All seminars will commence at 12:10pm in room M/0.34, The Mathematics Building, Cardiff University, Senghennydd Road (unless otherwise stated).

Please contact Dr Timm Oertel for more details regarding Operational Research/WIMCS lectures and Dr Andrey Pepelyshev for more details regarding Statistics lectures.

Seminars

Date	Speaker	Seminar
12 June 2018	Prof. Oleg Klesov (Kyiv Polytechnic Institute, Ukraine)	Law of large numbers for general renewal processes We prove the law of large numbers for renewal processes. In contrast to the strong law of large numbers, the latter may hold even if the first moment is infinite.
28 May 2018	Jozsef Lorinczi (Loughborough University)	Some sample path properties of ground state-transformed jump processes In this talk I will discuss ground state-transformed processes arising under a Doob h-transform of a Lévy process generated by a non-local operator perturbed by a potential. The so obtained process is a Lévy-type process with unbounded coefficients. Using the ground state of such a non-local Schrödinger operator, which

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		relates with the stationary density of the process, I will present detailed results on the long-time almost sure behaviour of sample paths.
23 April 2018	Victoria Steblovskaya	Optimal Hedging in an Extended Binomial Market with Transaction Costs An overview of the results on optimal non-self-financial hedging in an extended binomial market will be presented, (joint research with N. Josephy and L. Kimball). We consider an incomplete market model where stock price ratios are distributed over a bounded interval, which generalizes the traditional Cox-Ross-Rubinstein (CRR) binomial complete market model. Non-self-financing hedging strategies are studied to construct an optimal hedge for an investor who takes a position in a European contingent claim. We derive a no-arbitrage option price interval and establish properties of the non-self-

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		financing strategies and their residuals. We develop an algorithmic approach for hedging the risk in a derivative security by optimizing a risk/return criterion most relevant for the investor. We demonstrate the superiority of our approach in comparison to more traditional local risk minimization techniques. We extend our approach to the case of a market with proportional transaction costs. We consider a position in a European contingent claim settled by delivery which satisfies the some conditions. We build a theoretical basis for our approach and construct a numerical algorithm that optimizes an investor relevant criterion over a set of admissible non-self-financing strategies. We demonstrate the applicability of our algorithm using both simulated data and real market data.

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19 March 2018	Justin Ward (Queen Mary University of London)	TBC TBC
5 March 2018	Paul Allin (Imperial College London)	What's wrong with GDP (and has Wales got it right)? Gross domestic product (GDP) is one of the best known of official statistics. It is also one of the least understood and it is increasingly coming under fire. GDP is a headline measure of the amount of economic activity within a country over a given period of time. At one level, criticisms of GDP focus on activities that are excluded from it, and on the extent to which the measurement of GDP is managing to keep up with the sophistications of a modern global economy. However, GDP attracts even more criticism for what it is not. That is, there are demands for wider measures of the wellbeing of a country. These should embrace the current levels and distribution of welling and allow for a country's

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		development and progress to be assessed more fully than just by GDP. Moreover, sustainable development is back on the agenda, with the Wellbeing of Future Generations Act in Wales and through the UN's sustainable development goals for 2030. In both cases, indicators beyond GDP are needed. We will explore the implications for GDP, and for official statistics more generally, of this beyond GDP agenda. In particular, is this an example of Goodhart's Law, where the use of a statistic as a measure of performance appears to affect its quality as a statistic? If so, there are two challenges here. First, official statistics are meant to be used widely, so we do need robust measures. Second, as Bill Bryson has observed, even when the British are good at counting things they may not be so good at doing something about preserving the things being counted. We suggest this calls for more outreach

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		by official statisticians, to engage with politics, policy and public opinion.
12 February 2018	Anatoly Zhigljavsky (Cardiff University)	Mahalanobis distance in large dimensions TBC
5 February 2018	Marco Oesting (University of Siegen)	Extremal Behavior of Aggregated Data with an Application to Downscaling The distribution of spatially aggregated data from a stochastic process X may exhibit a different tail behavior than its marginal distributions. For a large class of aggregating functionals ℓ we introduce the ℓ-extremal coefficient that quantifies this difference as a function of the extremal spatial dependence in X. We also obtain the joint extremal dependence for multiple aggregation functionals applied to the same process. Explicit formulas for the ℓ-extremal coefficients and multivariate dependence

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		structures are derived in important special cases. The results provide a theoretical link between the extremal distribution of the aggregated data and the corresponding underlying process, which we exploit to develop a method for statistical downscaling. We apply our framework to downscale daily temperature maxima in the south of France from a gridded data set and use our model to generate high resolution maps of the warmest day during the 2003 heatwave.
15 December 2017	Yuexiao Dong (Temple University)	Model-Free Variable Selection with Matrix-Valued Predictors We introduce a novel framework for model-free variable selection with matrix-valued predictors. To test the importance of rows, columns, and submatrices of the predictor matrix in terms of predicting the response, three types of hypotheses are formulated under a unified framework, and a simple

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		permutation test procedure is used to approximate the null distribution of the test statistics for all three tests. A nonparametric maximum ratio criteria (MRC) is proposed for the purpose of model-free variable selection. Unlike the traditional stepwise regression procedures that require calculating p-values at each step, MRC is a non-iterative procedure that does not require p-value calculation. The effectiveness of the proposed methods are evaluated through extensive numerical studies and an application to the electroencephalography (EEG) dataset.
27 November 2017	Daniel Gartner (Cardiff School of Mathematics)	To be announced.
20 November 2017	Joe Paat (ETH Zurich)	The effect of reducing subdeterminants in integer programming Consider the problem of solving an integer linear program with corresponding

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		constraint matrix A. If A is totally unimodular (that is, if the subdeterminants of A are bounded by 1), then the integer program can be solved as a linear program with no integer constraints. With this in mind, one can ask the following question: if the subdeterminants of A are bounded by some integer k, then how many integer constraints are required to solve the integer program? We discuss this question, and for some cases, we provide upper bounds, which depend on k, for the number of integer constraints required to solve the integer program. This is work done with Robert Weismantel and Stefan Weltge from ETH Zurich.
13 November 2017	Ivan Papic (J. J. Strossmayer University of Osijek, Croatia)	Correlated continuous time random walks and fractional Pearson diffusions Continuous time random walks have random waiting times between particle jumps. We define

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		the correlated continuous time random walks (CTRWs) that weakly converge to fractional Pearson diffusions (fPDs) in Skorohod space with J1 topology. We define fPDs as time-changed Pearson diffusions via inverse of the standard stable subordinator. Obtained fractional Pearson diffusions as a weak limit of the corresponding CTRWs include the non-heavy tailed fPDs: fractional Ornstein-Uhlenbeck, Cox-Ingersoll-Ross and Jacobi diffusion. The jumps in these CTRWs are obtained from Markov chains through the Bernoulli urn-scheme model and Wright-Fisher model. The jumps are correlated so that the limiting processes are not Lévy but diffusion processes with non-independent increments. The waiting times are selected from the domain of attraction of a stable law.

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30 October 2017	Dr. Eugen Pircalabelu (KU Leuven)	Using probabilistic graphical models to assess functional brain connectivity based on mixed coarseness scale fMRI data We estimate brain networks from fMRI datasets that do not all contain measurements on the same set of regions. For certain datasets, some of the regions have been split in smaller subregions, while others have not been split. This gives rise to the framework of mixed scale measurements and the purpose is to estimate sparse graphical models. The resulting graphical models combine information from several subjects using the data available for all coarseness levels, overcome the problem of having data on different coarseness levels and take into account that dependencies exist between a coarse scale node and its finer scale nodes, since finer scale nodes are obtained by splitting coarser ones. Our procedure is directed towards estimating effects between split and unsplit

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		regions, since this offers insight into whether a certain large ROI is constructed by aggregating homogeneous or heterogeneous parts of the brain. To overcome the problem of mixed coarseness levels, the expand and the reduce algebraic operators are used throughout the procedure. To estimate sparse graphs, the alternating direction method of multipliers (ADMM) algorithm is used and to ensure similarity of graphs across coarseness levels, the procedure uses the fused graphical lasso and group graphical lasso penalties for certain block submatrices and a classical lasso penalty for the remaining submatrices. The method results in estimating graphical models for each coarseness level in the analysis, referred to as within level edges, and identifies possible connections between a large region and its subregions, referred to as between level edges. We also investigate zooming-in and out procedures to assess the

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		evolution of edges across the coarseness scales. The applicability of the method we propose goes beyond fMRI data, to other areas where data on different scales are observed and where the joint estimation of graphs that resemble each other is desired. Moreover, the method avoids the tedious task of selecting one coarseness level for carrying out the analysis and produces interpretable results at all available levels. Empirical and theoretical evaluations illustrate the usefulness of the method.
23 October 2017	Luke Smallman (Cardiff School of Mathematics)	Sparse Exponential Family PCA In this talk, generalisations of principal component analysis to the exponential family of distributions will be discussed with an emphasis on introducing sparsity in the loadings. The performance of such methods on text data will also be demonstrated.

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16 October 2017	Prof. Stephen Disney (Cardiff Business School)	The Re-Shoring Decision: Dual Sourcing, Order Smoothing and Non-Stationary Demand Companies often experience non-stationary demand as products evolve over their life cycle. We investigate a tractable families of single and dual sourcing policies tailored to such a demand environment. We adopt a conventional discrete time inventory model with a linear control rule that smooths orders and allows an exact analytical analysis of an easy-to-implement dual sourcing policy. Our policy performs well relative to dual sourcing policies in the literature that we adapt to a non-stationary setting. Our model provides insights under which cost, demand and lead-time settings re-shoring becomes attractive.