Topics in probability and statistics: An introduction to quantum probability

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Short description:
Noncommutative probability is the probability of quantum theory. In von Neumann's approach (real) random variables become (perhaps unbounded) self-adjoint operators on a Hilbert space (equivalently, real-valued projection-valued measures; equivalently, strongly continuous one-parameter unitary groups). The key difference to classical (commutative) probability is that these operators - "observables" - need no longer (and typically do not) commute. We aim to cover: quantum probability space as a von Neumann algebra on a Hilbert space endowed with a normal state; two fundamental examples: quantum coin toss, Aspect experiment; probabilities on projection lattices of quantum spaces; position-momentum canonical pair; characteristic functions and moments; energy and time evolution; products of quantum probability spaces; Fock spaces; Weyl representation and infinitely divisible distributions. Throughout we would stress the parallels and eventual differences to classical (commutative) probability. As far as possible we would comment on the significance/interpretation of the mathematical structures from the point of view of Physics.

Literature:
Lecture notes would be available.

- K. R. Parthasarathy. An Introductions to Quantum Stochastic Calculus. Springer Basel AG, 1992.
- P.-A. Meyer. Quantum Probablity for Probabilists. Springer-Verlag Berlin-Heidelberg, 1995.

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