

Melbourne Monash Meeting on Probability & Related Fields – 2011/2

Monash University, July 20, 2011

3:00–3:30 Daryl Daley (University of Melbourne)

Queueing output processes: some problems

I complement recent work of Yoni Nazarathy (and talks he has given at Monash and Melbourne) about the asymptotics of the variance of the number of departures from a stationary M/M/1/K system (i.e. buffer of size K with Poisson arrivals and a single server taking exponentially distributed time to complete service). This limit function has a discontinuity when the arrival and service rates are equal, with a ‘magic’ factor $2/3$ (in place of 1). What happens in a many-server system: does the property persist? Is it the same constant? What if the Poisson process assumptions are weakened? Are there implications for queueing networks? Is the discontinuity property symptomatic of some more deep-seated phenomenon? I answer the easier of these questions.

3:30–4:00 Greg Markowsky (Monash University)

A series which gives the expected exit time of planar Brownian motion from a simply connected domain

Any simply connected domain in \mathbb{R}^2 (other than \mathbb{R}^2 itself) is conformally equivalent to the unit disc. I will show how this conformal equivalence can be used to calculate the expected exit time of Brownian motion from domains, and give a number of consequences. Included will be a method for summing series using probabilistic considerations.

4:00–4:30 Olivia Mah (Monash University)

Volatility in the Black-Scholes and other formulas

In this talk, we examine the compatibility between the Black-Scholes formula and stock price models with non-constant implied volatility. Our implied volatility is assumed to be a (possibly random) function of time t .

Our main result shows that if the price of a call option is given by the Black-Scholes formula for finitely many strike prices, then the implied volatility is not necessarily a constant but will approach a constant if the number of strike prices increases. Moreover, we obtain a bound on the variation of the implied volatility, providing us with sets of constraints limiting the acceptable values of the implied volatility parameters. We show that the more maturities we have, the more refined our constraints on the implied volatility would be. Since we do not place any assumptions on the underlying stock price process, the implied volatility process or how they are related, our results are model-free.

In addition, we extend our investigation on the compatibility issue by using a more general formula than the Black-Scholes for our implied volatility. Under this more general framework, we obtain the same conclusion, namely, that implied volatility is not necessarily a constant but will approach a constant if the number of strike prices increases.

4:30–5:00 Break

5:00–5:30 Owen Jones (University of Melbourne)

Multifractal spectra for random self-similar measures via branching processes

Random self-similar measures can be split into a number of independent component measures which are scaled copies of the original. By drawing on connections with the general branching random walk we obtain a full multifractal spectrum for a class of such measures. Our results generalise those of Arbeiter and Patzschke (1996) and Patzschke (1997) to allow an unbounded, random, number of components and arbitrarily small scalings. Joint work with John Biggins (University of Sheffield) and Ben Hambly (University of Oxford)

5:30–6:00 Kais Hamza (Monash University)

Martingales with given marginals

While it is well known that stochastic processes are not uniquely defined by their one-dimensional marginals, the question of how to construct martingales with given marginals has recently become the focus of a substantial body of work. In this talk we will review some of the constructions found in the literature.

Joint work with Fima Klebaner and Jie Yen Fan (Monash University)