

# PSYC 3010 – Advanced Statistics

**Unit of Study Code:** PSYC3010

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

**Credit Point Value:** 6 Credit Points

**Qualifying:** PSYC (2012 or 2112) plus one other Intermediate Psychology Unit from PSYC (2011 or 2111), PSYC (2013 or 2113), PSYC (2014 or 2114).

**Assessment:**

**Classwork:**

SECTION 1

Tutorial test, 10 % of the total mark of the unit  
Week 5, August 25 to August 29

1,000 words Assignment, 15% of the total mark of the unit  
Due Date: Monday 15<sup>th</sup> September

SECTION 2

Tutorial Prac, 20% of the total mark of the unit  
Week 11, 13 October to 17 October

**Examination:**

55% of the total mark of the unit  
part multiple choice, part short answer questions

**Evaluation of teaching and learning:**

Date: week 13 of semester  
Type: questionnaire

### ***Unit of study general description:***

The first section of this course deals with the design and analysis of experiments in psychology for which some form of analysis of variance is appropriate. The second section of the course deals with multiple regression and path analyses. Tutorials for both parts will involve the use of statistical packages on a computer as well as hand calculators. Students should bring a calculator to all tutorials.

### ***Graduate Attributes and Student Learning Outcomes***

This course is structured around the graduate attributes associated with the scientist-practitioner model, the basis for the training of psychologists in Australia and internationally. Graduate Attributes are the generic skills, abilities and qualities that students should acquire during their university experience and the School of Psychology is committed to providing an environment to promote these skills. In addition, this unit of study will provide students with generalised and transferable skills that will also be useful in careers outside psychology.

The following graduate attributes and student learning outcomes will be developed through lectures, tutorial and assessment activities in particular. They will be assessed primarily in the tutorial test, written assignment, tutorial prac and in the final examination.

#### ***1: Knowledge and Understanding of Advanced Statistics for Psychology***

Display advanced knowledge, conceptual and applied, of statistical tools most often used in psychological research, whether experimental or survey based.

##### *Student learning outcomes:*

At the end of this course, students will be able to:

- (i) Critically analyse empirical studies
- (ii) Calculate and interpret a one-way analysis of variance, including tests of contrasts.
- (iii) Calculate, analyse and interpret data from factorial designs including ANOVA and contrasts.
- (iv) Demonstrate a deep understanding of the problem of multiple comparisons and control of the Type I error rate.
- (v) Demonstrate understanding of issues involved in the treatment of data involving repeated measurements.
- (vi) Perform computer-based analyses for ANOVA and contrast testing, and interpret the results appropriately.
- (vii) Calculate and interpret multiple regression (MR) and related methods.
- (viii) Evaluate different types of MR and choose the analysis appropriately for a research question.
- (ix) Carry out computer-based analyses for MR and to interpret the results appropriately.
- (x) Evaluate how matters of the reliability of psychological test items affect research and data analyses.
- (xi) Write effectively psychological reports that cover both ANOVA and MR analyses.
- (xii) Use spreadsheet and data analysis programs, focusing on SPSS.
- (xiii) Have basic understanding of the AMOS programme.

#### ***2: Research Methods in Advanced Statistics for Psychology***

Understand, apply and evaluate research methods in Psychology, including research design, advanced data analysis and interpretations, and the appropriate use of terminology.

##### *Student learning outcomes:*

- (i) To develop a critical understanding of the major methods of research in psychology and how they relate to psychology as science.
- (ii) Ability to distinguish and evaluate research studies that focus on finding causality or/and prediction.
- (iii) Demonstrate an understanding of the conceptual link between ANOVA and MR analyses.
- (iv) Undertake statistical analysis appropriately.
- (v) Interpret statistical analyses correctly and competently depending on the research design and the postulated hypotheses.
- (vi) Develop the ability to describe the key principles for designing and evaluating research focusing on behaviour change.
- (vii) Evaluate and use relevant statistical terminology appropriately in psychological research.
- (viii) Design basic studies to address psychological questions: frame research questions; formulate hypotheses; operationalise variables; choose an appropriate methodology and data analysis technique; analyse data and interpret results appropriately; and write interpretations and research reports.

### **3: Critical Thinking Skills in Advanced Statistics for Psychology**

Respect and use critical and creative thinking, sceptical inquiry, and the scientific approach to solve problems related to thought and behaviour.

*Student learning outcomes:*

- (i) Demonstrate an attitude of critical thinking that includes persistence, open-mindedness, and intellectual engagement.
- (ii) Evaluate the quality of information, including differentiating empirical evidence from speculation.
- (iii) Evaluate issues of causality versus prediction using different theoretical and methodological approaches.
- (iv) Use reasoning and evidence to recognise, develop, defend, and criticise arguments based on research design and statistical analyses.
- (v) Demonstrate a capacity for higher-order analysis, including the capacity to identify patterns in human behaviour.
- (vi) Recognise and defend against the major fallacies of research design and data analyses.
- (vii) Demonstrate creative and pragmatic problem solving.

### **4: Values in Advanced Statistics for Psychology**

Value empirical evidence; act ethically and professionally.

*Student learning outcomes:*

- (i) Promote evidence-based approaches to understanding behaviour.
- (ii) Be able to recognise problems associated with biased sampling methods
- (iii) Evaluate how matters of the reliability of psychological test items affect results.
- (iv) Recognise the limitations of psychological research methods.
- (v) Exhibit a scientific attitude in critically thinking about, and learning about, human behaviour, and in creative and pragmatic problem solving.

### **5: Communication Skills in Advanced Statistics for Psychology**

Communicate effectively in a variety of formats and in a variety of contexts.

*Student learning outcomes:*

- (i) Interpret the results effectively using relevant terminology and formats (e.g., assignment, tutorial prac)
- (ii) Learn to communicate the results effectively for a variety of purposes (e.g., scientific report; to inform lay audience).

### **6: Learning and the Application of Advanced Statistics for Psychology**

Understand and apply psychological principles to personal and social issues.

*Student learning outcomes:*

- (i) To develop an awareness of the applications of the statistical theory and research design in psychology.
- (ii) Apply psychological research design to examine problems in everyday life and in society.
- (iii) Understand major issues involved in debates about research design in psychology.
- (iv) Demonstrate a capacity for independent learning to sustain personal and professional development in the changing world of the science and practice of psychology.

## **SYLLABUS**

### **Section 1. Anova and Contrasts.**

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. Differing approaches to the analysis of repeated measures data. Planned contrasts for designs involving repeated measures data.

## Section 2. Multiple Regression and Beyond.

Multiple Regression: Revision of Simple Linear Regression model and Introduction to Multiple Linear Regression.

Multiple Regression: Multiple independent variables, the assumptions, the estimates, the SPSS output. Prediction and Explanation. Different types of Multiple Regression.

Categorical Variables in Multiple Regression: Dummy Variables.

Continuous Variables: Interaction and Curves. Matters of moderation, mediation and common causes. Curvilinear Regression.

Beyond Multiple Regression: Path analysis. Introduction to AMOS.

Test reliability, its estimation, effects of unreliability

### TIMETABLE

WEEK	LECTURES	TUTORIALS
1	One-way ANOVA	
2	Contrasts: Formulation and Testing	One-way ANOVA
3	Contrasts: the problem of multiple comparisons	Contrasts
4	Two-way ANOVA	Contrasts
5	Contrasts for 2-way ANOVA designs	**Test; Contrasts
6	Repeated measures data	Multifactor ANOVA
7	Repeated measures / Introduction to Linear Regression	Repeated measures
8	Multiple Regression	Revision/Simple Regression
9	Multiple Regression: more details	Multiple Regression
10	Categorical Variables in Multiple Regression	Multiple Regression
11	Continuous Variables: Interaction and Curves	PRAC
12	Path Analysis	Multiple Regression
13	Test reliability and its estimation	Multiple Regression/Path Analysis

### TEXT

There is no set text for the Anova & Contrasts section, but if students wish to purchase a book, the following would be useful:

Keppel, G. & Wickens, T.D. (2004) *Design and Analysis: A Researcher's Handbook*. (4<sup>th</sup> Ed) NJ: Prentice Hall.

For the Multiple Regression and Beyond part (weeks 7-13) the text is:

Keith, Z. T. (2006). *Multiple Regression and Beyond*. New York: Pearson Education, Inc.

### OTHER REFERENCES

#### Section 1. Anova & Contrasts.

Hays, W.L. (1994). *Statistics*. (5th Ed). Fort Worth: Harcourt Brace

Howell, D.C. (2007). *Statistical methods for psychology* (6th Ed). Australia: Thomson Wadsworth.

Maxwell, S. E. & Delaney, H. D. (2004). *Designing experiments & analyzing data: a model comparison perspective*. (2<sup>nd</sup> Ed) Belmont, CA: Wadsworth.

#### Section 2. Multiple Regression and Beyond.

Berk, R. A. (2006). *Regression Analysis: A constructive Critique*. Advanced Quantitative Techniques in the Social Sciences Series. Sage Publications, Inc.

Pedhazur, E. J. (1997). *Multiple Regression in Behavioral Research: Explanation and Prediction*. Harcourt Brace College Publishers: New York.