



Universidad
Carlos III de Madrid

SYLLABUS

1. INTRODUCTION. Formulation and meaning of a statistical regression problem. Regression models. Goals of a regression analysis. Data in a regression analysis. **Appendix:** Regression software.

2. THE MULTIPLE LINEAR REGRESSION MODEL (I): ESTIMATION. Definition and matrix formulation. The least squares principle. Normal equations and least squares estimates. Geometric interpretation. Variance estimation. Properties of the least squares estimates. Gauss-Markov theorem. Normality assumption and maximum likelihood estimation. Sampling distributions. Centered regressors. Decomposition of the total variability in sums of squares. Coefficient of determination. **Appendix:** The multivariate normal distribution.

3. THE MULTIPLE LINEAR REGRESSION MODEL (II): HYPOTHESIS TESTING, AND CONFIDENCE REGIONS. The F-test for the linear general hypothesis: motivation and construction. Particular cases: Partial F-tests and tests for parameter subsets. Confidence intervals for the individual coefficients. Confidence regions for parameter subsets. Prediction intervals. Appendix: Indicator variables.

4. MULTICOLLINEARITY, RESIDUAL ANALYSIS, AND DIAGNOSTIC TECHNIQUES. Multicollinearity: description and consequences. Residual analysis. Outliers, extreme cases and influential data points. Diagnostics and influence measures: Cook's distance.

5. GENERALIZED LEAST SQUARES. Generalized least squares estimation: cases of known and unknown covariance matrix. Heteroscedasticity. Transformations. Serial correlation.

6. TIME SERIES MODELS. Autoregressive (AR) and moving average (MA) models. ARMA and ARIMA models.

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