UNIVERSITY OF KENT

Faculty of Science, Technology & Medical Studies

MA864: FURTHER STATISTICAL THEORY

Module Description

1. **Title of Module**. MA864, Further Statistical Theory
2. **Department**. Institute of Mathematics, Statistics and Actuarial Science.
3. **Start Date**. Immediate
4. **Number of students**. About 12 students
5. **Modules to be withdrawn**. None. This is an existing module.
6. **Level of Module**. Postgraduate (level M)
7. **Number of credits**. 15
8. **Term**. Both teaching terms
9. **Prerequisite and co–requisite modules**. This module is taken by all students registered for MSc or Postgraduate Diploma in Statistics. The other modules (MA802, MA853, MA855, MA856, MA857 and MA858) are co-requisites.
10. **Programme of study**. MSc and Postgraduate Diploma in Statistics
11. **Subject–specific learning outcomes**.

    On successful completion of this module, students

    - will be able to synthesise knowledge, and appreciate statistical links between disparate subject areas [A2];
    - will have a systematic understanding of selected key statistical topics [A1, A4, B1, C1];
    - will be able to apply appropriate advanced statistical techniques critically to solve problems involving real world data [A3, A4, B5, C2, C3];

12. **Generic learning outcomes**.

    On successful completion of this module, students

    - will have a systematic understanding of the rôle of logical argument [A5, B4];

– will have developed technical expertise, particularly in relation to computer software [D3, D5].

13. **Curriculum**. This module comprises several components, covering important areas of statistical methodology that are more specialised than the core areas covered in modules MA802 and MA853. These components, which may contain research–related work, may vary somewhat from year to year, depending on the availability of particular staff. Students are expected to attend lectures on two of the individual topics included in this module.

– **Time Series**. Motivation through examples, features of time series data, objectives, stationarity and autocovariance functions, plots and transformations, trend and seasonal components, white noise, random walks, MA(q), AR(p), ARMA(p, q), Box–Jenkins seasonal model, periodic processes, estimating the autocorrelation functions, fitting ARMA models, model identification, the use of Akaike's information criterion and AICC.

– **Bayesian Statistics**. Admissibility and Bayes decisions, subjective and reference priors, conjugate analysis for binomial, Poisson, exponential and normal models, predictive distributions for exponential family models, normal theory Bayesian analysis for hierarchical models, asymptotic posterior distributions and approximation methods including Laplace's method. Markov chain Monte Carlo, including Gibbs and Metropolis–Hastings algorithms and convergence issues.

– **Nonparametric Methods**. Scales of measurement and the appropriateness of statistical measures, criteria for comparing hypothesis tests and other procedures, comparisons between variables in matched and independent samples, rank correlation, analysis of variance and concordance, categorical analysis of variance for nominal data, testing for goodness of fit to a distribution, Kolmogorov–Smirnov tests and an introduction to other procedures, especially testing for normality, some nonparametric tests of randomness.

14. **Indicative reading list**.

Brockwell, P. J., and Davis, R. A. (1996). *Introduction to Time Series and Forecasting*. New York, Springer–Verlag.

Conover, W. J. (1999) *Practical Nonparametric Statistics, 3rd ed*. New York, Wiley.

Lee, P. M. (1997). *Bayesian Statistics: An Introduction*. London, Arnold.

Gelman, A., Carlin, J. B., Stern, H. S., and Rubin, D. B. (2003). *Bayesian Data Analysis*. London, Chapman and Hall.

15. **Learning and teaching methods**.

For each student, the module will comprise about 36 hours of lectures. Approximately 4 exercise sheets are set and discussed. The exercise sheets give students

practice in solving problems as well as enabling them to develop their understanding of the material. Total study hours 150.

16. **Assessment methods and how these relate to testing achievement of the intended learning outcomes**. This module is assessed by a single two–hour closed–book examination in Term 3. Candidates are required to answer questions on two of the components of this module. Examination questions are designed to test the learning outcomes outlined in Section 11.

17. **Implications for learning resources**. This is an existing module, and there are no special resource implications.

18. **Students with disabilities**. Students with disabilities will not have any non–justifiable disadvantage in taking this module.

Statement by the Director of Learning and Teaching: 'I confirm I have been consulted on the above module proposal and have given advice on the correct procedures and required content of module proposals'

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Director of Learning and Teaching Date

Statement by the Head of Department: 'I confirm that the Department has approved the introduction of the module and will be responsible for its resourcing'

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Head of Department Date