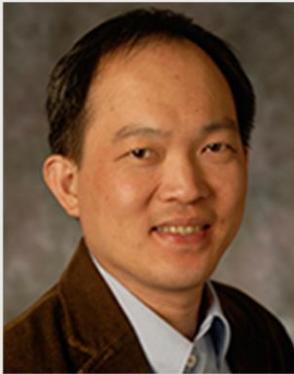


# COLLOQUIUM ON THE STATISTICAL SCIENCES

## THE SCHOOL OF STATISTICS

### University of the Philippines

invites all students and faculty to a series of lectures to be given by



#### **Dr. Jimmy de la Torre**

Professor, University of Hong Kong

#### **Three-Step Estimation of Cognitive Diagnosis Models with Covariates**

This research focuses on how covariates can be related to latent classifications in the context of cognitive diagnosis model (CDMs). It extends the one-step and three-step approaches from latent class analysis to the CDM framework to allow covariates to be related, not only to the latent classes, but also the attributes. Additionally, new correction weights for the three-step procedure are proposed, and they are shown to have smaller bias and root mean squared error, as well as fewer instances of likelihood separation, compared to the existing corrections. This research suggests that incorporating correction weights in the three-step approach to estimating CDMs with covariates is a viable alternative, particularly when the one-step approach is impractical.

#### **Mr. Miguel A. Sorrel**

Universidad Autónoma de Madrid

#### **Two-Step Likelihood Ratio Test for Model Comparison in Cognitive Diagnosis Models**

One procedure for item-level model comparison in cognitive diagnosis modeling is the likelihood ratio (LR) test. Although the LR test is relatively robust, its current implementation is computationally expensive given that it requires calibrating a large number of reduced models, which are then compared to the general model. In this research, we introduce the two-step LR test (2LR), which is an approximation of the LR test based on a two-step estimation procedure under the generalized deterministic inputs, noisy, "and" gate model framework. This approximation is computationally more efficient because it only requires calibrating the general model. The 2LR test is shown to have similar performance as the LR test so it can be considered a viable tool for empirical research.



18 April 2017, Tuesday  
4:00 – 6:00 PM  
Colloquium Room  
2<sup>nd</sup> Floor, UPSS Building



UNIVERSITY OF THE PHILIPPINES

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# COLLOQUIUM ON THE STATISTICAL SCIENCES

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**“Likelihood analysis of Gaussian copula distributions (GCDs) via a parameter-expanded Monte Carlo EM (PX-MCEM) algorithm”**

To be given by:



**Dr. Alexander R. de Leon**

Visiting Professor, UP School of Statistics  
Associate Professor, Department of Mathematics & Statistics,  
University of Calgary

21 April 2017, Friday  
4:00 PM to 6:00 PM  
Colloquium Room  
2<sup>nd</sup> floor UP School of Statistics Building

### Summary

Mixed discrete and continuous data arise in a variety of settings. In this talk, we adopt a general model based on the Gaussian copula we term Gaussian copula distributions (GCDs; Jiryaie et al., 2016, Journal of Statistical Computation & Simulation) to model the joint distribution of a mixture of (possibly non-Gaussian) continuous and discrete (e.g., binary, categorical) random variables, where the latter are described by thresholded continuous latent variables. An attractive feature of GCDs is their use of Gaussian copulas to separately model dependencies between non-Gaussian variables, thereby preserving the variables' distinct marginal properties. We adopt an efficient approach to maximum likelihood estimation for GCDs via a parameter-expanded Monte Carlo EM (PX-MCEM) algorithm (Liu et al., 1998, Biometrika). By using parameter expansion, we not only avoid the direct evaluation of the likelihood function, which involves computing multivariate Gaussian truncated orthant probabilities, but we also improve the computational efficiency of the algorithm. A Monte Carlo approach to evaluating the moments of truncated multivariate Gaussian distributions via the R package `tmvtnorm` avoids the tedious analytical calculations in the E-step. Another advantage of the PX-MCEM algorithm is that it has a computationally tractable M-step that merely entails the use of a root-solver (e.g., function `multiroot` in R package `rootSolve`); standard errors of estimates are calculated by bootstrap. Based on simulated data and real data from a breast cancer study at the University of Calgary, we illustrate the application of GCDs and its likelihood analysis in practice.

This is joint work with Mingchen Ren (University of Calgary) and Ying Yan (University of Calgary).