



DE LA SALLE UNIVERSITY
College of Science
 Department of Mathematics



LINMODE – Linear Models

Prerequisite: STATHE2, MTRXTHE

Prerequisite to:

Instructor: _____
Consultation Hours: _____

Contact details: _____
Class Schedule and Room: _____

Course Description

A study of the various linear statistical models that arise in practice. Topics include multivariate normal distribution, distribution of quadratic forms, general linear models, estimation and tests of hypotheses about linear hypotheses and design matrices giving rise to analysis of variance models.

Learning Outcomes	
On completion of this course, the student is expected to present the following learning outcomes in line with the Expected Lasallian Graduate Attributes (ELGA)	
ELGA	Learning Outcome
Critical and Creative Thinker Effective Communicator Lifelong Learner Service-Driven Citizen	At the end of the course, the student will perform regression analysis, apply appropriate statistical concepts, processes, tools, and technologies in solving various conceptual and real-world problems.

Final Course Output		
As evidence of attaining the above learning outcomes, the student is required to submit the following during the indicated dates of the term.		
Learning Outcome	Required Output	Due Date
At the end of the course, the student will perform regression analysis, apply appropriate statistical concepts, processes, tools, and technologies in solving various conceptual and real-world problems.	An inquiry-based group project highlighting the use of regression analysis in different problem situations encountered in the real world.	Week 13

Rubric for assessment				
CRITERIA	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)
Formulation of the Research Problem and Objectives (10%)	Research problem and objectives are clearly defined and significant; demonstrates evidence that the research problem was researched and designed well.	Research problem and objectives are clearly defined and significant.	Research problem is clearly defined but some objectives are insignificant.	Research problem and objectives are vague and insignificant.
Correct Application of the Statistical Concepts (35%)	Statistical analyses are appropriate with correct interpretations and relevant conclusions.	Statistical analyses are appropriate with correct interpretations.	Some statistical analyses are inappropriate.	Statistical analyses are inappropriate.
Depth of Analysis (30%)	The analysis convinces the reader about the wisdom of conclusions, implications and consequences on the basis of statistical methods and findings.	The analysis engages the reader to appreciate the wisdom of conclusions, implications and consequences on the basis of statistical methods and findings.	The analysis has limited ideas that do not explain the wisdom of conclusions, implications and consequences on the basis of statistical methods and findings.	The analysis has incorrect ideas and conclusions.

Clarity and Organization of Written Report (10%)	Written report is organized logically and presented clearly with effective transitions.	Written report is organized logically and presented clearly.	Written report is organized and some discussions are not clear.	Written report is not organized.	
Oral Presentation (15%)	Overall presentation is creative and well organized with innovative ideas.	Overall presentation is creative and well organized.	Overall presentation is organized.	Overall presentation is not organized.	

Additional Requirements
<ul style="list-style-type: none"> • Quizzes • Class Participation (seatwork and group exercises, homework, recitation) • Computer hands-on exercises using SAS • Final Examination

Grading System				
	FOR EXEMPTED STUDENTS (w/out Final Exam)	FOR STUDENTS with FINAL EXAM		Scale: 95-100% 4.0 89-94% 3.5 83-88% 3.0 78-82% 2.5 72-77% 2.0 66-71% 1.5 60-65% 1.0 <60% 0.0
		<i>with no missed quiz</i>	<i>With one missed quiz</i>	
Average of quizzes & Project	86%	60%	50%	
Class participation & Lab exercises	14%	10%	10%	
Final exam	-	30%	40%	

Learning Plan			
LEARNING OUTCOME	TOPIC	WEEK NO.	LEARNING ACTIVITIES
At the end of the course, the student will perform regression analysis, apply appropriate statistical concepts, processes, tools, and technologies in solving various conceptual and real-world problems.	1. Simple Linear Regression 1.1 The Problem and Motivation Behind Curve Fitting 1.2 The Least Squares Estimates 1.3 Maximum Likelihood Estimates 1.4 Inference Regarding $\beta_0, \beta_1, \sigma^2, \beta_0 + \beta_1 x_0$ 1.5 Correlation: Inference and Relationship to Simple Linear Regression Model	Weeks 1-4	Prior knowledge and beliefs survey Concept mapping Library work Group discussion and presentations Computer laboratory activity (SAS) Skills exercises Student self-assessment and reflection
	Quiz No. 1	Week 5	
	2. Measures of Model Adequacy 2.1 Tests for Linearity 2.2 Tests for Normality 2.3 Tests for Homoscedasticity 2.4 Tests for Independence 2.5 Outliers Deletion 2.6 Transformations	Weeks 5-6	
	3. Multiple Linear Regression 3.1 Matrix Representation and Estimation of Parameters 3.2 Algebraic/Geometric	Weeks 7-10	

	Interpretation of Multiple Linear Regression Model 3.3 Tests and Confidence Intervals Based on the t Distribution 3.4 Full versus Reduced Model: The Partial F Test 3.5 Extra Sum of Squares and Multicollinearity		
	Quiz No. 2	Week 10	
	4. Variable Selection and Model Building 4.1 Criteria for Selecting Appropriate Models: MSE, C_p , and adjusted R^2 4.2 Forward Selection, Backward Elimination and Stepwise Selection Procedures 4.3 Multicollinearity: The PRESS Statistic and the Hat Matrix	Weeks 11-12	
	Quiz No. 3	Week 12	
	5. Issues in Regression Modeling	Week 13	
	Inquiry-based Group Project	Week 13	

References

- Bapat, R. B. (2012) *Linear algebra and linear models*. New Delhi: Hindustan Book Agency/Springer.
- Christensen, R. (2011). *Plane answers to complex questions [electronic resource]: The theory of linear models*. New York, NY: Springer New York.
- Draper, N.P., & Smith, H. (1998). *Applied regression analysis (3rd ed.)*. New York: Wiley.
- Freedman, D. (2009). *Statistical models: theory and practice*. Cambridge: Cambridge University Press.
- Kahane, L. H. (2008). *Regression basics*. Los Angeles: Sage Publications.
- Montgomery, D.C. & Peck, E.A. (1992). *Introduction to linear regression analysis (2nd ed.)*. New York: Wiley.
- Neter, J., Kutner, M., Wasserman, W., & Nachtsheim, C. (1996). *Applied linear regression models (3rd ed.)*. Chicago: Irwin.
- Neter, J., Kutner, M., Wasserman, W., & Nachtsheim, C. (1996). *Applied linear statistical models (4th ed.)*. Chicago: Irwin.
- Yan, X. (2009). *Linear regression analysis: theory and computing*. Hackensack, NJ: World Scientific.

Online Resources

- Chen, X., Ender, P., Mitchell, M. and Wells, C. (2003). *Regression with SAS*, from <http://www.ats.ucla.edu/stat/sas/webbooks/reg/default.htm>. Accessed September 14, 2012
- StatSoft, Inc. (2012). Electronic Statistics Textbook. Tulsa, OK: StatSoft. WEB: <http://www.statsoft.com/textbook/>. Accessed September 14, 2012
- Lock, R. (1998) *WWW Resources in teaching Statistics* from <http://it.stlawu.edu/~rlock/tise98/onepage.html>. Accessed September 14, 2012.
- West, R. *Regression Applet* from <http://www.stat.sc.edu/~west/javahtml/Regression.html>. Accessed September 14, 2012.

Class Policies

- The required minimum number of quizzes for a 3-unit course is 3, and 4 for 4-unit course. No part of the final exam may be considered as one quiz.
- Cancellation of the lowest quiz is not allowed even if the number of quizzes exceeds the required minimum number of quizzes.
- As a general policy, no special or make-up tests for missed exams other than the final examination will be given. However, a faculty member may give special exams for
 - approved absences (where the student concerned officially represented the University at some function or activity).
 - absences due to serious illness which require hospitalization, death in the family and other reasons which the faculty member deems meritorious.

4. If a student missed two (2) examinations, then he/she will be required to take a make up for the second missed examination.
5. If the student has no valid reason for missing an exam (for example, the student was not prepared to take the exam) then the student receives 0% for the missed quiz.
6. Students who get at least 89% in every quiz are exempted from taking the final examination. Their final grade will be based on the average of their quizzes and other prefinal course requirements. The final grade of exempted students who opt to take the final examination will be based on the prescribed computation of final grades inclusive of a final examination. Students who missed and/or took any special/make-up quiz will not be eligible for exemption.
7. Learning outputs are required and not optional to pass the course.
8. Mobile phones and other forms of communication devices should be on silent mode or turned off during class.
9. Students are expected to be attentive and exhibit the behavior of a mature and responsible individual during class. They are also expected to come to class on time and prepared.
10. Sleeping, bringing in food and drinks, and wearing a cap and sunglasses in class are not allowed.
11. Students who wish to go to the washroom must politely ask permission and, if given such, they should be back in class within 5 minutes. Only one student at a time may be allowed to leave the classroom for this purpose.
12. Students who are absent from the class for more than 5 meetings will get a final grade of 0.0 in the course.
13. Only students who are officially enrolled in the course are allowed to attend the class meetings.

Approved by:

Dr. Arturo Y. Pacificador, Jr.
Chair, Department of Mathematics