AUSTRALIAN SCHOOL OF ENVIRONMENTAL STUDIES

AES1171/AES1174/AES1101

COURSE OUTLINE

Course Code:	AES1171/AES1174/AES1101
Course Title:	AES1171/74 Statistics for the Environment AES1101 Statistics and Data Management
Faculty:	Faculty of Environmental Sciences
School:	Australian School of Environmental Studies
Programs:	Bachelor of Environmental Science Bachelor of Environmental Management BSc in Land & Water Management BSc in Pollution Studies BSc in Ecology and Conservation Biology Bachelor of Environmental Planning/Bachelor of Science Bachelor of Engineering in Environmental Engineering/Bachelor of Science Bachelor of Laws/Bachelor of Science - Law & Environmental Science Bachelor of Engineering in Environmental Engineering Bachelor of Environmental Technology Bachelor of Environmental Planning Bachelor of Commerce in Banking Finance and Risk Management Bachelor of Science/Bachelor of Education (Secondary)
Status:	Core, first year
Credit Point Value:	AES1171: 10 AES1174: 8 AES1101: 10
Cross registration:	AES1171 Unrestricted Access AES1174 Restricted Access AES1101 Restricted Access
HECS Band:	2
Prerequisites:	Mathematics A, or AES1091 *Introduction to Mathematics and Statistics*, or equivalent

Year and Semester: Semester 2, 2001

Course Convenor/s: Assoc Prof Janet Chaseling **room:** E2N 2.24 **tel:** (07) 3875 7515
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Teaching Team:			
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OBJECTIVES

At the end of this course students should be able to carry out the following tasks confidently with competence and understanding:

- understand the basics of The Research Method and its relationship to statistical inference;
- define clearly the problem within a given situation, and identify the question(s) of interest;
- select and apply appropriate exploratory data analysis techniques to gain a better understanding of the information contained in a data set and identify appropriate summary measure(s) for a given situation;
- understand the concept of statistical inference and its two branches, estimation and hypothesis testing, including the difference between a population and a sample;
- be aware of the need for appropriate sampling processes, and be familiar with randomness;
- understand the concept of sampling distributions and be able to use the Normal, *t*-, *F*-, Binomial, Poisson and Chi-squared distributions, when appropriate;
- find point and interval estimates of a number of population parameters including the mean and proportion and the difference between two means or two proportions;
- perform tests of hypotheses for a variety of population parameters, including means, proportions, correlation coefficients and the simple linear regression coefficient;

- understand the concept of experimental design, as it relates to the statistical model and hypotheses and appreciate the need for experimental design at an early stage of the research process;
- carry out analysis of variance and subsequent statistical testing in accordance with a completely randomised experimental design to assess the effects of factors described in a factorial treatment design;
- distinguish between causal relationships and spurious relationships;
- apply linear regression models, and use these models for predictive purposes, whilst appreciating the need for appropriate measures of error and reliability when making estimates and predictions;
- interpret and report simple statistical inferences in terms of the original written problem;
- use basic SAS commands for file manipulation, exploratory data analysis and simple inference.

BRIEF DESCRIPTION

Students will review exploratory data analysis and probability while learning skills in computer software. Inferential statistics for estimation and testing will be introduced conceptually and through the theory required for means, proportions and association. Emphasis will be on selecting and understanding appropriate methods for real data within the context of the scientific method, and on communicating results in English.

CONTENT

The following topics will be covered some in more detail than others:

the scientific method; statistical distributions including, normal, binomial, poison, F-, t-, χ^2 and; statistical inference for estimation and hypothesis testing; inference for means and proportions; simple statistical models; completely randomised experimental design; treatment design; analysis of variance; extended t-test; simple and multiple linear regression; correlation; tests of independence; goodness of fit; data management; statistical software, SAS.

ORGANISATION AND TEACHING METHODS

Lectures: 3 hours per week for 14 weeks
Workshops: 2 hours per week for 12 weeks

Lectures
Students will receive lectures that introduce the required material and provide examples and guidance for applying newly learned techniques. Lectures will be supported by written material to which students should add information learned in lectures. This combined material together with referenced sections of the text book,

will provide the guidance students need to carry out examples on their own during workshop sessions and in their own time. Lectures will draw on the relevant sections of the prescribed textbooks.

Workshops/Computer Laboratories

The workshops provide an important component of the learning process, in which students have the opportunity to practise the statistical methods they are learning in lectures, under the guidance of tutors. All workshops will be carried out in computer laboratories and students will be required to use the computers for implementation of the software SAS. Examples used in workshops will come from a range of real research in environmental areas. During the workshops, students will carry out a large component of their individual project, which provides a major part of the assessment. Attendance at all workshops is expected, as it is during these times that students will complete ongoing assessment which will be acknowledged by their personal tutor. Each week personal tutors will review the work completed towards the project.

Each week students will receive material which should be filed and retained for later work in the semester.

Critique of Allocated Student Partner's Assessment

During week 4, students will be assigned an *allocated student partner* from a different program of study. Each student will be required to review his/her partner's assessment prior to submission and provide a brief (no more than 200 words) critique. This critique is to be submitted by each student along with his/her own submission in weeks 6 and 12. The critique should be made available to the partner student BEFORE submission of the item, and should act as an additional source of help in completing the assessment.

ASSESSMENT

1.	**Workshop Project**		**50%**
	(Equivalent to 3000 words in total)		
	Weekly tasks assessed during workshop by tutors – weeks 2 to 4 and 7 to 11:	16% total	
	Individual project task submitted to allocated tutor during workshop in weeks 6 and 12: 10% and 14%	24% total	
	Individual critiques of allocated student partner's project submission - submitted with project tasks in weeks 6 and 12	10% total	
2.	**Final Examination - 2 hours - normal examination period**		**50%**
	closed book - formulae and tables provided		

Assessment Criteria

Workshop Activities and Projects:

Weekly tasks will vary and will involve students in applying the techniques learned in lectures to their particular project dataset. It is hoped that individual students will undertake a project which relates to their own particular degree program thus providing an opportunity to apply the statistical techniques within a relevant environment.

Assessment will involve three components: assessment activities done during the workshops in weeks 2, 3, 4, 7, 8, 9, 10 and 11 (2% each); submission of individual written tasks in weeks 6 and 12 (10% and 14%) and two critiques of each student's allocated partner's assessment submissions (5% each). No late submissions will be accepted for the weekly assessment activity component. Individual submissions and critiques in weeks 6 and 12 will be subject to the standard late submission penalties and rules – see Administration Point 4 below. Note that all project assessment will be on an individual student basis; there will be no group assessment.

Weekly tasks will be assessed on the following criteria:

1. completeness of task
2. understanding of task
3. ability to apply skills to specific project
4. ability to explain task

Individual submissions will be assessed on the following criteria:

1. clarity of expression
2. cohesiveness of material
3. correctness of solution
4. understanding of material

Final Examination: Marking criteria will consist of :

1. definition of the problem
2. process of solution
3. correctness of solution
4. interpretation of solution

PRESCRIBED TEXTBOOK AND SUPPORTING MATERIALS

Prescribed Texts:

Introduction to the Practice of Statistics 3rd Edition by David S. Moore and George P. McCabe (1999), W.H. Freeman and Company, New York, USA.

SAS® Manual for Moore and McCabe's Introduction to the Practice of Statistics 3rd Edition by Michael, J. Evans (2000), W.H. Freeman and Company, New York, USA.

Lecture notes paralleling the material presented in the lecture will be provided during lectures for student.

GENERIC SKILLS

Students will develop quantitative and problem solving skills. These will be tested through the progressive project activities and the examination.

ADMINISTRATION

1. Unless otherwise specified in the course outline, assessment items must be submitted to Griffith Flexible Learning Services, or by post if prior agreement of the course convenor has been obtained, but **not** by facsimile.

2. If students wish to submit assessment items with any similar material for two or more courses, they must first seek approval of all course convenors. Failure to do so could be interpreted as cheating.

3. Students should note that submission of an assignment represents an affirmation that it is all their own work and that nothing has been copied from the work of others except where appropriately referenced.

4. Late Penalties: The penalty for late submission of assessment items is 10% of the total assessment mark for the item per day, unless otherwise specified in the course outline. No assignments will be accepted after the one-week period. A Special Consideration form must be completed and submitted to the Student Administration Centre if students request waiver of the late penalty or an extension to an assessment item. Extensions **may** be granted for medical conditions, however, extensions will not be granted for work commitments, family commitments or computer failure.

5. Special Consideration: Students applying for special consideration (due to medical or other grounds) for assessment items must complete the appropriate application form **available from the Student Administration Centre**. Special consideration is not retrospective and students should submit Special Consideration forms as soon as they experience any difficulties which may interfere with study or examination performance. It is expected that any applications for special consideration will be received within 24 hours after the date of examination

6. Enrolment in this course is granted on the basis that a grade of "P" (Pass) or better has been achieved in any prerequisite or assumed-prior-knowledge course, as specified in Section 1 of this course outline. Failure to meet this requirement may result in your having difficulty with the course and not being able to complete it successfully. Any additional support or special assistance cannot be expected or requested if the prerequisite is waived, or if prior-knowledge requirements have not been met.

SCHEDULE

WEEK	LECTURES	WORKSHOP	ASSESSMENT	LECT
1 **16 July**	Basic Probability – Revision Exploratory Data Analysis – Revision Introduction to the SAS software	**NONE**		Janet
2 **23 July**	Statistical Inference – hypothesis testing & estimation Statistical Distributions – Introduction Goodness of Fit The Pearson χ^2 – distribution Contingency tables – the test of independence	Using SAS – intro and EDA Project selection Sampling distributions	Weekly Assessment Task 2%	Janet
3 **30 July**	The Scientific Method Sampling Distributions – the proportion The Binomial Distribution	Contingency Tables Tests of Independence Tests of Goodness of Fit SAS	Weekly Assessment Task 2%	Ron Janet
4 **6 Aug**	***The Scientific Method (Continued)*** Test of proportion; the Sign test; Estimating a proportion - point & interval	The Scientific Method	Weekly Assessment Task 2%	Ron Janet
5 **13 Aug**	Sampling Distributions – the mean Normal & *t* distributions Estimating a mean – point & interval	Binomial Distributions, Testing & Estimating a Proportion SAS		Janet
6 **20 Aug**	Comparing mean values *t*-tests: independent and paired data	Confidence interval of mean SAS	Workshop Project 1st Written Task 15%	Cameron
7 **27 Aug**	The statistical model The Analysis of Variance The *F*- distribution Multiple comparison of means – protected *t*- test	*t*- tests: independent and paired SAS	Weekly Assessment Task 2%	Cameron
8 **3 Sept**	Treatment design Factorial ANOVA	ANOVA and Multiple Comparison Tests SAS – DO loops &ANOVA	Weekly Assessment Task 2%	Janet
9 **10 Sept**	Factorial ANOVA (continued) Interactions	Treatment Design Factorial ANOVA I SAS	Weekly Assessment Task 2%	Janet
10 **17 Sep**	Bivariate data – correlation: Pearson & Spearman The regression model – simple linear regression	Factorial ANOVA II SAS	Weekly Assessment Task 2%	Janet
MIDSEMESTER BREAK – 24 September to 28 September				
11 **1 Oct**	Statistical Models – treatment design & regression	Correlation & Regression SAS	Weekly Assessment Task 2%	Janet
12 **8 Oct**	Multiple Linear Regression	Statistical Models	Workshop Project 2nd Written Task 19%	Janet
13 **15 Oct**	Other distributions – Poisson, Negative Binomial Statistics in research	Multiple Regression Distributions SAS		Janet
14 **22 Oct**	REVISION	REVISION		Janet
SWAT VAC - 29 October to 2 November				
EXAM PERIOD - 5 November to 17 November			Final Examination - 2 hours 50%	