

## H6STATS2: Statistics II

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| Module Code:                                                                | H6STATS2                                                                                                                                                              |
| Long Title                                                                  | Statistics II <b>APPROVED</b>                                                                                                                                         |
| Title                                                                       | Statistics II                                                                                                                                                         |
| Module Level:                                                               | LEVEL 6                                                                                                                                                               |
| EQF Level:                                                                  | 5                                                                                                                                                                     |
| EHEA Level:                                                                 | Short Cycle                                                                                                                                                           |
| Credits:                                                                    | 10                                                                                                                                                                    |
| Module Coordinator:                                                         | TONY DELANEY                                                                                                                                                          |
| Module Author:                                                              | TONY DELANEY                                                                                                                                                          |
| Departments:                                                                | School of Computing                                                                                                                                                   |
| Specifications of the qualifications and experience required of staff       | This module requires a lecturer holding a Master's degree or higher, in a discipline with a significant statistics component. e.g Statistics, Mathematics, Economics. |
| <b>Learning Outcomes</b>                                                    |                                                                                                                                                                       |
| <i>On successful completion of this module the learner will be able to:</i> |                                                                                                                                                                       |
| #                                                                           | <b>Learning Outcome Description</b>                                                                                                                                   |
| LO1                                                                         | Apply appropriate statistical inference techniques to the analysis of data across a variety of domains.                                                               |
| LO2                                                                         | Source data ethically and communicate statistical results in a comprehensive and professional manner.                                                                 |
| LO3                                                                         | Compare and contrast alternative models to assist with forecasting.                                                                                                   |
| LO4                                                                         | Identify patterns in data and implement dimension reduction techniques.                                                                                               |
| LO5                                                                         | Assess issues of effect size and statistical power.                                                                                                                   |
| <b>Dependencies</b>                                                         |                                                                                                                                                                       |
| <b>Module Recommendations</b>                                               |                                                                                                                                                                       |
| No recommendations listed                                                   |                                                                                                                                                                       |
| <b>Co-requisite Modules</b>                                                 |                                                                                                                                                                       |
| No Co-requisite modules listed                                              |                                                                                                                                                                       |
| <b>Entry requirements</b>                                                   | Learners should have attained the knowledge, skills and competence gained from stage 1 of the BSc (Hons) in Data Science                                              |

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| Module Content & Assessment                                                                                                                                                                                                                                                                                                                                                       |                       |                           |            |
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| <b>Indicative Content</b>                                                                                                                                                                                                                                                                                                                                                         |                       |                           |            |
| <b>Review of Basic Statistical Concepts</b><br>Fundamentals of Probability . Sampling . Estimation & confidence intervals. Hypothesis testing & t-tests . ANOVA . Non-parametric tests. Correlation & basic regression.                                                                                                                                                           |                       |                           |            |
| <b>Ethics in sourcing and analysis of data</b><br>Data Sources. Ethics in data sourcing. Maintenance of data security                                                                                                                                                                                                                                                             |                       |                           |            |
| <b>Topics in Regression Analysis I</b><br>Principles of regression model building. Non-linearity of data. Transformations. Correlation of error terms                                                                                                                                                                                                                             |                       |                           |            |
| <b>Topics in Regression Analysis II</b><br>Heteroscedasticity in regression models. Diagnostics for leverage and influence. Multicollinearity                                                                                                                                                                                                                                     |                       |                           |            |
| <b>Logistic Regression &amp; Linear Discriminant Analysis I</b><br>Principles behind the binary logistic regression model. Odds & odds ratios. Estimating logistic regression coefficients. Wald statistic – contribution of predictors. Prediction using logistic regression                                                                                                     |                       |                           |            |
| <b>Logistic Regression &amp; Linear Discriminant Analysis II</b><br>Multinomial logistic regression. Linear discriminant analysis                                                                                                                                                                                                                                                 |                       |                           |            |
| <b>PCA/Factor Analysis</b><br>Applications of PCA & exploratory factor analysis. Suitability of data for PCA / factor analysis. Interpretation of principal components. Factor rotation. Clustering methods                                                                                                                                                                       |                       |                           |            |
| <b>Multivariate Analysis of Variance (MANOVA)</b><br>ANOVA vs MANOVA. Applications of MANOVA . SSCP matrices. MANOVA test statistics . Interpretation of MANOVA software output                                                                                                                                                                                                   |                       |                           |            |
| <b>Multilevel Linear Models I</b><br>Hierarchical data. Theory of multilevel linear models                                                                                                                                                                                                                                                                                        |                       |                           |            |
| <b>Multilevel Linear Models II</b><br>Building a multilevel model. Assessing the fit of multilevel linear models                                                                                                                                                                                                                                                                  |                       |                           |            |
| <b>Effect Size &amp; Statistical Power</b><br>Effect size in research. Effect size metrics. Statistical power and sample size. Statistical Power analysis                                                                                                                                                                                                                         |                       |                           |            |
| <b>Critical appraisal of null hypothesis significance testing</b><br>Appropriate use of NHST in research. Reporting test results. Examples of misuse of NHST                                                                                                                                                                                                                      |                       |                           |            |
| <b>Assessment Breakdown</b>                                                                                                                                                                                                                                                                                                                                                       |                       |                           | <b>%</b>   |
| Coursework                                                                                                                                                                                                                                                                                                                                                                        |                       |                           | 50.00%     |
| End of Module Assessment                                                                                                                                                                                                                                                                                                                                                          |                       |                           | 50.00%     |
| <b>Assessments</b>                                                                                                                                                                                                                                                                                                                                                                |                       |                           |            |
| <b>Full Time</b>                                                                                                                                                                                                                                                                                                                                                                  |                       |                           |            |
| <b>Coursework</b>                                                                                                                                                                                                                                                                                                                                                                 |                       |                           |            |
| <b>Assessment Type:</b>                                                                                                                                                                                                                                                                                                                                                           | Continuous Assessment | <b>% of total:</b>        | Non-Marked |
| <b>Assessment Date:</b>                                                                                                                                                                                                                                                                                                                                                           | n/a                   | <b>Outcome addressed:</b> | 1,2,3,4,5  |
| <b>Non-Marked:</b>                                                                                                                                                                                                                                                                                                                                                                | Yes                   |                           |            |
| <b>Assessment Description:</b><br>Formative assessment will be undertaken utilising exercises and short answer questions during certain tutorials. In class discussions will be undertaken on contemporary topics. Feedback will be provided individually or as a group in oral format.                                                                                           |                       |                           |            |
| <b>Assessment Type:</b>                                                                                                                                                                                                                                                                                                                                                           | Continuous Assessment | <b>% of total:</b>        | 50         |
| <b>Assessment Date:</b>                                                                                                                                                                                                                                                                                                                                                           | n/a                   | <b>Outcome addressed:</b> | 1,2        |
| <b>Non-Marked:</b>                                                                                                                                                                                                                                                                                                                                                                | No                    |                           |            |
| <b>Assessment Description:</b><br>Learners will be asked to estimate models using elements of multiple regression, logistic regression and/or multilevel linear model techniques. The project will focus on practical application of models. Project data must be sourced ethically and an application for ethical approval made where necessary in accordance with school policy |                       |                           |            |
| <b>Assessment Type:</b>                                                                                                                                                                                                                                                                                                                                                           | Easter Examination    | <b>% of total:</b>        | 50         |
| <b>Assessment Date:</b>                                                                                                                                                                                                                                                                                                                                                           | n/a                   | <b>Outcome addressed:</b> | 1,2,3,4,5  |
| <b>Non-Marked:</b>                                                                                                                                                                                                                                                                                                                                                                | No                    |                           |            |
| <b>Assessment Description:</b><br>The examination will be in the region of two hours in duration and may include a mix of: theoretical, applied and interpretation questions. Assessment of LO1 and LO2 will cover theory and conceptual understanding.                                                                                                                           |                       |                           |            |
| No End of Module Assessment                                                                                                                                                                                                                                                                                                                                                       |                       |                           |            |
| No Workplace Assessment                                                                                                                                                                                                                                                                                                                                                           |                       |                           |            |
| <b>Reassessment Requirement</b>                                                                                                                                                                                                                                                                                                                                                   |                       |                           |            |
| <b>Repeat examination</b><br>Reassessment of this module will consist of a repeat examination. It is possible that there will also be a requirement to be reassessed in a coursework element.                                                                                                                                                                                     |                       |                           |            |
| <b>Reassessment Description</b><br>By examination.                                                                                                                                                                                                                                                                                                                                |                       |                           |            |

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| Module Workload                      |                                    |       |              |                                 |
|--------------------------------------|------------------------------------|-------|--------------|---------------------------------|
| Module Target Workload Hours 0 Hours |                                    |       |              |                                 |
| Workload: Full Time                  |                                    |       |              |                                 |
| Workload Type                        | Workload Description               | Hours | Frequency    | Average Weekly Learner Workload |
| Lecture                              | Classroom & Demonstrations (hours) | 24    | Per Semester | 2.00                            |
| Tutorial                             | Other hours (Practical/Tutorial)   | 24    | Per Semester | 2.00                            |
| Independent Learning                 | Independent learning (hours)       | 202   | Per Semester | 16.83                           |
| Total Weekly Contact Hours           |                                    |       |              | 4.00                            |

| Module Resources                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
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| <i>Recommended Book Resources</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |
| <p>Field, A.. (2018), Discovering Statistics using SPSS Statistics (5th ed), SAGE Publications, London.</p> <p>Heumann, C. &amp; Schomaker Shalabh, M.. (2016), Introduction to Statistics and Data Analysis with Exercises, Solutions and Applications in R, Springer, Switzerland.</p> <p>Moore, D., McCabe, G., &amp; Craig, B.. (2014), Introduction to the Practice of Statistics, 8e, WH Freeman &amp; Co, New York.</p> <p>Pallant, J.. (2016), SPSS Survival Manual (6 ed), McGraw Hill, United Kingdom.</p> |  |
| <i>Supplementary Book Resources</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
| <p>Cortinhas, C. &amp; Black, K.. (2012), Statistics for Business &amp; Economics, Wiley, United Kingdom.</p> <p>Foster, J., Barkus, E. &amp; Yavorsky, C.. (2006), Understanding and Using Advanced Statistics, SAGE Publications, London.</p> <p>James, G., Witten, D. Hastie, T. &amp; Tibshirani, R.. (2013), An Introduction to Statistical Learning with applications in R, Springer, New York.</p>                                                                                                            |  |
| <i>This module does not have any article/paper resources</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |
| <i>This module does not have any other resources</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |
| Discussion Note:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |