measurement and the logic of scientific quantification, including the Theory of Conjoint Measurement.
(8) Understanding of how the Theory of Conjoint Measurement may be applied to unidimensional scaling in psychology.

Evidence of learning:

The quality of students' performance in tutorial tests, in a written assignment, and in written examinations will be taken as evidence of learning.

SYLLABUS

Section 1. Statistics.

The problem of multiple comparisons. The one way fixed effects ANOVA model: partitioning variation and degrees of freedom. Expected mean squares and the formation of F ratios.

Asking focused questions: testing contrasts. Planned orthogonal contrasts. Trend analysis.

Controlling the Type I error rate with multiple comparisons: the Scheffe procedure and the Bonferroni procedure.

Factorial designs: The two way ANOVA model with fixed effects. Partitioning between-group variation into main effects and interaction effects. Main effect and interaction contrasts for a two way ANOVA design.

Decision-wise vs family-wise control of Type I errors.

Repeated measures or within-subject variables. Univariate vs multivariate approaches to the analysis of repeated measures data. Planned contrasts for designs involving repeated measures data.

Section 2. Psychometrics.

Psychological tests, response patterns, and test scores. Item and test statistics.

The Classical Theory of Psychological Test Scores: axioms, definitions, and some of their consequences; applications of the theory; problems with the interpretations of true score and error score; the different kinds of reliability and validity.

Concept of Measurement: approaches to measurement in Psychology; operationism; representationalism and the classical approach.

The Logic of Quantification: distinction between quantitative and non-quantitative variables; fundamental and derived measurement; conjoint measurement.

Unidimensional scaling: Coombs' theory of unidimensional unfolding; single-peaked preference functions and the method of ratings.
## TIMETABLE

<table>
<thead>
<tr>
<th>WEEK</th>
<th>LECTURES</th>
<th>TUTORIALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>One-way ANOVA</td>
<td>One-way ANOVA</td>
</tr>
<tr>
<td>2</td>
<td>Contrasts: Formulation and Testing</td>
<td>Contrasts</td>
</tr>
<tr>
<td>3</td>
<td>Contrasts: the problem of multiple comparisons</td>
<td>Contrasts</td>
</tr>
<tr>
<td>4</td>
<td>Two-way ANOVA</td>
<td>Contrasts</td>
</tr>
<tr>
<td>5</td>
<td>Contrasts for 2-way ANOVA designs</td>
<td>Two-way ANOVA</td>
</tr>
<tr>
<td>6</td>
<td>Repeated measures data</td>
<td>Contrasts for 2-way ANOVA</td>
</tr>
<tr>
<td>7</td>
<td>Repeated measures / Response patterns &amp; item statistics</td>
<td>Repeated measures</td>
</tr>
<tr>
<td>8</td>
<td>Classical Test Theory</td>
<td>Item statistics</td>
</tr>
<tr>
<td>9</td>
<td>Test reliability &amp; its estimation</td>
<td>Classical test theory</td>
</tr>
<tr>
<td>10</td>
<td>Test validity &amp; the concept of measurement</td>
<td>Test reliability</td>
</tr>
<tr>
<td>11</td>
<td>The logic of quantification</td>
<td>Measurement and quantity</td>
</tr>
<tr>
<td>12</td>
<td>Conjoint measurement</td>
<td>Conjoint measurement</td>
</tr>
<tr>
<td>13</td>
<td>Unidimensional scaling</td>
<td>Unidimensional unfolding</td>
</tr>
</tbody>
</table>

## TEXT

There is no set text. (Note that Maxwell & Delaney (1990) is especially useful for all parts of Section 1 (Lectures 1 – 13); Magnusson (1966), for Lectures 14 – 19; and Michell (1990) for Lectures 20 – 26).

## REFERENCES

Section 1. Statistics.


Section 2. Psychometrics.


