**Prof. Ken Russell**, School of Computing and Mathematics, Charles Sturt University, Wagga Wagga

**Title:** Obtaining Efficient Designs for Multinomial Experiments by two Optimality Criteria

**Abstract:** Suppose that it is proposed to conduct an experiment in which the outcome from each experimental unit will be classified as being in one of k categories. It is believed that the probabilities that an outcome belongs in these categories is a function of one or more controllable covariates. The design question is: at what values of these covariates should the observations be made?

I will consider a Generalized Linear Model for the multinomial distribution, and will model a relevant function of the category probabilities by linear predictors. The Maximum Likelihood estimators of the parameters of the model can be obtained, as can the information matrix of the parameters. The D-optimality criterion identifies those values of the covariates for which the determinant of the information matrix is maximised, and these values yield the D-optimal design. Some D-optimal designs will be presented.

Very often the aim of the experiment is to estimate the probabilities of the different categories, and the calculation of the estimates of the parameters is just an important step along the way. One may seek as design points the values of the covariates for which (a linear combination of) the Mean Squared Errors of the estimators of the probabilities is minimised. This gives rise to the Integrated Mean Squared Error (IMSE) criterion. This criterion will be described, and designs obtained using IMSE-optimality will be displayed. The calculations required by this criterion can be time-consuming, and a method to speed up calculations will also be described.