2013 YCCSA SUMMER SCHOLARSHIP PROJECT SUBMISSION

This form is for prospective project supervisors to submit their projects to be included in the YCCSA Summer Scholarships Programme for 2013.

It is the purpose of the Summer School that any projects submitted are interdisciplinary in nature.

Date	*07 March 2013*
Supervisor's Name	*Professor Tim Croudace, Chair in Psychometric Epidemiology, Health Sciences & HYMS HULL YORK MEDICAL SCHOOL*
Supervisor's Dept	*HYMS funded but "embedded" in the University Department of Health Sciences Mental Health and Addictions Research Group (Headed by Professor Simon Gilbody).* *Professor Croudace will move to the top floor of the ARRC building in May 2013 with the relocation of the Mental Health and Addictions Research Group from Alcuin C Block. The successful application will therefore be locate in close proximity to the new Social Science computing clusters and have expert programming support from a Grade 7 psychometrician Jan Boehnke, who will start work alongside Prof Croudace in May 2013.*
Collaborators names and Departments	*Tim Croudace (Professor of Psychometric Epidemiology, HYMS and Health Sciences)* *1: Steve Smith (Electronics) Evolutionary Computation specialist* *2 Mark Wilson (ARRC) White Rose ARRC Computing Centre*
Project Title	**Possibilities and Potentials In Mokken Scale Analysis: Evolutionary Computation for Estimation and exploration of the power of grid-computing for new *e-psychometrics*** ***Stochl J, Jones PB and Croudace T (2012)*** *Mokken scale analysis of mental health and well-being questionnaire item responses: a non-parametric IRT method in empirical research for applied health researchers BMC Medical Research Methodology Jun 11;12:74. doi: 10.1186/1471-2288-12-74.*
Project Description	*Non-parametric methods have huge potential for application in clinical, health services and applied social science research (Stochl, Jones, Croudace, 2012). Psychometric scale analysis using the Mokken method involved computer intensive stepwise item selection procedure that is hugely demanding on computer time. Computer intensive methods and parallel computing help with contemporary implementation of such innovative methods using grid computing. As noted by Straat et al (2013) "when selected during the procedure items satisfy the scaling conditions but they may fail to do so after the scale has been completed ….." and "the procedure is approximate and thus may not produce the optimal item partitioning". Their recent study suggests a procedure and GA approach that appears to offer great promise at addressing these challenges. With long instruments for psychometric scaling of population wide psychological characteristics we are keen to explore how well a genetic algorithm approach, compared to other evolutionary algorithms can consider something close to all possible partitioning and perhaps leads to more optimal scaling results. The project will recruit someone who will explore the performance of the R Mokken genetic algorithms in existing anonymised and "available for analysis secondary analysis datasets from previous training projects funded by the ESRC (Researcher Development Initiative, Croudace et al; course materials and webpage currently archived by ESRC Restore team).*

	This project will explore the estimation of statistical models for psychometric tests using: 1) novel evolutionary computation methods, and 2) a new social sciences computing architecture,and 3) a range of item level datasets suitable for scaling that vary in size and complexity (number of items and number of dimensions, respectively). *The successful candidate will apply non-parametric IRT-item response theory models- e.g. Mokken scaling to existing anonymised and simulated data, and interface with issues relating to Test Assembly from Item Banks for the measurement of mental health and well-being.* *Recently MSA has become available in modern free software (www.cran.r.org) and evolutionary algorithms (genetic algorithms) proposed as a model estimation strategy.* *This project will exploit massively parallel computing architecture to provide proof of principle and establish the value of evolutionary computing and grid-enabled computing for large scale psychometric computing challenges for non-parametric item response theory and for computer adaptive testing item bank (item selection and administration).*
Required skills	*Mathematics and Computer skills for applied statistics plus an interest in measurement.*
Project dates	*Starting on Monday, 15 July 2013 and finishing on Friday, 13 September. Includes free attendance at Summer School on the University of Hull Scarborough campus (early Sept).*
Other information	*This project has been conceptualised in conjunction with, the ARRC Data Analysis Cluster within the York Alcuin Research Resource Collaboration (ARRC) (Mark Wilson), the Dept of Electronics (Steve Smith), the Centre for Complex Systems Analysis (YCCSA) and the ESRC funded White Rose Doctoral Training Centre Advanced Quantitative Methods pathway.* *The intern will have the opportunity to learn from a supervisory team that brings together staff from across science, social science computing and health sciences departments, with Prof Croudace and his team, including participation in a residential Summer School week.* Package '**mokken**' **cran.rproject.org/web/packages/**mokken/mokken**.pdf** LA van der Ark -Feb 15, 2013 – "ga": item selection using a **genetic** algorithm
References	*Adema, J. & van der Linden, W. (1989). Algorithms for computerized test construction using classical item parameters. Journal of Educational Statistics, 14, 279—290.* *Feuerman, F. & Weiss, H. (1973). A mathematical programming model for test construction and scoring. Management Science, 19, 961—966.* *Mokken, R. J. (1971) A Theory and Procedure of Scale Analysis. Berlin, Germany: De Gruyter.* *Molenaar, I.W. and Sijtsma, K. (2000) User's Manual MSP5 for Windows [Software manual]. Groningen, The Netherlands: IEC ProGAMMA.* *Sijtsma, K, and Molenaar, I. W. (2002) Introduction to nonparametric item response theory. Thousand Oaks, CA: Sage.* *Straat, J. H., Van der Ark, L. A. & Sijtsma, K. (2013). Comparing optimization algorithms for item selection in Mokken scale analysis. Journal of Classification.30(1) 75-99* *Van der Ark, L. A. (2007). Mokken scale analysis in R. Journal of Statistical Software. http://www.jstatsoft.org* *Verschoor, A (2007) Genetic Algorithms for Automated Test Assembly. Ph.D. Thesis Stichting Cito Instituut voor Toetsontwikkeling Arnhem*

When complete, please email the form to sarah.christmas@york.ac.uk